EUROPA XXI
Vol. 41, 2021, pp. 59-76
https://doi.prg/10.7163/Eu21.2021.41.3

Institute of Geography and Spatial Organization
Polish Academy of Sciences

DIGITIZATION IN AUSTRIAN SMALL-TOWN REGIONS: OPPORTUNITIES AND RISKS FOR SPATIAL PLANNING AND DEVELOPMENT

Ulrike Stroissnig
University of Vienna, Department of Geography and Regional Research
Universitaetsstr. 7/5, 1010-Vienna: Austria
ulrike.stroissnig@gmx.at

Abstract. The digitization of our society continues to progress, which comes with implications for cities and regions. This paper reviews the existing literature on digitization and spatial development. It then identifies the potentially concerned sectors of spatial development through re-interpreting the basic 'functions of existence' in the light of digitization. Expert interviews in three selected Austrian small-town regions inform the outcome of the paper: an extensive list of opportunities and risks through digitization in the fields of mobility, economy, tourism, environment, social infrastructure, local governance and planning.

Keywords: Austria, case study, digitization, small-town, spatial development, urban region.

Introduction

The digitization of our society continues to progress – with implications for spatial development in several respects (mobility, infrastructure, work environment, lifestyles, ...). In order to be able to deal proactively with current and future challenges, it is advisable to address digitization in spatial planning. The aim of this paper is to identify the opportunities and risks resulting from digitization for spatial development of Austrian small-town regions.

Since this work is still being written in the middle of the Covid-19 pandemic, there are not enough statistics and studies available on the effects on the development of digitization or spatial development. However, where effects are foreseeable, references to the pandemic will be drawn. It is already observable that the barriers to entry of digital technologies have been lowered by the Covid-19 pandemic and that the use of them has been accelerated.

In the first sections, the term digitization is defined, followed by an analysis of the digitization progress in Austria, the spatial planning system in Austria, and an attempt to summarize the current state of research about the interlinkage of digitization and spatial development. The following section describes the methods used in this paper, which also clarifies the procedure of the expert interviews and the analyses carried out. Thereafter, the results on opportunities and risks of digitization in spatial development of small-town regions are listed and reflected.

Digitization progress in Austria

The OECD (2017, p. 24) defines digitization as 'the conversion of an analogue signal conveying information (e.g. sound, image, printed text) to binary bits. Although still costly to digitise or collect, information can be represented in a universal manner, and it can be stored as data.' The OECD does not only talk about the conversion of analogue signals to binary, i.e. digital data – these can also be digitized, collected and then presented or stored on a large scale (keyword: big data). As an important issue the networking of data and digital devices with one another is addressed here.

The Academy for Territorial Development in the Leibniz Association sees digitization as a transformation process that takes place in bursts of time, in different locations and often is also fragmented by sectors (ARL, 2019, p. 33). This definition offers a different focus on the effects in space

It can be said that in this paper digitization is understood as a fundamental transformation process from analogue to digital data and technologies with different spatial, social and sectoral effects. The individual digital technologies are not listed in advance, as they are constantly evolving and it is not possible to draw up a complete and therefore generally applicable list.

Austria ranks 13th in the digitization index (DESI) of the European Union (EU). The top positions of the index are occupied by Finland, Sweden, Denmark and the Netherlands., the worst performing countries are Romania, Greece and Bulgaria (EC, 2020, p. 3).

The DESI is made up of five different indicators: Connectivity, Human capital, Use of internet services, Integration of digital technology, and Digital public services. The connectivity indicator includes several sub-indicators (e.g. broadband usage and expansion, 4G and 5G network coverage) and can be described as a weak point in the assessment, as Austria only ranks 22nd in the EU. This is mainly due to lower fixed network and mobile broadband use as well as poorer coverage with VHCN fixed network technologies in households. In the second indicator, human capital (sub-indicators e.g. digital skills, ICT specialists/graduates), Austria ranks 9th in the EU and ranks well above the average. In the indicator on use of internet services, the assessment is made up of sub-indicators that record, for example, the use of social networks, online banking, music, or games. Here, Austria ranks below average in 18th place in the EU, which is mainly attributed to the low use of video calls and online sales. In terms of the integration of digital technology into business activities, Austria ranks 17th, which corresponds roughly to the EU average. Relevant sub-indicators here are, for example, electronic data exchange, cloud services, e-commerce, and the use of big data in companies. Austria still has some catching up to do, especially in the field of clouds and big data. In the fifth indicator, Digital Public Services, Austria is ranked eighth and thus clearly above the EU average. Austria already has well-developed e-government structures, online application forms, and public services for businesses that can be used (EC, 2020, pp. 3-14).

Spatial development and planning in Austria

Two approaches will clarify how spatial development is understood in this paper. Spatial development defined by the ARL refers, on the one hand, to the term 'space' with different levels of scale and action, ranging from the municipal, regional, and state levels to the national and supranational levels. On the other hand, the term 'development' is involved, which can be understood both descriptively, analytically and normatively. The descriptive understanding retrospectively describes the process of how a space has developed over a certain period of time, or prospectively describes possible future development paths based on forecasts or scenarios. The normative perspective, on the other hand, indicates, in the form of plans, strategies or concepts, which future development

of the respective space is aimed at (ARL, 2018, p. 1874).

The Austrian Commission for Spatial Planning (ÖROK) usually uses spatial development in connection with strategic and conceptual planning instruments (e.g. development concepts), whereby the more formative, dynamic character of the term 'development' illustrates the significance that goes beyond regulatory tasks (Gruber, Kanonier, Pohn-Weidinger & Schindelegger, 2018, p. 56).

As spatial planning is not explicitly mentioned in the competence articles of the Federal Constitution (Art. 15 Para. 1-B-VG), it is located at the provincial level (*Länder*) in Austria. The federal states are thus responsible for legislation and enforcement and there are nine different legal regulations in each federal state. However, a few planning powers at federal level are assigned to the sectoral ministries (forestry, water management, transport routes – railways, federal roads, shipping, aviation, energy law). However, sectoral planning with a high spatial relevance is also anchored at the provincial level (e.g. nature conservation, building law, housing subsidies, land transport). The so-called local spatial planning is located at the municipal level. Due to the implementation at the local level in the municipalities, they are the central authorities for spatial planning – but always under the supervision of the provincial authorities and the laws and regulations passed by the federal and provincial governments. No legislative competence is anchored in the municipalities and in planning decisions, a consideration of all interests of local and regional objectives takes place. It is possible to form associations and cooperate with other municipalities to pursue inter-communal planning. Regional spatial planning includes the already mentioned federal state level (*Länder*) and, in some federal states, an additional regional level. Regional plans and strategies thus bind the provincial authorities, and subsequently municipalities are obliged to implement the regional objectives in the zoning plans or local development concepts. At the federal level, the ÖROK was created in 1971 as a coordinative body and permanent organ of the federal government, the *Länder* and the municipalities, with the aim of coordination and cooperation. It develops the Austrian Spatial Development Concept (ÖREK) and elaborates many other contributions to spatial research. Both the political level and the administrative level are represented in the bodies, which are divided into various committees and working groups (Gruber et al., 2018, 63ff; Humer, 2018)

City regions and small-town-regions

A city region is a functional spatial unit consisting of the core city and a surrounding travel-to-work-area; the core city comprises the administrative area of the central municipality and is functionally linked to the surrounding area from which workplace commuters, education commuters and consumers come from (Faßmann, 2009, p. 56). As this definition already indicates, this paper is not referring to administratively defined regions, but to the functional spatial unit consisting of the core city and a travel-to-work-area, as these are the actual regional living environments of both society and the economy. The small-town-regions used for this work have been selected by using *Stadtregionen.at* (KDZ, 2021). This project was launched in 2015 by the Austrian Association of Cities and Towns and the KDZ – Centre for Public Administration Research and is based on the urban-rural typology of Statistics Austria and its regional delimitations (Humer, 2018; KDZ, 2021).

Basic functions of existence in a spatial perspective

In order to divide spatial development into a few essential areas, this paper uses the basic human functions of existence, which were already integrated into the context of geography by the 'Vienna-Munich School of Social Geography': Living, working, providing oneself, educating oneself, recreation, participating in traffic, living in the community (Weichhart, 2008, p. 37).

Transportation participation furthermore connects all other functions with each other and leads to connectivity of the different living environments. This is of particular relevance for digitisation, as digital networking can take place with the help of digital technologies and mobility is undergoing major transformations. We interpret these basic functions of existence through the following seven sectors of spatial development, which are considered separately in the interview evaluation:

- Mobility and Transport
- Business and Economy
- Tourism
- Environmental and open space development
- Social infrastructure
- Local management and governance
- Local planning and settlement structures.

The connection between digitization and spatial development

Mobility and Transport

Digitization is seen as a potential way to improve mobility (e.g., with shared mobility, autonomous driving, mobility as a service). Traffic is reduced and the use of ICT infrastructure is expected to increase efficiency and reduce the carbon footprint in regions. So far, digitization in mobility is noticeable only in urban areas (especially in the case of sharing services), which is attributable to the higher demand. Rural areas are still disadvantaged (Binder & Matern, 2020, p. 11).

Many automated cars could reduce the number of vehicles, and parking lots in cities could be minimized. In rural areas, however, even more vehicles would be needed to achieve a reduction in traffic and fulfil the demand. Another advantage of self-driving cars is the possibility to work in the car while driving (at least in case of some professions) and to cope with longer distances to work (Soteropoulos, Berger & Ciari, 2019, 44f).

Automation also offers numerous possibilities for public transport, for example with smaller vehicles in shorter intervals – thus the operation of much tighter cycles and more individualized routes is possible, which ultimately leads to a convergence of individualized and public transport, but with increased space requirements for transfers (DIU, 2019, p. 21; Engelke, Hagedorn, Schmitt & Buechel, 2019, p. 20). In combination with sharing systems for bicycles, a more efficient transport system can thus be created, but one that tends to favour urban regions (Soteropoulos et al., 2019, 44ff). On the other hand, it is also expected that the accessibility of previously poorly developed areas will be improved, even if individual automated driving cannot replace public transport (Engelke et al., 2019, p. 20).

As a counterposition to automated driving, it has to be mentioned that autonomous and connected driving does not stop urban sprawl but further promotes it and creates additional

competition to public transport or active mobility as walking or cycling (Dangschat, 2019, p. 10; Soteropoulos et al., 2019, p. 44). And in case public transport is reduced as a result, this exacerbates spatial polarization and social exclusion even more, as especially older residents and school children depend on it (Binder & Matern, 2020, p. 13). The future prospects for taxis/cabs are not particularly promising either, as self-driving cars could largely replace them (Engelke et al., 2019, p. 12).

In the logistics industry, research is already being conducted on platooning solutions (vehicles in columns with shorter distance in-between) to optimize long-distance freight transport (DIU, 2019, p. 17). Freight transport is being reorganized and made more energy- and cost-efficient through autonomous driving (Engelke et al., 2019, p. 12).

In customer delivery, automated solutions will also become possible in the future (in terms of the so-called 'last mile') – for example with drones or mini-robots – but it must be ensured that no overload of public space occurs, whether on the road or in the air (DIU, 2019, p. 18).

Through digital measurement systems and the interconnection of transport management systems, it is possible to actively regulate traffic. For example, traffic congestion and local air pollution can be reduced by actively managing traffic signals based on the traffic situation. In addition, sensor and monitoring technologies, for example in street lighting, can increase traffic safety in cities (DIU, 2019, p. 19; Engelke et al., 2019, p. 12).

Mobility as a Service (MaaS) networks the many mobility services and offers them online via platforms or apps. Due to their multi- and intermodality, these services represent the everyday realities of their users better and the attractiveness of public transport is increased. Real-time-data is provided and mobility services can be booked and used collectively through one system (DIU, 2019, 16f).

In spatial terms, this implies that there likely will be a significant reduction in the traffic volume due to the better coordination of the different mobility services and the resulting increased acceptance. The occupancy rate of cars is also increased (through carpooling, etc.) and travel times are reduced with direct door-to-door connections (Engelke et al., 2019, p. 12).

Business and economy

Digitization processes in the field of business and economy are very diverse and the spatial effects are often not predictable. Buzzwords such as 'Industry 4.0' are often used to summarize all developments under one term. This includes various employment effects, more flexible work organization possibilities, digital education and training, presumably reduced use of resources, new business models, changing competition among companies, the issue of digital security, and technical standards and regulations (Aichholzer et al., 2015, 9f). Many of these developments have no clearly identifiable spatial impact or indirect effects due to resource reduction, a changed traffic situation or employment changes.

E-commerce has a wide range of consequences for spatial development. Although it is not the only cause of the problems of stationary retail, it has accelerated the developments and the disparities between strong and weak operating concepts in different urban structures are becoming apparent (BBSR, 2017, p. 77).

Overall, there are still minor differences in the use of e-commerce between urban and peripheral areas. Depending on the product range, the level of use in rural areas varies. Established products (e.g. books or clothing) are consumed more frequently than in urban areas, whereas less established products (e.g. food) are less in demand in rural areas. In small towns, a further decline of existing local stores is to be expected due to e-commerce. It can also be assumed that stationary

and digital offers in retail will be combined in the future, such as click & collect offers, where goods ordered online can be picked up locally in a nearby store (Hangebruch, Osterhage & Wiegandt, 2019, 14f).

Due to increased e-commerce, logistics is playing an increasingly important role in urban and regional planning. In order to deliver more packages to consumers on the one hand and to save as many resources as possible in the process, alternative concepts have been developed. Micro-hubs are one example in this respect. These involve the creation of more efficient structures that can be flexibly rolled out to urban and rural areas (Gluch, 2019, 36ff).

While in the case of delivery tours without a micro-hub, each delivery is made individually from the seller to the end consumer. With the use of a micro-hub, the delivery is only made to the micro-hub and the product is then taken from there to the end consumer – ideally by environmentally friendly transportation vehicles. A micro-hub can be a pick-up station, a service point, a drop box or a distribution station, depending on local availability and the customer's needs (Keiser, 2019, p. 17).

Flexibilization of the labour market gives rural areas a considerable opportunity. Variability in time and place results from faster data transmission and the new communication options associated with it, which for example make home-office working models more attractive. Platform economies are also leading to new forms of work such as 'work-on-demand' or 'crowdworking' being launched in many companies. Rural regions now have the opportunity to establish so-called co-working-spaces, where decentralized working can take place in premises equipped for this purpose (Setz, Frank & Suter, 2019, p. 9).

Additionally, people with jobs that have a lower-than-average prevalence in rural areas can be retained in rural areas and possibly even the demographic change can be mitigated; these new forms of employments have a strong impact on the labour market and subsequently on the spatial-functional structure in these regions, especially if, for example, stationary structures are abandoned due to the availability of online services (DIU, 2019, p. 14). Therefore, it is even more important that these developments, which have been further accelerated by the Covid-19 pandemic, are integrated into local and regional planning and that the opportunities for rural areas are recognized.

Rural areas in Austria are strongly characterized by the agricultural sector. The spatial structures are based, among other things, on their land use patterns as well as the resources that are produced and consumed. Digitization gives agriculture the opportunity to analyse existing processes, to question its work processes with precise data analysis and to generate forecasts for the future. As land use continues to be very high due to construction and transportation, agricultural land is suffering. Through digital tools, the preserved land can be used more efficiently and in a more environmentally friendly way, ensuring food supply for our growing society. Various apps and tools, drones, robots or increasingly the use of big data are used for this purpose. Through digitization, agriculture expects an increase in output, easier compliance with legal regulations, process optimization, resource savings as well as more proactive actions and increased market know-how through decentralized educational programs (Hildebrandt & Landhäußer, 2017, 429ff).

Tourism

In tourism, digital technologies have developed from an advertising medium and a tool for online communication into an application area where personal needs of travellers can be identified, analyzed and adjusted accordingly (e-tourism). Technologies such as wi-fi, search engines, Web 2.0, tablets, smartphones, sensors, Internet of Things (IoT), crowdsourcing, open source, drones, ma-

chine learning, artificial intelligence, etc. will transform the world of tourism significantly. Due to the rapid growth of user-generated content online and the spread of technologies and devices, our society is also experiencing a massive acceleration and mass amounts of data and information are being collected. In addition, Facebook, Twitter, Instagram, TikTok, and other social media contribute the fact that they are no longer only used to publish content, but increasingly as interaction platforms (Soteropoulos et al., 2019, 10ff).

New digital travel platforms (e.g., Booking.com, Airbnb) now play a central role in marketing. Market entry barriers have been removed and small providers have the opportunity to have a presence on the same online platforms as the large providers. On the one hand, this leads to more price transparency, but on the other hand, to greater competitive pressure in tourism. In addition, the dominance of these online platforms continues to grow, which can be viewed critically, as they could threaten and standardize local and individualized forms of tourism (Aichholzer et al., 2019, p. 8; Kadi, Plank & Seidl, 2019).

Especially with platforms such as Airbnb, private individuals are now becoming hoteliers and participate in the market almost independently. This is an example of how digitization is changing economic markets and cycles. Risks are outsourced from companies to private individuals, for example by having strangers to stay overnight in private households (Ravenelle, 2020, 169f).

However, Airbnb and other platforms also confront spatial development with the problem of increased land use pressure, as these forms of rental properties have a strong impact on the local housing market, especially in touristic areas. These difficulties have led to the establishment of more and more regulations and attempts to reduce the negative impact on local property prices, etc.

Quite apart from the Covid-19 pandemic, the future of tourism is assessed very diversely. Even though there will be shifts in certain segments, the enthusiasm of people to visit other places will not end. Newly discussed in this context are virtual trips that can be made with the help of computer technology. This offer arose due to the increased socio-cultural awareness (travel abandonment, environmental awareness) in combination with digitization, which is what made online tourism possible in first place. A variation thereof is virtual-reality-tourism in physical space. In this case, it is possible for visitors to experience a virtual world (e.g., the past/future) on site – without the exhibits or the environment being present. Of course, this technology can also be used to bring travel home virtually and visit specific locations with a VR device. Whether these virtual trips will lead to less people actually traveling physically in future (substitution thesis) is still unknown. However, virtual travel hubs in people's local communities or travel rooms in their apartments or houses would be possible. The antithesis to these developments (surrogate thesis), however, considers virtual trips to be only second-class imitations that are only relevant as advertising media for genuine, physical trips involving a change of location (ARL, 2018, p. 2680).

Tourism is an important spatial development sector in Austria and the many potential changes can have different impacts on spatial dynamics. The pressure of land use will increase in the future and a shift to digital space can lead to a wide variety of effects. Depending on the perspective and the region, both potentials and risks arise.

Environmental and open space development

In this field, a particularly large number of secondary effects occur from other technology applications in other sectors of spatial development. For example, smart farming in agriculture could increase biodiversity and transform the natural environment through better analysis and changes in land use. Another example is autonomous driving, which, if widely applied to transport systems such as buses, vehicles, transport drones, etc., would save resources and reduce the impact

on the environment. Other technologies that may have an impact on the environment & open space development are VR/AR (glasses, 3D visualizations, ...), 3D printing, sharing technologies, IoT, self-tracking devices, and digital communication technologies (social media/networks, smart workspaces, ...) (Engelke et al., 2019, p. 8)

- In a survey conducted by the University of Applied Sciences in Rapperswill (Engelke et al., 2019, p. 16), theses on how the digital transformation could affect landscapes and open spaces emerged:
- In visitor management, signs and boards are being replaced by virtual and augmented reality, and information is being communicated on displays and smart devices.
- IoT can be used to solve local recreation conflicts between visitors by using temporally intelligent commands and regulations, since the smart software can analyse different sensor data and use it to de-escalate conflicts.
- The open space and any local recreation areas will not only be visited for recreation, but also for work. Smart workspaces could be utilized to make public spaces suitable for work as well, for example by providing seating areas not only for resting, eating and playing, but also for working.
- New forms of work and living (remote working, smart workspaces, etc.) are increasing the pressure on local recreation areas in terms of usage duration (24/7).
- Due to motorized walking assistance and automated driving, people stay active longer, which results in changed user groups in open spaces. The infrastructure in local recreation areas needs to be adapted accordingly.
- Digital Detox: An increasing number of people are seeking to withdraw from digital space and rest in nature. This can be an important factor for local recreation areas when people with and without digital devices want to relax in the same location.
- Through social media, many leisure and recreational opportunities can be communicated to citizens, but viral marketing may also lead to an increase in visitor numbers, which in turn may overburden on-site capacities.

By connecting the energy-relevant sectors heat, electricity and transport, digitization contributes to improve the use of energy potential and distribution of renewable energy. For example, the batteries of electric vehicles can be used to store electricity overnight, as a growing proportion of energy is produced from renewable sources. To achieve this goal, a decentralized, ICT-supported system is necessary (microgrids, virtual power plants, smart grids, smart markets, ...) to make sure that the capacity of the grids is used efficiently (DIU, 2019, p. 22).

Regarding climate issues, changes in the energy sector can have a major impact on mitigation. Through increased energy efficiency, reduced greenhouse gas emissions, the growing spread of connected e-vehicles and other transformations, a major contribution can be made to achieve the climate protection goals of the Paris Agreement and the Sustainable Development Goals. Smart connected infrastructure and buildings can significantly reduce their associated emissions, and new digital tools are able to monitor greenhouse gas emissions levels in real-time. The ability to conduct wide-scale analysis with real-time and on-site environmental data can help to improve many environmental parameters (including air pollution, for example). However, many technical devices have a rapidly increasing energy demand, which should not neutralize the positive developments mentioned above. One example in this regard is the Bitcoin network, which already exceeds the energy demand of some nations. Additionally, it is possible to use digital communication tools to raise awareness on the climate crisis and to change behaviours and policies. Through online communication tools (e.g. social media), citizens can be engaged through various information channels of governments, businesses, and other stakeholders. In contrast, we face the problem of misinformation, fake-news and the distribution of such information in an uncontrolled way

(TWI2050, 2019, 54ff).

Social Infrastructure

The availability of adequate social infrastructure is essential for municipalities and regions. This includes the education sector, health care, but also local social gathering places and other facilities providing services of general interest. Digitization – especially in the context of demographic change – could accelerate the closure and decline of social infrastructure (Stöglehner, 2020, 252f).

In addition to social infrastructure, it is relevant to determine to what extent society has access to digital services. Digitization is currently exacerbating the polarization between different social milieus (based on education, income or other competences). This phenomenon is called the 'digital divide', which increasingly excludes people without digital skills from participating in digital life, which, however, is becoming increasingly important in today's living realities. Digital competences are now also being taught in schools and further education programs should be seen as an indispensable public responsibility (DIU, 2019, p. 25).

Digital technologies not only enable the teaching of educational content with digital tools but can transfer educational programs to digital space as well. Webinars held online replace conventional physical seminars and can be attended from any location. This affects not only school and university courses, but also adult education programs and other advanced training courses. More people are able to participate, the courses are not dependent on location or time, innovative forms of presentation can be used, digital networking with other participants is possible, overall costs are saved, and travel expenses are avoided. Overall, this development leads to an increase in participation and equal opportunities in educational activities, especially for employees in rural areas, who are not disadvantaged in online education compared to employees in urban areas. Broadband connectivity is necessary, however. In this way, spatial distances can be reduced in both directions: people from urban areas can participate in digital courses from rural areas and vice versa. The flexibilization in the education sector also shifts the locations used for studying into the digital space, resulting in a devaluation or repurposing of previous studying spaces (e.g., classrooms, seminar rooms). For municipalities, it is recommended that new spaces for education are provided in locations that have not previously been used for this purpose. Public libraries, cafés, public parks and other public spaces could be used for this purpose. In a transdisciplinary spatial development, the various potential use options can be combined and planned accordingly (Schulz, 2018, May 31, 4ff).

Health care in rural regions is facing high pressure (Humer & Granqvist, 2020). The availability of rural doctors in rural areas is constantly decreasing and the driving distances that must be taken are increasing. This brings up the issue of spatial constraints for health care in spatial development (Fritzsche, 2014, 193ff). In home care for elderly people, new ICT technologies could be used to increase the quality of care (Stöglehner, 2020, p. 252). In telemedicine, measures such as Internet-supported home visits, digital documentation of medical cases, electronic application forms and the quick exchange of health data are enabled (Fritzsche, 2014, 193ff). The existing range of services can be usefully supplemented by these digital services to enable health care independent of the geographical location.

In terms of the inclusion of all citizens and equal living conditions, however, it must also be ensured that services outside the digital world remain available. According to Fritzsche (2014, 193ff), this will remain the case in future, as the importance of local doctors is unchanged and the opportunities offered by telemedicine are more likely to be linked to already existing structures. The provision of services of general interest in rural-peripheral regions must be of central importance.

Digital applications can be a valuable addition.

Local management and governance

Data collection and access can play a key role in community/regional planning and governance. For example, infrastructures can be maintained in a more evidence-based manner, algorithms can create forecasts on the use of infrastructure by the inhabitants, and if the actual situation can be identified in planning processes earlier, measures can be implemented faster and a monitoring system can be set up. Furthermore, due to increasing connectivity, it is possible to interlink data from different administrative departments and surveys and thereby gain a multitude of valuable expertise. However, it is important to ensure data security in the municipalities for all involved stakeholders and to establish data authority on the local level (DIU, 2019, 27f).

But digital technologies can also play a major role in communication, information and participation of citizens. Through the use of new data gathering methods (e.g. with drones) and the software used for data analysis and evaluation (GIS & digital tools, etc.), surveys may be conducted much more extensively and with greater accuracy (Engelke et al., 2019, p. 8). Through digital planning processes and participation formats, the insights can be demonstrated to local politicians and the public (e.g., through visualizations), and new forms of networks and communication between stakeholders are created (DIU, 2019, 27f).

Local planning and settlement structures

This sector is probably the one where most of the interactions with digitization impacts from previous sectors of spatial development occur, since effects from e.g. mobility, environmental and open space development, and social infrastructures are clearly reflected in local spatial planning. Although this section will not discuss these again, specific changes that are becoming increasingly apparent in local development will now be discussed briefly.

According to a survey by the University of Applied Sciences Rapperswill (Engelke et al., p. 20), 82% of the mobility and transport planning experts surveyed consider that urban sprawl will increase as a result of improved accessibility in previously underdeveloped areas. The improved accessibility of regions is the result of mobility transformations and improved broadband coverage.

In small towns, a new form of urbanity could emerge through the intersection of residential and working areas in multifunctional building utilizations. Newly emerging business models are increasingly settling in attractive, urban locations instead of purely business locations. This leads to an increased demand for space with attractive quality of stay, existing social and technical infrastructures and good accessibility. Thus, places with formerly traditional services in city centres can experience new uses and functions, which creates a more small-scale and mixed structure. However, this also increases competition among the various uses in central locations and thus raises land and rental prices or displaces other traditional business types. The multifunctional building uses contribute to land and climate protection through intelligent and resource-saving construction forms (less soil sealing and resource consumption). Vacant buildings can be recycled and used for this purpose too (DIU, 2019, 14f).

In public space, design will become more important as the ‘experience’ when shopping, dining, housing and in culture is playing a major role and can therefore only compete with digital space by offering such a high quality that cannot be created in e-commerce or other online services. For that reason, it is important to plan streets and squares as social meeting points and to strengthen city

centres. The small-scale structures create a space that many people like to use and the densification in inner-city locations could also meet land-saving targets in the future (DIU, 2019, p. 23).

In addition to the spatial effects and the numerous interactions with other sectors of spatial development, it is important to mention demographic change. Especially in rural regions, the impact will be very noticeable in the next decades and it is necessary to mitigate the effects. Digitization gives the opportunity to keep particularly the young generation in the regions if it comes with good accessibility (physical and digital), many attractive local services and the possibility to work, educate oneself and use social infrastructures in rural areas combined with a high quality of life. –Whether this really could be achieved or whether the rural small-town regions see this as an opportunity will be one of the central topics in the following expert interviews.

Study characteristics and methodology

The theoretical basis of this paper contains a systematic literature research (about digitization, spatial planning and development in Austria and urban regions) in order to identify all spatial effects of digitization. The literature sources used were the Scopus database as well as key publications by spatial development institutions in Austria, Germany and Switzerland. The preceding sections are intended to reflect the current state of research relevant to this paper.

Based on the identified relevant spatial effects of digitization in the literature and the defined sectors in spatial planning, a selection of three case studies of small-town regions has been made (using *Stadtregionen.at* with the urban-rural typology of Statistics Austria). When selecting the case studies, different topographical areas, economic regions and the proximity to big agglomerations were taken into account in order to achieve a selection that was as balanced as possible. The following small-town regions were chosen: the Alpine-peripheral *Zukunftsraum Lienzer Talboden* (located in NUTS 3 AT333), the well accessible *Stadtregion Amstetten* (in NUTS 3 AT121) and the capital region *Stadtregion Eisenstadt* (in NUTS 3 AT112).

Expert interviews were carried out in each case region to collect primary data. The selection of experts has been systematic, depending on the responsibilities and expertise in the individual case region. The guideline-based interviews were intended to address the current situation on the one hand and to assess future developments on the other. The linkage of digitization (and digitization progress) in the region with other spatial development components (spatial factors) was of central importance. Subsequently, a transcription and a qualitative content analysis of the expert interviews were made from which opportunities and risks of digitization for small-town-regions have been derived.

A list of all mentioned opportunities and risks that emerged from these eleven expert interviews can be found in the following section. As far as possible, efforts were made to list only impacts of digitization with spatial effects, however, due to the numerous direct and indirect effects, this is a matter of consideration, which has also already been discussed in the interviews. This list can thus only be an approximation and must not be considered as a complete and final analysis, as both digitization and spatial developments are undergoing constant change.

Opportunities and risks for small-town regions

In this section, all mentioned opportunities and risks concerning spatial development in small-town regions are listed. Due to the numerous direct and indirect effects and the undergoing con-

stant change in digitization and spatial development, this list can only be seen as an approximation and as a basis for discussion in science and in planning processes.

Mobility and Transport

Table 1. Opportunities and risks of digitization regarding Mobility and Transport

MOBILITY AND TRANSPORT	MO1:	Productive use of travel time in autonomous driving leads to greater commuting distances and more people living in peripheral areas
	MO2:	Reduction of traffic congestion due to fewer vehicles on the road, if sharing-concepts in autonomous driving are used
	MO3:	Revolution of the mobility system and individualization of public transport (use of automated vehicles)
	MO4:	Inclusion of immobile groups in society due to automated driving
	MO5:	Creation of intermodal public transport offers in online booking platforms and apps
	MO6:	Improved management of the so-called 'last mile' through networking of all mobility offers
	MO7:	Mobility on demand/as a service with mobility hubs, sharing models and micro public transports
	MO8:	Digital ridesharing as a contribution to traffic reduction and social interaction
	MO9:	Digital guidance systems to control and optimize the traffic situation
	MO10:	Innovative mobility concepts with large logistic-centres and resource-saving delivery processes
	MO11:	Use of drones as part of local supply for remote areas
	MO12:	Evaluation of mobility patterns and data leads to better public transport offers in rural areas
	MO13:	Fitting measures in regional planning based on detailed mobility profiles
	MO14:	IoT technologies with sensor technology facilitate maintenance and save resources
	MO15:	Use of drones to monitor traffic incidents and collect recent data
	MO16:	Reduced commuting mobility due to home office models in peripheral areas
	MO17:	Remote working in public transport with good internet connection
	MR1:	Higher competitive pressure for public transport because of individual autonomous driving
	MR2:	Increase in mobility due to low barriers to entry in autonomous driving (no driving licence needed, individual transport from and to each private home, convenience, etc.)
	MR3:	Higher traffic load due to increasing delivery traffic in logistics (e-commerce, etc.)
	MR4:	Exclusion of the non-digital-savvy population in online booking platforms
	MR5:	Oversaturation of airspace and usage conflicts due to drones

Source: modified after Stroissnig (2021).

Business and Economy

Table 2. Opportunities and risks of digitization regarding Business and Economy

BUSINESS AND ECONOMy	BO1:	Broadband/fibre glass as a basic technology to attract and retain companies in a region and increase regional added-value
	BO2:	New working models make living and working in peripheral regions more attractive
	BO3:	Community offices/co-working-spaces as an opportunity to offer local jobs in municipalities
	BO4:	Digital networking possibilities reduce physical distances and the importance of location factors
	BO5:	Networking among companies and with research institutions increases innovative strength
	BO6:	Reduction of migration tendencies to urban areas through sufficient online services
	BO7:	Digital business networks and social media as an opportunity for networking of local companies
	BO8:	E-commerce as an option to supply remote regions (including drones)
	BO9:	Logistic-centres with tax splitting by all benefiting municipalities to distribute products
	BO10:	Marketing/purchasing/booking of regional offers via digital platforms
	BO11:	Monitoring systems to optimize work processes and reduce resource consumption
	BO12:	Improvement of planning measures based on Big Data
	BO13:	Local supply of agricultural goods based on digital payment systems
	BO14:	Relocation of production processes to the regions through additive manufacturing
	BO15:	Optimization of existing production chains and delivery systems with digital data analysis
	BO16:	Digital training in companies to reach a more efficient and innovative regional economy
	BO17:	Use of data in planning as an analysis tool for regional economic cycles
	BO18:	Use of online banking to reduce mobility and resources, added with other options for the non-online-savvy population
	BO19:	Leading role in AI and IoT brings positive effects on jobs and regional added-value
	BR1:	E-commerce exacerbates situation in city centres, jobs are lost and regional added-value declines
	BR2:	Logistic-centres seal a large surface and only create a few jobs in the region
	BR3:	Outsourcing of digital services leads to loss of knowledge and influence by local stakeholders
	BR4:	Threat of job losses in the region due to digitization
	BR5:	Networking on digital platforms is less innovative than physical interaction
	BR6:	Risk of image damage on social media for local companies with impact on a whole region

Source: modified after Stroissnig (2021).

Tourism

Table 3. Opportunities and risks of digitization regarding Tourism

TOURISM	TO1:	Use of online booking platforms with simplified handling for local businesses and worldwide visibility as a marketing tool for the entire region
	TO2:	Social media as a marketing tool to address new target groups
	TO3:	Diverse and innovative use of digital formats (apps, VR/AR) in tourism
	TO4:	Integration of digital service systems for information and marketing
	TO5:	Virtual travelling as a convincing marketing tool to visit the region
	TO6:	Use of Big Data, IoT and AI as a tool for further analysis and development of tourism offers and planning measures
	TR1:	Financial dependency of businesses on non-regional online booking platforms
	TR2:	Platforms such as Airbnb responsible for higher rental prices or housing shortage in a region
	TR3:	Fewer visiting guests in a region due to the possibility of virtual travelling
	TR4:	Over-tourism in some areas due to social media hypes
	TR5:	Economic damage in a region due to bad online reviews
	TR6:	'Digital overload' due to the use of too many digital tools that overwhelm guests
	TR7:	Conflicts of use among visitors due to online marketing of people in different target group

Source: modified after Stroissnig (2021).

Environmental and open space development

Table 4. Opportunities and risks of digitization regarding Environmental and open space development

ENVIRONMENTAL AND OPEN SPACE DEVELOPMENT	EO1:	Monitoring environmental parameters and natural hazards by a variety of digital technologies
	EO2:	Fact-based planning measures to preserve the local natural and cultural heritage
	EO3:	Forecasting models based on Big Data and AI enable targeted control measures
	EO4:	Targeted marketing of natural space and the environment (in social media, apps, etc.)
	EO5:	Use of apps and digital services as edutainment tools
	EO6:	Dissemination of important information about environmental issues to citizens
	EO7:	Saving resources through less mobility due to autonomous driving, the use of drones, etc.
	ER1:	Over-use of natural spaces in a region due to potential hypes in social media
	ER2:	Conflicts of use in open spaces due to built infrastructure (pylons, power lines, etc.)
	ER3:	Increasing energy and resource consumption because of new digital technologies
	ER4:	'Data overload' due to high data collection volumes that exceed the usefulness of these data

Source: modified after Stroissnig (2021).

Social infrastructure

Table 5. Opportunities and risks of digitization regarding Social infrastructure

SOCIAL INFRASTRUCTURE	SO1:	Digital education offers lead to equal opportunities for urban and rural areas in a long term perspective
	SO2:	Preservation of school locations threatened by closure with hybrid models (mixed digital and physical presence days)
	SO3:	Digital education opportunities increase the know-how and innovative strength in a region
	SO4:	Telemedicine used as an additional service in peripheral regions to support the declining number of rural physicians
	SO5:	E-health technologies improve preventive health care and diagnoses
	SO6:	High-quality medical care as a flagship for a region to attract newcomers and improve the healthcare for the general public
	SO7:	Digital communication tools increase networking and information flows in communities
	SO8:	Online platforms and apps increase the visibility of local services and increase regional circuits
	SR1:	Strong decline of local social institutions due to digital services and communication options
	SR2:	Migration to metropolitan areas cannot be softened by e-learning and other digital services, SR3:because urbanisation processes have a stronger impact
	SR4:	Great scepticism towards e-health services, mostly due to the replacement of social interactions

Source: modified after Stroissnig (2021).

Local management and governance

Table 6. Opportunities and risks of digitization regarding Local management and governance

SOCIAL INFRASTRUCTURE	GO1:	E-government services are used to pass on information to citizens and save time and effort
	GO2:	Apps as digital citizen cards simplify applications and communication in municipalities
	GO3:	Automated administrative processes using artificial intelligence accelerate work processes and increase transparency
	GO4:	Fast and uncomplicated involvement of citizens in municipalities via digital tools
	GO5:	Digital participation formats, webinars, crowdfunding and challenges encourage participation
	GO7:	Digital citizen boxes to collect new ideas, suggestions and damage reports by citizens
	GO8:	Facility management using digital sensor technologies helps communities to save resources
	GO9:	Digital networking possibilities increase coordination and collaboration in administrative authorities and associations in a region
	GR1:	Frequent rejections or lack of interest in online surveys without personal consultation
	GR2:	'Digital overload' for people because of too many online formats and participation opportunities
	GR3:	Loss of identity in communities and declining use of local facilities and associations in municipalities due to lack of physical interactions
	GR4:	Large number of isolated solutions without useful interfaces in e-government

Source: modified after Stroissnig (2021).

Local planning and settlement structures

Table 7. Opportunities and risks of digitization regarding Local planning and settlement structures

LOCAL PLANNING AND SETTLEMENT STRUCTURES	PO1:	Digital zoning plans and GIS programs improve analysis and planning processes
	PO2:	Digital management of vacant premises leads to new settlements and growth in a region
	PO3:	Forecast models and digital calculators for settlement structures as a tool to create proactive planning strategies
	PO4:	Digital immigration networks to reduce migration tendencies into metropolitan areas and resettlement of already migrated citizens
	PO5:	Digital visualization tools illustrate planning (AR/VR, models, etc.)
	PO6:	More objective planning processes and higher transparency through public accessible web-GIS
	PO7:	Decentralized and flexible working models as an advantage for peripheral regions
	PO8:	In-migration/less out-migration through digital development of rural regions
	PO9:	Smart technologies in cities, regions, settlements and houses save resources
	PO10:	Changed road construction and settlement structures due to different mobility patterns
	PO11:	Digital traffic guidance systems lead to traffic reduction and modal shift (higher efficiency, ontribution to climate protection, etc.)
	PR1:	Resilience as a big risk factor in terms of electricity, data security and outages affecting physical supply chains
	PR2:	Decline of the retail sector and vacancy in city centres will be accelerated by e-commerce and digitization
	PR3:	Compact settlement structures lose importance due to digital infrastructure and housing sprawl is progressing further

Source: modified after Stroissnig (2021).

Discussion and conclusion

The opportunities and risks mentioned in the previous section show the wide range of possibilities for small-town regions. Due to their focus on local conditions in the three case studies, they are mainly applicable to such small-town regions. However, due to the thoughtful choice of the case studies (spatial distribution, different economic structure, location in/outside urban agglomerations, etc.), it was possible to create a comprehensive representation of Austrian small-town regions. As planning processes are highly integrative, complex and multi-level, it is not possible to draw a clear line that states what is specific to small-town regions or what is equally applicable to larger city regions or general planning decisions. This must be considered when applying and discussing the findings. In the author's opinion, many statements can also be applied to other regions and municipalities in Europe.

In this paper, the opportunities and risks of digitization for small-town regions in Austria were evaluated. The field of digitization and spatial development opens up numerous further research options, especially to identify ways in which the identified opportunities and risks can be picked up in the strategic planning and development of particular regions. In addition, it is necessary to analyse specific sectors of spatial development that are especially affected by digitization in more detail. However, this paper was merely intended to provide an overview of the opportunities and risks.

Overall, the opportunities for small town regions, located mostly in rural areas in Austria, are considered to be much more significant than the risks. Many regions have high expectations

regarding the impacts of digitization and the associated equal opportunities for urban and rural areas. However, it can be assumed that, as with all other developments, there will not just be profiteers. Some small-town regions might not keep up with digitization developments at all. The basis for all further developments mentioned by all experts is broadband, whose expansion in Austria's rural regions is still lagging behind. In this field, the small-town region *Zukunftsraum Lienzer Talboden* could be used as a good practice example. In any case, the opportunities of digitization are manifold and definitely relevant for municipalities and regions. In the author's perspective, proactive planning strategies and an intercommunal or trans-regional vision is necessary in order to be able to cope with the transformations in digitization.

References

Aichholzer, G., Gudowsky, N., Saurwein, F., Rhomberg, W., Weber, M., & Wepner, B. (2015). *Industrie 4.0. Foresight & Technikfolgenabschätzung zur gesellschaftlichen Dimension der nächsten industriellen Revolution: Zusammenfassender Endbericht*. Wien: Institut für Technikfolgen-Abschätzung. https://doi.org/10.13140/RG.2.1.1797.2245

ARL (2018). *Handwörterbuch der Stadt- und Raumentwicklung*. Akademie für Raumentwicklung in der Leibniz-Gemeinschaft.

ARL (2019). *Nachrichten der ARL*. Akademie für Raumentwicklung in der Leibniz-Gemeinschaft.

BBSR (2017). *Smart City Charta: Digitale Transformation in den Kommunen nachhaltig gestalten*. Bundesinstitut für Bau- Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR).

Binder, J., & Matern, A. (2020). Mobility and social exclusion in peripheral regions. *European Planning Studies*, *28*(6), 1049-1067. https://doi.org/10.1080/09654313.2019.1689926

Dangschat, J. (2019). Gesellschaftlicher Wandel und Mobilitätsverhalten: Die Verkehrswende tut not! In ARL (Ed.). *Nachrichten der ARL* (01/2019, pp. 8-11). Akademie für Raumentwicklung in der Leibniz-Gemeinschaft.

DIU (2019). *Räumliche Dimensionen der Digitalisierung: Handlungsbedarfe für die Stadtentwicklungsplanung. Ein Thesenpapier*. Berlin. Deutsches Institut für Urbanistik.

EC (2020). *Digital Economy and Society Index (DESI) 2020: Austria*. Retrieved from https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=66906

Engelke, D., Hagedorn, C., Schmitt, H.-M., & Buechel, C. (Ed.). (2019). *Raumwirksamkeit der Digitalisierung. Ergebnisse einer breit angelegten Delphi Umfrage*. Rapperswil: Hochschule für Technik Rapperswill. https://doi.org/10.5281/zenodo.3459432

Faßmann, H. (2009). *Allgemeine Stadtgeographie* (2. Aufl., Neubearb., Dr. A1). Das geographische Seminar, 1. Westermann.

Fritzsche, S. (2014). *Vernetzte Gesundheit planen – Internet als Werkzeug, Entwicklungsimpuls und Forschungsgegenstand im ländlichen Raum*. Arbeitsberichte der ARL: Vol. 8. Akademie für Raumforschung und Landesplanung.

Gluch, M. (2019). Micro-Hubs: Antwort auf die Herausforderungen der Letzten-Meile-Logistik. *RaumPlanung*, *202*(3/4), 36-41.

Gruber, M., Kanonier, A., Pohn-Weidinger, S., & Schindelegger, A. (2018). *Raumordnung in Österreich und Bezüge zur Raumentwicklung und Regionalpolitik*. Österreichische Raumordnungskonferenz, 202.

Hangebruch, N., Osterhage, F., & Wiegandt, C. (2019). Onlinehandel in ländlichen Räumen: Fluch oder Segen? *RaumPlanung*, *202*(3/4), 8-15.

Hildebrandt, A., & Landhäußer, W. (Eds.). (2017). *CSR und Digitalisierung: Der digitale Wandel als Chance und Herausforderung für Wirtschaft und Gesellschaft*. Berlin, Heidelberg: Springer Gabler.

Humer, A. (2018). Linking polycentricity concepts to periphery: implications for an integrative Austrian strategic spatial planning practice. *European Planning Studies*, *26*(4), 635-652. https://doi.org/10.1080/09654313.2017.1403570

Humer, A., & Granqvist, K. (2020). The gradual city-ness and town-ness of public service locations: towards spatially sensitive sector policies. *Geoforum*, *113*, 81-91. https://doi.org/10.1016/j.geoforum.2020.05.008

Kadi, J., Plank, L., & Seidl, R. (2019). Airbnb as a tool for inclusive tourism? *Tourism Geographies*. https://doi.org/10.1080/14616688.2019.1654541

KDZ (2021). Stadtregionen.at. Zentrum für Verwaltungsforschung. Retrieved from https://stadtregionen.at/

Keiser, A. (2019). *Standortanforderungen und räumliche Auswirkungen von Micro-Hubs*. Hochschule für Technik Rapperswill. Retrieved from https://raumdigital.hsr.ch/fileadmin/user_upload/raumdigital/user_upload/20190902_PA1_Keiser_Standortanforderungen_Micro_Hubs_reduced.pdf

OECD (2017). OECD Digital Economy Outlook 2017. Paris: OECD Publishing. https://doi.org/10.1787/9789264276284-en

Ravenelle, A. J. (2020). Digitalization and the hybridization of markets and circuits in Airbnb. *Consumption Markets & Culture*, *23*(2), 154-173. https://doi.org/10.1080/10253866.2019.1661244

Schulz, J. (2018, May 31). *Digitalisierung in der Bildung. Chancen für eine gleichwertige räumliche Entwicklung?* Akademie für Raumforschung und Landesplanung (ARL), Landesarbeitsgemeinschaft Berlin/Brandenburg/Mecklenburg-Vorpommern, Cottbus. Retrieved from https://nbn-resolving.org/urn:nbn:de:bsz:14-qucosa2-233933

Setz, M., Frank, J., & Suter, S. (2019). *Die regionalwirtschaftliche Entwicklung in der Schweiz*. regiosuisse – Netzwerkstelle Regionalentwicklung. Retrieved from https://regiosuisse.ch/export/report?locale=de&ids=2839

Soteropoulos, A., Berger, M., & Ciari, F. (2019). Impacts of automated vehicles on travel behaviour and land use: an international review of modelling studies. *Transport Reviews*, *39*(1), 29-49. https://doi.org/10.1080/01441647.2018.1523253

Stöglehner, G. (Ed.). (2020). *Grundlagen der Raumplanung 2: Strategien, Schwerpunkte, Konzepte.* Vienna: Facultas Universitätsverlag.

Stroissnig, U. C. (2021). *Chancen und Risiken der räumlichen Entwicklung durch Digitalisierung in Kleinstadtregionen*. Master's thesis, University of Vienna. Retrieved from https://ubdata.univie.ac.at/AC16421111

TWI2050 (2019). *The Digital Revolution and Sustainable Development: Opportunities and Challenges: Report prepared by The World in 2050 initiative*. Laxenburg: International Institute for Applied Systems Analysis. https://doi.org/10.22022/TNT/05-2019.15913 The World in 2050

Weichhart, P. (2008). *Entwicklungslinien der Sozialgeographie: Von Hans Bobek bis Benno Werlen*. Sozialgeographie kompakt, 1. Stuttgart: Steiner.