Silvia Ručinská, Josef Bernhart,
Franziska Cecon and George Cornel Dumitrescu

Exploring Digital and Green Concepts

Knowledge Base for Cities and Municipalities

Wolters Kluwer

Exploring Digital and Green Concepts

Knowledge Base for Cities and Municipalities

Edited by Silvia Ručinská, Josef Bernhart, Franziska Cecon and George Cornel Dumitrescu

Wolters Kluwer

Citation:
RUČINSKÁ, S. – BERNHART, J. – CECON, F. – DUMITRESCU, G. C. (eds.) 2024. *Exploring Digital and Green Concepts. Knowledge Base for Cities and Municipalities*. 1st edition. Prague : Wolters Kluwer ČR, a. s., 2024, 208 p., ISBN 978-80-286-0048-8

Acknowledgement

Co-funded by the European Union

The project Digital Government for Green Municipalities and Cities (No. 2021-1-SK01-KA220-HED-000023505) is Co-funded by the Erasmus+ Programme of the European Union. Any communication or publication that relates to the project Digital Government for Green Municipalities and Cities (No. 2021-1-SK01-KA220-HED-000023505) reflects only the author's view and the European Commission is not responsible for any use that may be made of the information it contains.

Editors: Silvia Ručinská
Pavol Jozef Šafárik University in Košice, Košice, Slovak Republic
Josef Bernhart
Eurac Research, Institute for Public Management, Bolzano, Italy
Franziska Cecon
University of Applied Sciences Upper Austria, Linz, Austria
George Cornel Dumitrescu
Institute for World Economy (IWE), Bucharest, Romania

Reviewers: Claudiu Crăciun
National University of Political Studies and Administration, Faculty of Political Science, Bucharest, Romania
Oliver Sievering
University of Applied Sciences for Public Administration and Finance Ludwigsburg, Ludwigsburg, Germany

First edition, Wolters Kluwer ČR, a. s., October 2024

ISBN 978-80-286-0048-8 (paperback)
ISBN 978-80-286-0049-5 (pdf)

Table of Contents

List of Boxes, Figures and Tables

Boxes

Figures

Tables

Foreword

The publication **Exploring Digital and Green Concepts. Knowledge Base for Cities and Municipalities** is the result of the project Digital Government for Green Municipalities and Cities – DiGreen. The project is co-funded by the Erasmus+ Programme of the European Union.

The project has brought together experts from different universities and research institutions in a unique international consortium to address the problems of municipalities and cities. With experts coming from different countries and familiar with different policy frameworks and communal strategies, it has been possible to develop new perspectives on how municipalities and cities in Europe can respond to new trends and challenges and how they can adapt their policies and relations with their citizens. In this publication, we address challenges focusing on digitalisation and climate change.

The publication is designed as an interdisciplinary knowledge base encompassing backgrounds, common topics and challenges relevant to communal policy, digitalisation at the level of municipalities and cities, and green transition topics. Digital and green backgrounds provide necessary contexts and explanations about the digitalisation and digital transition, climate neutrality and sustainability, and highlight modern trends and challenges that the municipalities and cities face during the digital and green transition. Common topics for municipalities and cities summarize a selection of current communal management approaches, that can help municipalities and cities to cope and deal with digital and green transition opportunities, possibilities, and potential risks. Digitalisation at the communal level presents modern approaches to digital communal transition, highlighting general information, importance and benefits, practical applications, limitations and challenges. Green transition at the communal level emphasizes a representation of areas to be considered as an integral part of sustainable communal development, stressing out general information, importance and benefits, practical applications, limitations and challenges.

The main target groups of this publication are teachers and researchers, higher education students in public administration, political sciences and related disciplines, and professionals already working in the municipality or city self-government public bodies. The aim is to contribute to the scientific discourse and debate on the most urgent and relevant topics considering the digital and green transition, emphasizing the communal level of governance. Students who aspire to work for a municipality or city can develop the knowledge needed in the framework of digital transformation of society and climate neutrality. Professionals already working in a municipality or city

can develop their knowledge of digitalisation and climate neutrality to fulfil tasks within local public authority's activities.

The publication was produced in hard copy and electronic format, both in English. The online version is available through the official DiGreen project website.

We would like to thank the representatives of all the municipalities and cities who shared their good examples with us and the reviewers for their kind suggestions.

1
Digital and Green Backgrounds

1.1 Digitalisation and Digital Transformation

Authors: Belinda Hanner and Franziska Cecon

1.1.1 General Introduction

In daily life, especially the terms "digitalisation" and "digital transformation" are often used synonymously (Streicher, 2020). Briefly summarised, the term "digitisation" means that analogue data, such as text, image, video etc. gets converted into a digital format. The Term "digitalisation" describes the use of digital technology by users. The term "digital transformation" means the permanent change of an organisation in every way by implementing digital tools and new technologies due to strategic reasons (Gooyabadi et al., 2024). Digital transformation has not only an impact on the organisational level but also on the everyday life, the economy and society as a whole. Therefore, it is no surprise that in comparison to "E-Government", which means the processing of public services via the Internet, digital transformation influences the structures of the public sector more profoundly (Streicher, 2020).

Important digital transformation technologies and fields of application are:

- **Artificial Intelligence (AI):** Artificial neural networks with the ability to make conclusions on their own based on large volumes of data input are called AI. Possible fields of application are Chatbots (text-based dialogues between the software and users. This allows automated answers to a range of questions by keyword processing), Text Analysis (automated text evaluation) and Picture Analysis (recognition and classification of persons, animals and objects) (Streicher, 2020). For example, in the Austrian Parliament, emotion recognition and emotion prediction by AI systems are seen as interesting topics for the future. Using AI systems for analysing behavioural patterns of social-media users also, including text analysis, picture analysis, audio and video analysis and the analysis of biometric signals, is considered a possibility to make conclusions about emotional states, characteristics and behaviours of people in the future. In the USA and Great Britain, emotional facial recognition systems have been used for several years at border controls to identify suspects. Due to the risk of discrimination, in the European Union, the use of such AI-Systems is forbidden in the fields of education and work by the AI Act (ÖAW-ITA and KIT-ITAS, 2024).
- **Virtual Reality (VR):** It generates an artificial surrounding consisting of visuals and sound. Users can access Virtual Reality through a headset commonly known as "VR glasses". Possible fields of application are, for example, virtual tours through buildings and facilities to gain knowledge before the start of construction.
- **Augmented Reality (AR):** Through the camera lens of a smartphone or special glasses, the real surroundings are recorded, and some extra digitally provided information is added. Possible fields of application are additional data layers

during local area inspections. Also, Building Information Modelling (BIM) can be used to model data digitally regarding planning and building facilities. Drones, for example, can be used for aerial photography (Streicher, 2020). For example, in the Austrian public sphere, AR is still hardly widespread, but the digital and physical spaces are increasingly merging (Figure 1.1.1). Various future scenarios are considered as possible. In any case, regulation of the digital public space will become necessary (Gudowsky-Blatakes, 2022).

Figure 1.1.1 **A visualisation of what AR could look like in the public space**
Source: Gudowsky-Blatakes (2022).

- **Internet of Things (IoT):** The "Internet of Things" connects objects, devices, sensors and human users to an entire system. Therefore, physical and digital objects are interconnected, and their interaction is documented and digitally processed. IoT combines various technological concepts. In "Smart Cities", sensors connect various systems, and automated data analysis controls processes, e.g. intelligent lighting systems, including traffic lights. (Streicher, 2020). For example, the capital city of Austria, Vienna, has an IoT strategy. Among other measures, the city of Vienna is measuring air quality and controls pedestrian lights using IoT (Hagler et al., 2018).
- **Big Data:** Incredible amounts of data result in real-time from sensors, e.g. in technical equipment, smartphones, IoT and automotive. Big data software provides rapid data processing, query and analysis of vast amounts of data, including predictive data analysis in order to predict future events. Examples of use in the public sector are measuring the effectiveness of support measures and uncovering the abuse of benefits by analysing historical data. In this regard, the privacy policy of the user's data must be kept in mind by the employees of the public

administration (Streicher, 2020). For example, the Austrian Institute of Technology led the project "Real-time Data Analytics for the Mobility Domain". The project aimed to process enormous amounts of data from various sources such as traffic sensors, meteorological data, data from social media, mobile phone data and data from other sources in real time to provide a flexible mobility infrastructure. High-performance computing and big data solutions were used during the realisation of the project. The real-time data can facilitate route planning, for example, for patient transport and also has the potential to enable in-depth mobility surveys (Meir-Huber and Köhler, 2024).

- **Cloud-Technology:** Data is no longer stored on the users' devices but on online servers. Therefore, the data of a cloud user can be accessed from various end devices. A key function is data synchronisation. The disadvantage is low data security. In some areas, data protection-compliant cloud solutions are already available and can be used by the public sector. In the public sector, citizens and authorities desire simple data exchange, but it cannot be implemented for all data exchange processes due to legal reasons (Streicher, 2020). For example, due to unresolved data protection issues, cloud computing is still being used hesitantly in the Austrian public sector. In the future, cloud computing could be used to process large volumes of data and simplify inter-governmental collaboration (Hladky, 2024).
- **Blockchain:** Blockchain technology has the advantage of storing data transparently and unalterably, ensuring transaction security. However, due to legal reasons, blockchain technology is currently not applicable in all areas of the public sector. (Streicher, 2020). For example, the "Austrian Public Service Blockchain" has been used since 2019 (WKO, 2023). The Austrian Chamber of Commerce generates certified data with this service (WKO, 2024).

1.1.2 Aims & Objectives

In general, the process of continuous digital transformation can increase the efficiency and effectiveness of organisational processes and unleash the power of innovation (Gooyabadi et al., 2024). Societal development is accelerating. Therefore, **governments** need to find ways to keep up with these developments (Larsson and Teigland, 2020). So, in the context of the public sector, maintaining and increasing efficiency is the main aim of digital transformation. Digital Transformation affects municipalities, cities, and nations as well as the European level as a whole: It can ensure Europe's digital sovereignty (European Commission, 2022).

The European Commission provides **guiding principles regarding digital transformation** that build on European values. The five principles are "digital partnerships", "digital security and resilience", "digital interaction first", "digital sovereignty and autonomy" and "digital empowerment". For example, digital transformation takes place

on the organisational level (e.g. "digital empowerment" within the corporate framework) as well as on the cross-organizational level (e.g. "digital partnerships" of the Commission with other institutions, Member States, the private sector, academia and further organisations). Digital infrastructure is needed to preserve security and to work in a sustainable, effective and independent way. Faced with cyber-attacks, the Commission aims at a strong cybersecurity culture that can provide resilience within the Commission's digital infrastructure. Also, openness and transparency are important to fulfill the principles (European Commission, 2022).

Regarding **the implementation of digital transformation**, the most essential areas of activity are the organisation itself, the human beings, and the IT infrastructure (Streicher, 2020). To successfully implement the digital transformation, an open-mindedness regarding using these new practices and the strength to question previous approaches are required (Gooyabadi et al., 2024). Digital transformation is not implemented by realising just one project. Digital transformation requires several projects that change the whole organisation. Therefore, the entire organisation learns to be adaptive to change overall (Gooyabadi et al., 2024).

Digital tools harbour the risk of being misused, which can worsen existing social inequalities (European Commission: International Partnerships, 2024). Therefore, public services must be accessible online and offline due to legal conditions and to avoid the risk of excluding persons who do not have internet access or have other limitations regarding the use of digital public services (Streicher, 2020). Barrier-free accessibility must be guaranteed, and various standards and laws must be met. The **barrier-free accessibility** of public services can be seen as an advantage in the public sector (Nestler, 2022). In the context of digital public services, the identities of the users must be clear. This can prevent the misuse of personal data, and users can access it easily. A **digital identity** thus protects not only the individual user but all stakeholders involved. Both legal and technical aspects of digital identity must be taken into account (Streicher, 2020).

Human-centred digitalisation in the public sector can be realised by providing great service, user experience, aesthetic user interfaces, and comfortable usability to the **citizens** while functioning efficiently and effectively. A positive user experience can, for example, be provided by a software design in familiar patterns as like in software the citizens are already familiar with (Jakob's Law), by reducing the complexity regarding the usability of technology to avoid barriers to the decision-making of users (Hick's Law) and in aesthetic user interfaces. Putting the user experience at the centre of attention also lays the foundation of innovation in public administration. **Sometimes, the best problem solver is a personal conversation**. That's why digital public services should also offer the possibility of analogue assistance (Nestler, 2022).

A human-centred public administration should focus on the citizen experience and the user experience, including the employees' experience in public administration (Nestler, 2022). The staff in the public sector needs digital skills. Digital skills have

the potential to improve the impact of the employee's work in the public sector. Thus, training measures for the staff should ensure that the employees are able to use digital technologies to improve autonomy, productivity and agility at work. The digital skills of the staff also guarantee high-quality public services to the citizens (European Commission, 2022). Because digital transformation is enabled through the employees, new job profiles, increased self-responsibility, and **new work models** such as home-office and flexible working time models, a tendency towards **reducing hierarchical structures** is on the rise. Administrative employees need to assume the role of consultants and partners when interacting with the public (Streicher, 2020).

1.1.3 Strategies & Important Papers

Above, we have already shown practical examples of using digital technologies. Now, let's look at digital transformation on a transnational level.

In the European Union, the public sector's digital transformation focuses especially on **data, infrastructure and technology** (European Commission a, 2024). For example, in the EU, digital technologies are being used to implement the EU's digital strategy and the UN's 2030 Agenda, including the SDGs. The EU wants to make sure that the measures are inclusive and fair (European Commission: International Partnerships, 2024).

Digital Strategy of the European Union

The **digital strategy of the European Union** aims to gain digital sovereignty, enable digital transformation and contribute to the goal of a climate-neutral Europe by 2050 (European Commission a, 2024). Figure 1.1.2 gives an overview of the strategic goals of the digital strategy. Looking at the dimensions of the goals, it becomes clear that digital transformation not only affects businesses and infrastructure but also **creates a digital culture**, which means digital skills that enable people to use digital tools in their daily life (European Commission, 2022).

Examples provide some practical insights: As part of the digital strategy, among other things, the EU works on the **Digital Services Act** (DSA), which should provide a safe online environment for users by preventing illegal and harmful activities on marketplaces, social networks, app stores and so on (European Commission b, 2024). Creating access to a digital identity for all EU citizens and residents by **providing a personal digital wallet** to them, so that they can use it for public as well as for private services across the EU is another measure within the digital strategy of the EU (European Commission c, 2024). The **Digital Markets Act** (DMA) is another centre point. It creates objective criteria for large online platforms such as Alphabet, Amazon, Apple, ByteDance, Meta, Microsoft and others. The criteria aim to ensure that they act fairly by not allowing the use of unfair practices (European Commission d, 2024).

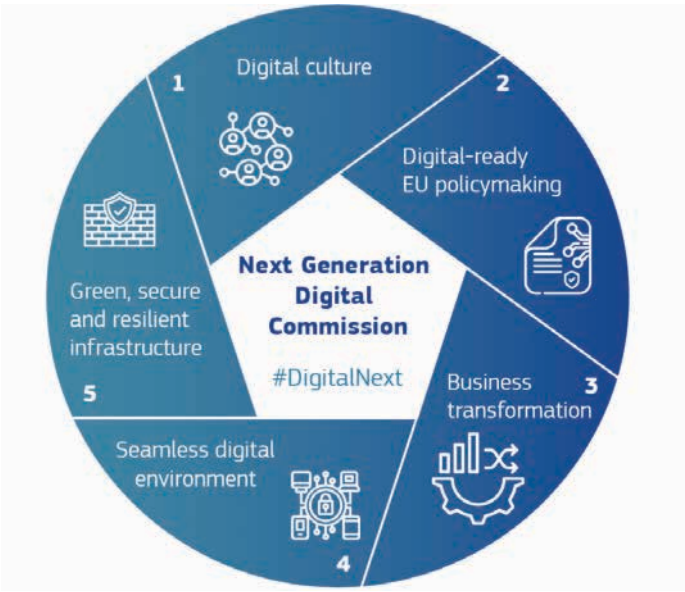

Figure 1.1.2 **The goals of the EU's digital strategy**
Source: European Commission (2022).

UN's 2030 Agenda for Sustainable Development

The universal **UN's 2030 Agenda for Sustainable Development** consisting of the 17 **"Sustainable Development Goals"** (SDGs) focuses on the economic, social and environmental dimensions of sustainable development and includes 169 targets (United Nations, 2024).

Paragraph 70 of the 2030 Agenda for Sustainable Development states, "We hereby launch a Technology Facilitation Mechanism. (...) The Technology Facilitation Mechanism will be based on a multistakeholder collaboration between the Member States, civil society, the private sector, the scientific community, United Nations entities and other stakeholders. It will be composed of a United Nations interagency task team on science, technology and innovation for the Sustainable Development Goals, a collaborative multistakeholder forum on science, technology and innovation for the Sustainable Development Goals and an online platform." (United Nations, 2024). In fact, digital technologies are classified as relevant for achieving 70 % of the SDGs (SDG Digital, 2024). Therefore, "the Agenda introduces 'Digital Transformation Enablers', which are intended to inform national governments (and others working in digital ecosystems) about the power and potential of digital technologies and data." (SDG Digital, 2024). Also, the municipal level is perceived as key to sustainable development (2030 Agenda de, 2021).

Figure 1.1.3 shows that the **digital public infrastructure** (DPI) is an essential enabler for implementing digital transformation.

In fact, digital technologies are classified as relevant for achieving 70 % of the SDGs (SDG Digital, 2024). Therefore, "the Agenda introduces 'Digital Transformation Enablers', which are intended to inform national governments (and others working in digital ecosystems) about the power and potential of digital technologies and data." (SDG Digital, 2024). The 'Digital Transformation Enablers' consist of the two sections 'non-technical enablers' and 'technical enablers'. The non-technical enablers include the pillars

- Leadership and strategy
- Governance, regulations, and policies
- Digital skills and capacity
- Funding, financing models, and incentives

Whereas the technical enablers encompass the components

- Digital public infrastructure (IDs and civil registries, Payments, Data sharing and models, Signatures and consent, Discovery and fulfillment)
- Connectivity infrastructure
- Data centres
- Cloud and high-performance computing infrastructure
- Other infrastructure
- Security

The non-technical enablers on the one hand can be seen as tools for planning and preparing the digital transformation successfully and the technical enablers oh the other hand provide the necessary tools for implementing the digital transition (ITU, UNDP, 2023). Also the municipal level is perceived as key to sustainable development (2030 Agenda de, 2021). Especially the digital public infrastructure (DPI) is an essential enabler for implementing digital transformation.

Figure 1.1.3 **Non-technical and technical digital transformation enablers**
Source: Authors based on ITU, UNDP (2023).

1.1.4 Summary

Digital technologies have evolved rapidly from the first steps of digitisation to the **worldwide trend** of digital transformation. They are changing and affecting the global economy as well as the people on a large scale. Digital technologies offer both **opportunities and risks**. Anyways, digital transformation continues to progress and the **public sector plays a key role** in implementing digital technologies from the transnational to the municipal level. Also, 70% of the SDGs are affected by digital technologies, so it is a fact that digital transformation is not a one-time measure but a **continuous process of change** and therefore can't be handled by single projects but by **cooperations** between the public sector, the private sector, the civil society and other stakeholders. In the public sector, all levels, from the municipalities up to the global level (e.g. the UN and the EU), are strongly affected by the successful realisation of digital transformation.

References

2030 Agenda de (2021). Kommunen sind zentral für nachhaltige Entwicklung. Online. [12/6/2024]. Available at: <https://www.2030agenda.de/de/publication/kommunen-sind-zentral-fuer-nachhaltige-entwicklung>.

European Commission (2022). *European Commission digital strategy – Next generation digital Commission.* Online. [12/6/2024]. Available at: <https://commission.europa.eu/document/download/70703206-2592-4175-b10d-12f97382094a_en?filename=C_2022_4388_1_EN_ACT&prefLang=en>.

European Commission a (2024). *A Europe fit for the digital age – Empowering people with a new generation of technologies.* Online. [15/1/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en>.

European Commission b (2024). *The Digital Services Act – Ensuring a safe and accountable online environment.* Online. [12/6/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-services-act_en>.

European Commission c (2024). *European Digital Identity.* Online. [12/6/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-digital-identity_en>.

European Commission d (2024). *The Digital Markets Act: ensuring fair and open digital markets.* Online. [12/6/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en>.

European Commission: International Partnerships. (2024), Responsible digitalisation. Online. [15/1/2024]. Available at: <https://international-partnerships.ec.europa.eu/policies/digital-and-infrastructure/responsible-digitalisation_en>.

GOOYABADI, A. A. et al. (2024). *Nonprofit Digital Transformation Demystified – A Practical Guide.* Switzerland: Springer Nature. DOI: <https://doi.org/10.1007/978-3-031-47182-7>.

GUDOWSKY-BLATAKES, A. (2022). *Augmented Reality im öffentlichen Raum.* Online. [12/6/2024]. Available at: <http://epub.oeaw.ac.at/ita/ita-dossiers/ita-dossier066.pdf>.

HAGLER, M. et al. (2018). *"Internet of Things" – Strategie – Digitale Agenda Wien.* Online. [12/6/2024]. Available at: <https://digitales.wien.gv.at/wp-content/uploads/sites/47/2019/11/iot-strategiev101290318.pdf>.

HLADKY, A. (2024). *Cloud Computing im öffentlichen Sektor ist entscheidend für die digitale Transformation.* Online. [12/6/2024]. Available at: <https://www.pwc.at/de/presse/2024/cloud-computing-im-oeffentlichen-sektor-entscheidend-fuer-digitale-transformation.html>.

MEIR-HUBER, M., KÖHLER, M. (2024). *Best Practice für Big Data Projekte.* Online. [12/6/2024]. Available at: <https://www.ffg.at/sites/default/files/allgemeine_downloads/thematische%20programme/IKT/big_data_in_austria-leitfaden.pdf>.

LARSSON, A., TEIGLAND, R. (2020). An introduction to digital welfare: a way forward? In *Digital Transformation and Public Services*, 1-12. Oxon : Routledge.

NESTLER, S. (2022). *Menschzentrierte Verwaltung – Praxisleitfaden für eine gelungene Usability und User Experience in der öffentlichen Verwaltung.* Wiesbaden : Springer Gabler. DOI: <https://doi.org/10.1007/978-3-658-36334-5>.

ÖAW-ITA, KIT-ITAS (2024). *Emotionserkennung als Hoffnungsträger für KI?* Online. [12/6/2024]. Available at: <https://www.parlament.gv.at/dokument/fachinfos/zukunftsthemen/154_KI-emotionserkennung.pdf>.

SDG Digital, (2024). *SDG Digital Acceleration Agenda.* Online. [12/6/2024]. Available at: <https://www.sdg-digital.org/>.

STREICHER, H. W. (2020). *Digitale Transformation in der öffentlichen Verwaltung – Praxishandbuch für Projektleiter und Führungskräfte*. Berlin : Springer Gabler. DOI: <https://doi.org/10.1007/978-3-662-60938-5>.

United Nations (2024). Transforming our world: The 2030 Agenda for sustainable development. Online. [12/6/2024]. Available at: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>.

ITU, UNDP (2023). SDG Digital Acceleration Agenda. Online. [12/6/2024]. Available at: <https://www.undp.org/sites/g/files/zskgke326/files/2023-09/SDG%20Digital%20Acceleration%20Agenda_2.pdf>.

WKO (2023). Blockchains in Österreich – Zum aktuellen Stand von Blockchain-Infrastrukturen. Online. [12/6/2024]. Available at: <https://www.wko.at/netzwerke/blockchains-oesterreich>.

WKO (2024). Blockchain-Service Datenzertifizierung – Innovationsservice: Daten einfach, sicher und kostenlos digital zertifizieren. Online. [12/6/2024]. Available at: <https://www.wko.at/digitalisierung/blockchain>.

1.2 Climate Neutrality and Sustainability

Authors: Dominik Prüller and Franziska Cecon

1.2.1 General Introduction

Due to the greenhouse effect, the earth keeps heating up. Scientists have observed that the Earth's temperature has increased by nearly 3°C since the beginning of weather recordings. This warming has serious consequences: glaciers are melting, sea levels are rising, and rising temperatures are causing water scarcity. (EWE, 2023b)

Global warming refers to the steady rise in the Earth's average temperature. This doesn't mean every year is warmer than last, but when we look at surface temperatures since the 19th century, there's a clear upward trend. The previous six years have been recorded as the warmest since 1881. For instance, in Germany, the average daily temperature was about 7.4°C in 1881 and increased to around 10.4°C in 2020. However, there are variations in temperature across different regions, as some parts warm up faster than others. (EWE, 2023b)

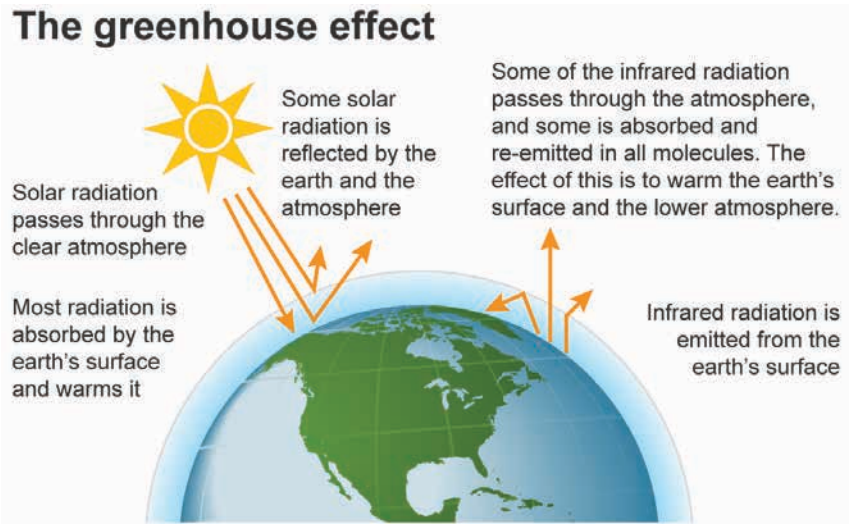

Figure 1.2.1 **The greenhouse effect**
Source: U.S. Energy Information Administration (2024).

Global temperatures are going up primarily as a result of what is known as the greenhouse effect. When the sun's rays reach the surface of the earth, it becomes heated. Some of this warmth is sent back into space but certain gases like CO2 keep some of it trapped in our atmosphere. This process can be likened to an actual greenhouse where sunlight passes through glass panes, heating up the air inside them; similarly, when light enters our atmosphere, the earth's surface also gets warm. Some heat is released back

out to space thereafter; however, a portion gets absorbed by compounds such as CO2, thus contributing towards maintaining an average temperature of about 15°C due to the natural greenhouse effect. If there wasn't any CO2 present, then the earth's surface temperature would be -18°C. (EWE, 2023a)

While this is a natural process, human activities – especially burning fossil fuels – produce additional greenhouse gases, trapping more heat and causing temperatures to rise further. Although natural factors affect the climate, human actions have the most significant impact on global warming. (EWE, 2023b) Therefore, human activities intensify this natural process. Burning fossil fuels and deforestation release more CO2, enlarging the CO2 layer in the atmosphere. Other activities, like rice farming and raising livestock, produce methane, which has even worse effects on the climate. (EWE, 2023a)

Greenhouse gases responsible for this effect include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and others. CO2, at 87%, is the primary contributor, followed by methane at 6.5%. (EWE, 2023a)

If global temperatures exceed 1.5°C above pre-industrial levels, scientists predict severe consequences. This prompted the Paris Agreement's goal to limit global warming to 1.5°C, with 197 countries aiming to reduce greenhouse gas emissions. Achieving these climate goals requires decarbonisation and transitioning to renewable energy sources. (EWE, 2023b)

The consequences of global warming are already visible: melting glaciers, rising sea levels, habitat destruction, and threats to wildlife like polar bears. Additionally, defrosting permafrost releases methane, accelerating the greenhouse effect. Changes in ocean temperatures can devastate coral reefs, while extreme droughts on land lead to food shortages and hunger. (EWE, 2023b)

Climate Neutrality

Climate neutrality refers to a state where the impact of human activities on the climate is balanced out by reducing emissions and increasing the absorption of greenhouse gases. This means that the emissions released into the atmosphere are compensated by activities that remove an equal amount of these emissions. (Honegger et al., 2020)

There are different levels of climate neutrality, such as weak neutrality, which involves buying emission credits generated by activities that reduce emissions elsewhere. However, this approach doesn't stabilise the climate system globally since it leads only to relative reductions, not an absolute decrease in emissions. The more effective approach is strong neutrality, which aims for a complete balance between greenhouse gas emissions and absorption, including natural and human-made absorption technologies. Achieving absolute neutrality would mean effectively eliminating emissions or offsetting them entirely through technologies that remove greenhouse gases from the atmosphere. (Honegger et al., 2020)

While reaching absolute neutrality may seem unrealistic due to challenges in completely eliminating emissions across all sectors, the goal is to get as close to neutrality as possible. Even if emissions were reduced to zero, some human activities, like aviation, could still impact the climate. (Honegger et al., 2020)

There are different kinds of neutrality, of which climate neutrality is the most comprehensive form, aiming to maintain the global average temperature by balancing all human-caused and natural factors affecting it. However, achieving this may be incredibly challenging due to the complex interactions of various pollutants in the atmosphere and surface features that can either heat or cool the Earth. (Honegger et al., 2020)

Therefore, another approach is greenhouse neutrality, which means balancing all greenhouse gases defined in international agreements. Yet another kind of neutrality is CO2 neutrality, which means balancing only carbon dioxide emissions and absorptions. This is less ambitious than climate neutrality but can be seen as a step towards it. (Honegger et al., 2020)

Sustainability

The concept of sustainability represents the idea of ensuring long-lasting effects. Initially, the term was used in forestry to describe the goal of securing continuous utilisation despite high wood demands for mining, avoiding complete deforestation, and ensuring the forest's natural regeneration. (NÖ Energie und Umweltagentur GmbH, 2023)

To foster a sustainable future for generations, conscious choices play a pivotal role. Embracing a sustainable lifestyle involves ecological considerations such as reducing carbon emissions, conserving energy, and preserving natural resources. Equally crucial are social aspects like upholding production standards and fair trade, along with economic factors such as efficiency, purpose, product lifecycle, and local sourcing. (NÖ Energie und Umweltagentur GmbH, 2023)

In our daily lives, there are many choices we can make to facilitate sustainability. Opting for minimal packaging, durable goods, reusable fabric or paper bags instead of plastic, buying second-hand items, selecting energy-efficient devices and supporting fair trade textiles and eco-friendly cleaning products contribute to sustainability. (NÖ Energie und Umweltagentur GmbH, 2023)

In nutritional habits, choosing seasonal local products, favouring organic and Fair-trade-labeled items, and a meatless diet contribute to sustainability. Also waste management, which involves waste reduction, and proper segregation, is important. Further important aspects are conscious shopping, storing food effectively, using leftovers, favouring reusable items, and opting for eco-friendly beverages like tap water or organic regional juices. (NÖ Energie und Umweltagentur GmbH, 2023)

Efforts in energy conservation through isolation, using lower washing temperatures, identifying and switching off or replacing energy-consuming devices, and minimising standby mode are further effective measures to be considered. Walking, cycling short

distances, public transport, carpooling, fuel-efficient vehicles, and reducing air travel contribute to sustainable mobility. (NÖ Energie- und Umweltagentur GmbH, 2023)

Additionally, practices like composting, using organic fertilisers, avoiding pesticides, and cultivating more natural plants foster sustainability in nature and gardens. At the workplace, using laptops over desktops, reducing paper usage, favouring recycled paper, and printing in black and white can promote sustainability. (NÖ Energie und Umweltagentur GmbH, 2023)

Three Pillars of Sustainability

Sustainability's three-dimensionality describes the integrative connection of the three pillars, areas, or dimensions of ecology, economy, and society. Ecological sustainability describes the use of a system in a way that it remains permanently preserved in its essential properties, and thus, its continued existence is secured. (Pufe, 2017)

The following aspects play a role: the ecological system is both a sink (for emissions) and a source (natural resources) that are directly and indirectly vital for survival. Without a certain state of nature and ecosystems, humanity can't survive. Human activities that cause ecological degradation include the extraction of raw materials, redirection of material and energy flows, landscape conversion, and soil sealing. Certain phenomena have already reached a level of overuse, such as overfishing of the seas, melting of the polar caps, and ozone holes. The speed of anthropogenic changes is problematic; for example, trees cannot follow the climate-induced shift in vegetation zones quickly enough. In the last hundred years, humans have influenced the earth more through industrialisation than in the previous 10,000 years. (Pufe, 2017)

Economic sustainability, just like ecological sustainability, is about using a system to preserve its core properties; therefore, its continued existence is guaranteed. Here, in order to achieve sustainability, it must be highlighted that economic growth is only possible in the long term through technical progress. However, if technical progress is capital and labour-intensive, the productivity of natural capital is not. In the long term, there must be an overload, overuse, and overstrain of the natural resource base. Instead, a paradigm shift should be made in the sense of "from wealth to sustainability". Therefore, people should only consume what can be consumed maximally without the necessity of reducing future consumption. A possible solution is the decoupling of growth and resource use through efficiency, sufficiency, and consistency, as well as through environmental, social, and institutional innovations. (Pufe, 2017)

Social sustainability describes the human-oriented use of a system or organisation, again, in a way that it remains permanently preserved and can continue to exist. Here, current problems that express social non-sustainability include terrorism, migration, the wealth gap, or discrimination, and how these aspects can disrupt entire economies and countries. Social resources include tolerance, solidarity, integration ability, inclusion, public welfare orientation, sense of justice and fairness. Another possible definition

of social sustainability is the solution to the distribution of problems between regions, social groups, genders, and age groups, as well as cultural integration. (Pufe, 2017)

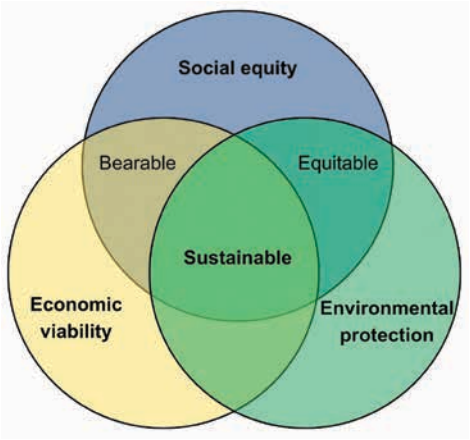

Figure 1.2.2 **Three pillars of sustainability**
Source: Future Learn (2023).

Figure 1.2.2 visualises the three pillars of sustainability: economic, ecological, and social. The economic pillar aims to secure human existence, protect human health, ensure basic services, provide self-sufficiency, distribute environmental resources fairly, and balance extreme income and wealth differences. The ecological pillar aims to preserve the social productive potential, use renewable and non-renewable resources sustainably, use the environment sustainably, avoid unreasonable technical risks, and sustainably develop material, human, and knowledge capital. The social pillar aims to preserve development and action opportunities, compare opportunities for education, profession, and information, participate in social decision-making processes, preserve cultural heritage and diversity, preserve the cultural function of nature, and preserve social resources. (Pufe, 2017)

1.2.2 Aims & Objectives

The role of Municipalities and Cities

Public administrations have a crucial role to play in the fight against climate change and achieving climate neutrality. Just like individuals can make a difference by adopting eco-friendly habits, public administrations can take action on a larger scale to reduce their carbon footprint and lead the way towards a more sustainable future. One of the most significant steps public administrations can take is to switch to renewable energy sources like solar, wind, and hydropower for their buildings, offices, and facilities. This reduces the need for fossil fuels that contribute to greenhouse gas emissions. Public buildings often use a lot of energy. By upgrading lighting, heating, and cooling systems

to more energy-efficient options, administrations can save energy and reduce emissions while reducing utility bills. Besides that, encouraging the use of public transportation, cycling, and walking can reduce the number of cars on the road, leading to fewer emissions and less traffic congestion. Public administrations can also switch to electric or hybrid vehicles for their fleets.

Apart from that, public administrations can foster sustainability by planting trees and conserving green spaces. Planting trees and preserving green spaces can absorb carbon dioxide and provide cleaner air. They also can promote waste reduction and recycling programs. This reduces the amount of waste that goes to landfills, which can produce harmful greenhouse gases.

Tackling Global Warming and its Consequences

Climate neutrality and sustainability are of high importance as they are necessary to tackle global warming and its consequences. Global warming has serious implications around the world. It affects water, food, our habitats, and even our health.

One big issue is the rising sea levels. This happens because the water in the oceans is getting warmer, and warm water takes up more space. Also, due to the higher temperatures, glaciers are melting, adding more water to the oceans. For many people living in coastal areas, even a small increase can be a huge problem, for example, in Bangladesh. It's a densely populated country where many people live in areas already low and close to the sea. If the sea rises just a bit, huge areas where millions live might disappear. This situation is faced by many regions in other parts of Asia, Africa, and the Americas. Also, places like wetlands and swamps are at risk. These areas are essential for lots of animals and plants, and they might not be able to handle the quick rise in sea levels. (Houghton, 2005)

Another important consequence is the loss of fresh water. With global warming, some places will get too dry, while others might get too wet. This could mean more droughts or floods, making it challenging to grow food and causing serious problems for human beings as well as for animals. Regarding food, there are significant effects on farming. Changes in temperature and water availability could pose a real threat to crop growth. (Houghton, 2005)

Also, animals, trees, and plants are at risk due to climate change. Some forests and coral reefs are already struggling because of the changes happening too fast. This means many different creatures are losing their homes or having trouble surviving. (Houghton, 2005)

The increasing temperatures also have serious implications for our health. With global warming, there could be more diseases spread by bugs like mosquitoes. Plus, extreme heat can be highly dangerous, especially for older people or those who are sick. (Houghton, 2005)

1.2.3 Strategies and Important (international) Papers and Documents

Renewable Energies

Renewable energies are energy sources that are infinitely available or can regrow in a much shorter period compared to fossil fuels like coal or natural gas. They include hydroelectric power, solar and wind energy, biomass, and geothermal energy. (Next Kraftwerke GmbH, 2023)

Solar energy (Photovoltaics) utilises the power of sunlight through photovoltaic cells to generate electric power. Wind power, historically used in windmill technology, has been used for generating electricity since the late 19th and early 20th centuries. Biomass usage traces back to the early 20th century, initially in wastewater treatment plants. However, using it for electricity production became economically unfeasible due to high costs. Hydropower, among the oldest energy sources used for mill operations around 5,000 years ago, became an important energy source during the Industrial Revolution. (Next Kraftwerke GmbH, 2023)

Climate-friendly mobility

Climate-friendly mobility is crucial for the health of our cities. Traffic jams, polluted air, and the constant noise emissions of cars have negative effects on our environment and human beings as well as animals. They aren't just inconveniences; they impact our economy, nature, and health. Changing how we move can significantly combat climate change and ensure cities remain livable. (Hamurcu, 2020)

Cities are growing fast, and how people get around matters. Switching to public transportation is of highest importance regarding this. Better buses and other public transport systems, cleaner technology, and well-designed systems can make people to stop using their cars or at least reduce usage and to opt for a more modern, eco-friendly way of traveling. (Hamurcu, 2020)

However, it is not just about buses and trains. Sustainable transportation should be good for the environment, affordable, and socially inclusive. Unfortunately, our current transport systems heavily rely on fossil fuels. Therefore, expanding public transport is crucial, as more buses and trains mean fewer cars on the road. Cleaner technologies like electric vehicles or advanced rail systems are crucial in fighting traffic jams and pollution. Making these changes requires remarkable investments, but these are investments in a better future and should, therefore, be prioritised by municipalities. (Hamurcu, 2020)

The Paris Agreement

The Paris Agreement is a global deal on climate change. It can be seen as a follow-up of the United Nations Framework Convention on Climate Change (UNFCCC)

from 1992, outlining responsibilities for countries to reduce greenhouse gas emissions and address climate change. However, these initial measures lacked quantification and binding commitments. This changed with the Kyoto Protocol in 1997, which mandated industrialised nations to limit or reduce emissions of six greenhouse gases during the 2008 – 2012 period compared to 1990 levels. Nevertheless, one major flaw of the Kyoto Protocol was its exclusion of commitments from developing nations, leading to a significant rise in their greenhouse gas emissions. This gap prompted intense negotiations for a comprehensive climate agreement, which led to the Paris Agreement of 2015. (Oesterreich.gv.at, 2023)

The Paris Agreement sets ambitious goals, aiming to limit global warming to below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. It also urges countries worldwide to submit and implement national plans to reduce emissions every five years, progressively raising their ambitions. Apart from that, it emphasises adaptation to unavoidable climate impacts and supports developing countries through capacity building, technology transfer, and funding. This agreement signifies not just a shift away from fossil fuels but a global transformation of energy systems, economies, and societies. (Oesterreich.gv.at, 2023)

EU Green Deal

The European Green Deal is a comprehensive plan to tackle climate change and environmental degradation across Europe. Its main goals are to make Europe the first climate-neutral continent by 2050 and ensure a transition to a modern, resource-efficient, and competitive economy. This deal focuses on several key aspects (European Commission, 2023).

- Reducing Greenhouse Gas Emissions: By committing to cut net greenhouse gas emissions to zero by 2050 and decrease emissions by at least 55% by 2030 compared to 1990 levels.
- Decoupling Growth from Resource Use: Building a sustainable economy by separating economic growth from the use of resources.
- Inclusivity: Ensuring no one, no region, is left behind in this transition.

To achieve these aims, the EU has proposed various measures (European Commission, 2023):

- Investment: A significant portion of the EU's budget and recovery plan funding is dedicated to the Green Deal, aiming to support eco-friendly initiatives.
- Policy Reforms: Implementing new policies in areas like energy, transport, and taxation to reach climate targets.
- Industrial Transformation: Encouraging innovation and creating markets for clean technologies to make industries greener and more competitive.
- Mobility Solutions: Promoting cleaner transportation by setting targets for emissions reduction in vehicles and investing in infrastructure for electric vehicles.

- Clean Energy Transition: Boosting renewable energy use, enhancing energy efficiency, and reducing dependence on fossil fuels.
- Building Renovation: Doubling efforts to renovate buildings for better energy efficiency.
- Nature Conservation: Focusing on biodiversity protection and restoring ecosystems to fight climate change and ensure a sustainable future.
- Global Collaboration: Collaborating with international partners to address climate challenges globally, sharing expertise, and aiding developing countries in climate action.

This ambitious plan encompasses diverse sectors, from energy and industry to transportation and nature conservation, aiming to create a more sustainable, resilient, and inclusive Europe while setting an example for global climate action. The measures also prioritise supporting vulnerable groups and ensuring a fair transition for all, with significant funding allocated for social support and green projects. (European Commission, 2023)

EU Taxonomy Regulation

The EU Taxonomy Regulation was created to guide investments toward sustainable projects and activities essential for meeting the EU's climate and energy goals. Its main aim is to provide a clear definition of what counts as "sustainable". This regulation establishes a unified classification system for sustainable economic activities. (BMK, 2023)

It answers questions such as, which investments and economic activities are truly green and environmentally sustainable? Which actually contributes to achieving climate goals? The regulation, passed in June 2020 at the European level, specifies that only those economic activities making a significant contribution to environmental goals are considered green. Simultaneously, they must not substantially harm other environmental objectives. (BMK, 2023)

The goals of the EU Taxonomy Regulation are pivotal in redirecting capital flows toward sustainability, a key step in achieving the overarching aim of a carbon-neutral EU by 2050. These objectives include setting clear definitions for companies and investors about what economic activities can be considered environmentally sustainable. It empowers investors, including individual ones, to direct their capital into eco-friendly activities while limiting the risks of false environmental claims. This prevents "greenwashing", where products are labelled as green without meeting the criteria. (BMK, 2023)

It aims to avoid market fragmentation by creating a single reference point for investors, companies, and member states through a clear definition of ecological sustainability for investment purposes. Additionally, it makes the disclosure of relevant revenues and investments by financial market actors and large companies mandatory. (BMK, 2023)

The taxonomy's evaluation criteria are based on six environmental objectives: climate protection, adaptation to climate change, sustainable use and protection of water and marine resources, transitioning to a circular economy, pollution prevention and reduction, and biodiversity and ecosystem protection and restoration. (BMK, 2023)

Importantly, the EU Taxonomy doesn't label financial products as green; instead, green financial products can refer to the Taxonomy's classification system. It doesn't mandate investing in green financial products but requires disclosure of relevant information. Also, it doesn't classify companies as "good" or "bad", it focuses on economic activities and doesn't assess the entire company. (BMK, 2023)

Carbon Pricing

Carbon pricing is like putting a price tag on greenhouse gas emissions, like carbon dioxide, to make sure the real cost of these emissions is accounted for. It can be seen as a way to connect the damage caused by, for example, pollution, extreme weather, and rising seas back to the sources responsible for it. Instead of telling companies exactly how to cut emissions, it nudges them by putting a price on their emissions. This means they can choose: either find cleaner ways to work and reduce their emissions or keep polluting and pay for it. (The World Bank, 2023)

It's a way to tackle climate change because it encourages everyone – governments, businesses, and investors – to think sustainably. For governments, it's a way to reduce emissions and even acquire some extra money, which could be used for sustainable friendly policies. Businesses use it to plan for a future where carbon emissions might cost them even more. And investors use it to figure out how climate change might affect their money and where to invest for a more sustainable future. (The World Bank, 2023)

There are a few ways to do this pricing. Some places use a system where companies buy and trade emissions rights, while others set a fixed tax on emissions. This question is mainly about finding the best way to lower emissions without hitting the economy too hard. With climate change being so important in these times, using different pricing ideas alongside other rules and support is critical to making a real difference. (The World Bank, 2023)

1.2.4 Summary

The greenhouse effect, climate neutrality, sustainability, and strategies to combat global warming are important topics for our future. The greenhouse effect, primarily driven by human activities like burning fossil fuels, leads to rising temperatures and severe consequences such as melting glaciers, rising sea levels, and habitat destruction. Climate neutrality involves balancing human activities' impact on the climate through emission reduction and absorption. Sustainability encompasses ecological, social, and economic considerations in fostering long-lasting effects. Strategies for combating global warming include transitioning to renewable energies, promoting climate-friendly

mobility, and international agreements like the Paris Agreement. The EU Green Deal aims for a climate-neutral Europe by 2050, while initiatives like the EU Taxonomy Regulation and carbon pricing should lead to higher investments towards sustainability. These strategies emphasise the urgency of immediate action to mitigate climate change and its impacts.

References

BMK (2023). *EU-Taxonomie-Verordnung*. Online. [20/06/2024]. Available at: <https://www.bmk.gv.at/green-finance/finanzen/eu-strategie/eu-taxonomie-vo.html>.

European Commission. (2023). *Umsetzung des europäischen Grünen Deals*. Online. [20/06/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_de>.

EWE (2023a). *Treibhauseffekt*. Online. [20/06/2024]. Available at: <https://www.ewe.com/de/zukunft-gestalten/klimaschutz/klimapedia/klimawandel/treibhauseffekt>.

EWE (2023b). *Erderwärmung.* Online. [20/06/2024]. Available at: <https://www.ewe.com/de/zukunft-gestalten/klimaschutz/klimapedia/klimawandel/erderwaermung>.

Future Learn (2023). The three pillars of sustainability. Online. [20/06/2024]. Available at: <https://www.futurelearn.com/info/courses/sustainability-society-and-you/0/steps/4618>.

HAMURCU, M. (2020). Strategic Planning Based on Sustainability for Urban Transportation: An Application to Decision-Making. Sustainability, 12(9), 3589. DOI: <https://doi.org/10.3390/su12093589>.

The World Bank (2023). *What is Carbon Pricing?* Online. [20/06/2024]. Available at: <https://carbonpricingdashboard.worldbank.org/what-carbon-pricing>.

HONEGGER, M. et al. (2020). *Klimaneutralität: ein Konzept mit weitreichenden Implikationen.* Online. [20/06/2024]. Available at: <https://www.zora.uzh.ch/id/eprint/195545/1/ZORA195545.pdf>.

HOUGHTON, J. (2005). Global warming. In: *Reports on Progress in Physics* 68 (2005). Online. [20/06/2024]. Available at: <http://www.gci.org.uk/Documents/C&CMantra.pdf>.

Next Kraftwerke GmbH (2023). Was sind Erneuerbare Energien (regenerative Energien)? Online. [20/06/2024]. Available at: <https://www.next-kraftwerke.de/wissen/erneuerbare-energien>.

NÖ Energie- und Umweltagentur GmbH (2023). Definition Nachhaltigkeit. Online. [20/06/2024]. Available at: <https://www.wir-leben-nachhaltig.at/aktuell/detailansicht/nachhaltigkeit>.

Oesterreich.gv.at (2023). Das Übereinkommen von Paris. Online. [20/06/2024]. Available at: <https://www.oesterreich.gv.at/themen/bauen_wohnen_und_umwelt/klimaschutz/1/Seite.1000325.html>.

PUFE, I. (2017). *Nachhaltigkeit, 3. Auflage, München: UVK/Lucius*

U.S. Energy Information Administration (2024). Energy and the environment explained. Online. [20/06/2024]. Available at: <https://www.eia.gov/energyexplained/energy-and-the-environment/greenhouse-gases.php>.

1.3 Trends and Challenges of the Communal Digital and Green Transition

Authors: Miroslav Fečko, Silvia Ručinská, Ondrej Mitaľ

1.3.1 European Municipalities and Cities under the Pressure of Trends and Challenges

In Western democracies, the increased number of competencies has been decentralized to municipalities and cities over the last 50 years (OECD, 2024; European Commission, 2017; Council of European Municipalities and Regions, 2013). Thus, the number of competencies executed as close to citizens is growing. In contrast to bureaucratic state administration, local self-government can be perceived as a part of public administration that tries to create innovative local public policies, rationalize the execution of its competencies, and thus face current trends and challenges. Competencies can be understood as any activity performed by municipalities and cities, and the sum of tasks and roles realized by local self-government units (Mederly et al., 2019). Different levels of decentralization can be found across the European democratic states. These variations and models also correspond with varying levels of financial independence and political responsibility. The competencies help municipalities and cities achieve the wider reason and meaning of their existence – ensure the all-round development of their territory. However, municipalities and cities aim to continuously improve the quality of their local public policies and public services.

The municipal level of governance has a natural predisposition to face modern trends and challenges, which helps municipalities and cities enrich their functioning and improve the quality of communal life among local stakeholders (Ručinská and Fečko, 2020). Municipalities and cities are often the places of first contact with citizens who have identified any kind of need or change in social reality and subsequently demand a change regarding the scope, form, or quality of public services. These changes can be perceived as the impact of contemporary ongoing trends and challenges on everyday functioning at the municipal level. The important role of municipalities and cities is to secure the consistency of local public policies and their benefits for citizens and businesses. For municipalities and cities, it is therefore crucial, both in theory and in practice, to examine and evaluate the impact of trends and challenges on the execution of their competencies, which ensure high quality of public services.

International organizations and expert institutions are using different approaches to outline challenges and trends that force changes in the execution of competencies at the local level of governance. Table 1.3.1 outlines selected approaches that characterize the most crucial trends and challenges for today's municipalities and cities.

Table 1.3.1 **Selected methodologies and approaches for understanding current trends and challenges**

Author	Source document	Selected trends
World Economic Forum (2024)	Strategic insights and contextual intelligence on cities and urbanization	• urban governance, • urban environment and resources, • urban diplomacy, • urban infrastructure and services, • urban economy, • urban society, • urban innovation, • urban resilience.
OECD (2023)	Global Trends in Government Innovation 2023	• new forms of accountability for a new era of local government, • new approaches to care, • new methods for preserving identities and strengthening equity, • new ways of engaging citizens and residents.
European Commission (2023)	Report on the quality of life in European cities	• satisfaction with living in the city, • safety and cohesion in the city, • job situation, housing, earning and living in the city, • mobility in the city, • culture, squares, parks and healthcare in the city, • healthy cities, • perceived quality of local public administration
OECD (2022)	Regions and Cities at a Glance 2022	• economic trends and spatial disparities, • environmental transition, • demographic change, • inclusion and liveability.
Deloitte (2021)	Trends shaping human living in the urban future	• Green planning of public spaces, • smart health communities, • 15-minute cities, • mobility: intelligent, sustainable and as a service, • inclusive services and planning, • digital innovation ecosystem, • circular economy and producing locally, • smart and sustainable buildings and infrastructure, • mass participation, • city operations through AI, • cybersecurity and privacy awareness, • surveillance and predictive policing through AI.

Source: Authors based on the references.

The development of contemporary society creates and accelerates many challenges and trends at the municipal level of governance. Theory and practice reveal various ways to delineate the trends and challenges that significantly impact local governments. (OECD, 2023; Rowley, 2022).

1.3.2 Trends and Challenges

Trends can be characterized as something that is discussed in the society. Trends also represent the prediction of future development that will not harm the interests of municipalities and cities when they pay attention to them. Reflecting the trends can bring benefits at present, but can also probably help municipalities and cities in overcoming future situations, which cannot be precisely identified at present. However, theoreticians agree that reflecting trends helps municipalities and cities prepare for future challenges and issues. Simultaneously, trends themselves are not directly concrete challenges and issues, but rather possible development trajectories.

A trend is something that resonates in a given sphere of society, municipalities and cities. Trends usually do not have the character of short-term topics discussed in a certain period and then fall into the background. Trends are therefore long-term topics that are transforming and developing over time.

To be considered about the trends helps municipalities and cities improve local policymaking and local governance. If trends are taken into account, challenges or issues may not appear, but if they do appear, municipalities and cities can solve them more easily because they were prepared. Sophisticated reflection of current ongoing trends can lead to better execution of their competencies and higher quality of life at the local level.

Challenges can be described as obstacles or situations that test the ability of municipalities and cities to execute their competencies properly. The challenge is a complex of various issues that municipalities and cities cannot avoid, thus they cannot make their own decision as in the case of trends. Challenges can be caused by a concrete trend, but at the same time, they can combine aspects of several ongoing trends.

The book identifies three trends that need to be understood by stakeholders and decision-makers in today´s municipalities and cities. The following list exemplifies the suggested innovative approach to three trends, related challenges, and issues embedded in the organization and structure of this book:

- Common topics for municipalities and cities:
  - strategic planning in public administration,
  - process management as a prerequisite for digitalisation,
  - effective knowledge management,
  - public engagement in modern municipalities and cities,
  - evidence-based policy making as a mean of improving communal life,
  - enhancing public administration resilience,
  - public integrity as a complex communal level guide,

- effective municipal communication with the stakeholders,

- Digitalisation at the communal level:
  - open data for local governments,
  - the role of IoT in urban development,
  - data management for smooth technological and sustainable growth,
  - balancing technology and human factors,
  - artificial intelligence as a topic of communal interest,
  - digital public services,
  - modern ways of focal communication,
- Green transition at the communal level:
  - sustainable urban transportation,
  - green buildings in the municipal landscape,
  - renewable energies powering municipalities and cities,
  - local communities benefiting from circular economy,
  - local significance of food waste management.

Both challenges and issues can be expected or unexpected. Monitoring and evaluating trends will not prevent the emergence of challenges and issues, but it can help municipalities and cities to be prepared and have response policies for managing challenges and issues. However, the interdependence among trends, challenges, and issues presents an opportunity for constructive and collaborative problem-solving (Table 1.3.2).

Table 1.3.2 **Interdependence of trends, challenges and issues**

The book will break down trends and challenges into fundamental and practical issues that municipalities and cities need to address. Subsequent chapters will offer various perspectives on the selected trends, challenges, and issues. This table provides an introductory understanding of the interconnectedness between trends, challenges, and issues.			
Trends	Common topics	Digitalisation	Green
Challenge	Smart and sustainable mobility based on evidence-based policymaking and stakeholders´ involvement		
Issue	communication with the public, communication with providers of digital services	smart traffic, smart lights, smart tracking apps	green bike paths and relevant infrastructure, reducing emissions and carbon footprint

Source: Authors.

As for this book, we perceive trends as a general direction of development that affects the execution of competencies at the local level. The trends are a long-term phenomenon because they currently have or will probably impact communal life in the near future. However, social reality may create a situation where municipalities and cities will

not be affected by some trends, for example, because of the size of the self-government unit, geographical location, or demands of the citizens.

A challenge is a set of issues, that municipalities and cities cannot avoid. Challenges can usually be decomposed into smaller issues. Solving these issues will continuously help municipalities and cities respond to challenges, mitigate their negative impacts, and gain positive momentum for the future development of the territory.

1.3.3 Summary

Municipalities and cities should not pay attention to trends and challenges because of their popularity, but rather because of the potential to improve the quality of communal life, local governance, and local policymaking.

The main benefit of local self-government units´ responses to ongoing trends is that they represent a "toolkit" for managing current challenges and issues in our shifting and dynamic society. At the same time, these responses can help municipalities and cities in the future to overcome challenges and issues, the shape of which we currently cannot imagine. This mindset contributes to sustainable development and management of territory that goes beyond the election period. Another benefit is the fact that evaluating and monitoring trends and challenges contributes to sustainable and predictable local governance and policymaking.

References

Council of European Municipalities and Regions. (2013). *Decentralisation at a crossroads Territorial reforms in Europe in times of crisis.* [Online]. [20/06/2024]. Available at: <https://www.ccre.org/img/uploads/piecesjointe/filename/CCRE_broch_EN_complete_low.pdf>.

Delloite. (2021). *Urban future with a purpose: 12 trends shaping human living.* [Online]. [20/06/2024]. Available at: <https://www2.deloitte.com/us/en/insights/industry/public-sector/future-of-cities.html>.

European Commission. (2023). *Report on the quality of life in European cities.* Publications Office of the European Union: Luxembourg. DOI: <https://doi.org/10.2776/830208>.

European Commission. 2017. *A comparative overview of public administration characteristics and performance in EU28*. [Online]. [20/06/2024]. Available at: <https://op.europa.eu/en/publication-detail/-/publication/3e89d981-48fc-11e8-be1d-01aa75ed71a1/language-en>.

MEDERLY, P. et al. (2019). *Výkon a financovanie prenesených kompetencií.* Bratislava : Zmos – Národný projekt Modernizácia miestnej územnej samosprávy. [Online]. [20/06/2024]. Available at: <https://npmodmus.zmos.sk/download_file_f.php?id=1193191>.

OECD. (2022). *OECD Regions and Cities at a Glance 2022*. OECD Publishing: Paris. DOI: <https://doi.org/10.1787/14108660-en>.

OECD. (2023). *Global Trends in Government Innovation 2023*. OECD Public Governance Reviews. OECD Publishing: Paris. DOI: <https://doi.org/10.1787/0655b570-en>.

OECD. (2024). *Multi-level governance*. [Online]. [20/06/2024]. Available at: <https://www.oecd.org/en/topics/policy-issues/multi-level-governance.html>.

ROWLEY, M. (2022). *Current Trends and Issues in Public Administration*. Online [15/03/2024], 2022. Available at: <https://www.columbiasouthern.edu/blog/blog-articles/2022/april/current-trends-and-issues-in-public-administration/>.

RUČINSKÁ, S., FEČKO, M. (2020). eServices as a Challenge for Small Municipalities: Slovak Republic Experiences. In: Hemker, T. et al. (eds). *Central and Eastern European eDem and eGov Days 2020: Conference Proceedings.* Wien : Facultas Verlag, pp. 383-392. DOI:10.24989/ocg.338.30.

World Economic Forum. (2024). *Explore strategic insights and contextual intelligence on cities and urbanization from the World Economic Forum.* [Online]. [20/06/2024]. Available at: <https://www.weforum.org/communities/gfc-on-the-future-of-cities/>.

2
Common Topics for Municipalities and Cities

2.1 Strategic Planning in Public Administration

Author: Dominik Prüller

2.1.1 General Introduction

The term "strategy" originally derived from the Greek word "strategós" meaning "commander" or "leader" in a military context. It was initially used to describe the planning and execution of military operations. The concept was later transferred from the military to economics. Strategy was defined as a sequence of interdependent actions directed towards a specific goal. Strategies should ensure the long-term success of an organization. (Bea and Haas, 2017)

Strategies are about a company's long-term development and how it plans to achieve its mission through well-thought-out actions. The range of possibilities in this regard is quite diverse. While strategies come in various forms, they all share a common purpose: to provide guidance, direction, and insight into the core direction an organization should follow. Strategies are a guide that keeps both organizations and individuals on a specific path, reducing distractions and facilitating effective decision-making. (Reisinger et al., 2013)

The concept of strategy is used across various fields like the military, politics, business, civil society, and planning administration. Despite differences in its application, there is a common understanding that strategies provide simplified concepts, help organize thinking on various topics, set priorities and reasons for them, offer reference points for decision-makers, reduce complexity, and promote consistent behaviour. Strategies are expected to address significant questions and relieve actors so they can focus on concrete actions and routines. Strategies can take the form of visions, general goals, plans, but also specific projects and actions. (Wiechmann, 2018)

The idea behind strategic planning is to secure the enduring success of an organization. This requires a deep understanding of the organizations' external environment and a clear commitment to future-oriented strategizing. In essence, strategic planning emerges as a dynamic process designed to address future obstacles, all in the name of safeguarding an organizations' ongoing success. Key elements of strategic planning include strategy formulation, environmental adaptability, and using the full potential of the organization. Therefore, strategic planning can be described as an integrated process of information synthesis, aligning the dynamic demands of the environment with the latent capabilities of the organization, all in pursuit of securing its long-term prosperity. (Bea and Haas, 2017)

Strategic planning is a concept developed in the 1970s and 1980s. There are differences between strategic planning and typical operational planning in many key aspects. Unlike operational planning, which has a short-term focus on specific areas, strategic

planning adopts a long-term perspective and includes the entire company. This strategic planning process is made up of five consecutive phases: goal formulation, environmental analysis, company assessment, strategy selection, and strategy implementation. Additionally, it can also include performance monitoring. This process is characterized as multi-operational and the involvement of multiple individuals is essential. It is an iterative approach, often requiring repetition. (Botzenhardt and Pätzmann, 2012)

Figure 2.1.1 **Six Elements of Strategic Planning**
Source: Authors based on Overgaag (2022).

According to Figure 2.1.1, strategic planning involves six key steps (Overgaag, 2022):

1. Defining a vision: A vision statement describes what an organization wants to achieve in the future. It serves as a guide for decision-making and sets an overall plan for the organization.
2. Creating a mission: A mission statement explains how the organization plans to achieve its vision. It provides information on why and how the organization operates.
3. Setting objectives: Objectives are specific results that the organization aims to achieve within a certain timeframe.
4. Developing a strategy: Strategy is a long-term plan that describes how the organization will achieve its objectives. It bridges the gap between the vision and execution and includes specific actions and plans.
5. Outlining an approach: An approach defines the methodology and framework for executing the strategy. It guides decision-making and ensures everything is in line with the organization's mission, vision, and objectives.
6. Defining tactics: Tactics are specific projects and activities that enable the implementation of the strategic plan.

There are six phases of strategic planning:

- **Formulation of strategic goals:** The formulation of strategic goals is a crucial part of strategic planning. Goals provide a framework and a direction for the organization and also guide an organization's activities and help to align them to a common objective. Goals also play a pivotal role in motivating employees to achieve these objectives. Furthermore, in conjunction with coordination, goals foster a sense of identity and teamwork. The most significant motivation arises when leadership succeeds in inspiring employees with their vision. Goals serve as a means of communication, conveying future activities to both internal and external stakeholders. Among these external stakeholders, investors and analysts are of particular importance. Clear and measurable goals enhance investors' willingness to engage with a company. Additionally, goals establish the basis to evaluate an organization's success by performance measurement. Without goals, effective control becomes impossible as the reference point for assessment is missing. Unfortunately, this fear of failure sometimes makes managers to not set measurable goals. (Bea and Haas, 2017)
- **Environmental analysis:** Organizations operate within an environment that offers both opportunities as well as risks. Systematically analysing the environment and the relevant market to identify and potentially influence these opportunities and risks is a crucial task in strategic planning. However, organizations face the challenge of dealing with an overwhelming amount of information. While continuous monitoring of all external factors may seem desirable, it's often impractical. Not every event is relevant to a specific strategic problem or question. Therefore, a central task in environmental analysis is to filter out the relevant information. To achieve this, the complex environment needs to be made comprehensible. First, a general analysis should describe the fundamental characteristics of the environment, such as its complexity and dynamics. Then, the global environment analysis focuses on factors that impact a wide range of organizations across branches and are generally beyond an organizations' control. Next, the individual branch needs to be analysed, followed by a stakeholder analysis, including customers, competitors, distribution partners, the society, and suppliers. It is important to also consider the interests of additional stakeholders, such as the public, environmental protection and consumer associations, and citizen initiatives. (Reisinger et al., 2013)
- **Organization analysis:** Analysing the organization's potentials is another important phase of strategic planning. The most crucial part of the organization analysis is to identify strengths and weaknesses. Whether a strategic factor is a strength or weakness depends on the overall situation and is different for every individual organization. Therefore, an environment analysis must always be conducted to assess an organization's strategic position. A common issue in identifying strengths and weaknesses is determining strategic success (performance

measurement). It is necessary to clearly define the relationship between strategic success factors and strategic success, and to clarify how strategic success can be measured. The sources of an organization's strategic success lie in its potentials. Conducting a potential analysis (also known as resource analysis) provides a profile of the capabilities that give an insight into a company's relative competitive position. (Bea and Haas, 2017)

- **Strategy selection and formulation:** Strategy formulation is the systematic process of planning and choosing the best course of action to achieve an organization's long-term objectives and vision. It basically should lead to a strategy that is a plan to reach the strategic goals that have been formulated before. Therefore, after setting organizational objectives and evaluating the organizational environment, it is necessary to set quantitative and measurable targets in order to later be able to track the progress of strategy implementation. Afterwards, it is necessary to prepare strategies for each department or organization division based on their role in strategy implementation. To do so, it is also necessary to further evaluate past, current, and future conditions to identify performance gaps and trends. Finally, the best strategy available to reach the goals, considering organizational strengths, limitations, and external factors, should be chosen. (Juneja, 2023)
- **Strategy implementation:** Strategy implementation is another key factor in strategic planning. In fact, many strategies are not successfully implemented. There are several reasons for this, such as a disconnect between visionaries and implementers, because visions are typically created at the upper management level, but middle and lower management are responsible to implement them. Another important factor is changing conditions over time, which means that by the time a strategy is implemented, it might already be out of date. But also, resistance from parts of the organization or its environment and coordination challenges can make it difficult to successfully implement a strategy. Therefore, strategy implementation must include all activities that are necessary to bring a strategy to life, covering aspects like budgeting, organization, and ensuring the right personnel are in place. A holistic approach, increasingly significant in practice, integrates organizational and personal aspects through an active project management, bridging the gap between strategic vision and reality. (Bea and Haas, 2017)
- **Strategy evaluation:** Strategic evaluation is a crucial aspect of strategic management, with its principles and goals varying depending on different perspectives. It serves top management by providing information for strategy planning and assessing its implementation. Shareholders use it to determine how strategies affect the organization's economic value. Stakeholder-focused evaluations focus on the diverse needs of all relevant groups in the organization's environment. Resource-centric evaluations focus on essential resources and capabilities. These evaluations should meet the needs of management, employees, shareholders, and other key stakeholders. However, strategic evaluation is becoming more

> challenging due to increasing complexity, changing economic conditions, and technological advancements, making predictions difficult. Despite these challenges, it remains essential for guiding organizations in today's more and more unpredictable environment. (Reisinger et al., 2013)

Strategic planning offers a number of advantages that enables organization to cope with various challenges. One of its key benefits is the shift from reactive to proactive management. By having a clear plan for the future, organizations can anticipate challenges and opportunities, which enables them to respond effectively rather than just reacting to circumstances as they arise. Furthermore, strategic planning provides a sense of purpose and direction by establishing clear objectives, which can help to motivate staff. It also makes it easier to ensure that the organization's technological resources are up to date and enable the organization to reach its goals. Besides that, effective communication is enhanced by emphasizing and focusing on important information sources and data. Strategic planning also redirects attention away from short-term budget and organizational constraints towards the long-term effectiveness of the organization as a whole. Additionally, strategic planning offers a solid foundation for long-term decision-making and performance evaluation. It also supports organizations in involving their staff in determining their long-term direction, which also increases their commitment. Moreover, strategic planning provides a rational framework for resource allocation, optimizing the use of available resources. It also overcomes organizational boundaries, facilitating decision-making on issues with long-term consequences while avoiding short-sighted decisions. (Schedler and Siegel, 2005)

Strategic planning is important for organizations aiming to achieve their long-term goals and maintain competitiveness. However, strategic planning can also have some disadvantages that need to be considered.

It can be highly challenging to execute a strategic plan, which can lead to a lack of commitment from both management and employees, making it difficult to actually carry out the plan. Organizations may also drift away from their strategic plan, leading to inefficiencies in resource allocation while implementing the strategy. Apart from that, strategic plans can be too rigid and may not be easily adaptable to changing circumstances, which means that a strategy might already be outdated at the time it is implemented. This can also result in slow responses to new trends. Another important factor is that strategic planning can be quite expensive, as organizations might need to hire consultants, purchase software, and acquire additional resources to implement the plan. Furthermore, employee training may be necessary to ensure proper implementation. Excessive focus on the strategic plan can also lead to a situation where teams become overly fixated on the plan and neglect alternative ideas. This can stop creativity and hinder the organization's ability to innovate, as strategic plans and the decision to stick to these plans may not allow new ideas. Strategic plans can also trigger battles between different departments or individuals about the plan and its implementation. Another challenge is that a lack of understanding of the plan and its objectives can lead to further

confusion or even fierce resistance against a strategy from the organization's staff or other stakeholders. (Chiquita, 2023)

2.1.2 Relevance for Municipalities

Strategic planning helps to clearly define where the public administration wants to go, how it intends to get there, and what specific actions it plans to take. Therefore, strategic planning helps public administrators to figure out their goals, priorities, and the best ways to achieve them. For example, a municipality might want to improve its digital services to make it easier for residents to access public information and services online. Through strategic planning, the municipality's administration can identify the areas that need improvement, such as creating a user-friendly website, implementing online payment options, or developing mobile applications for convenient access. They can set goals to make sure all residents can actually use the services provided and establish partnerships with technology companies or experts to help with the implementation. Strategic planning also allows the local administrators to outline specific actions and goals to achieve sustainability. For example, they may focus on improving public transportation, increasing access to recycling facilities, implementing energy-efficient infrastructure, and promoting renewable energy sources. Through strategic planning, the city can identify funding opportunities, collaborate with environmental organizations, and engage with the community to raise awareness and encourage sustainable practices.

Strategic planning in municipalities is crucial due to the need for long-term solutions to complex challenges within and outside the administration, such as financial pressures and socio-economic dynamics. Municipal strategic management must align with the public sector's unique characteristics, including political influence. It must be considered that municipalities have limited authority over tasks and resources, interacting with strategies and regulations at other governance levels. Also, there are different coordination mechanisms than in private companies, which has implications for strategy development, as it is necessary to consider the special situation in local administrations. Therefore, strategic planning at the local level must adapt to the public sector's unique features, including political influence and limited autonomy, and diverse goals. (Schedler and Siegel, 2005)

Despite its benefits, the use of strategic planning in municipalities often goes along with several difficulties that can negatively affect its outcome. One major issue is trying to find common ground to include all those different interests and priorities of a high number of stakeholders. Another problem is that there's not always enough money to do everything that needs to be done. Apart from that, another issue is that in a democracy, it must be expected that there are changes in local government composition after elections and new people in charge might change the plans that were made by the outgoing administration, which limits the long-term reliability of strategic planning. For example,

a local government has developed a strategic plan to address climate change and its potential impact on the community. However, after an election, a new administration takes office with different views on environmental policies. They may choose to modify or even abandon the previously established plan, leading to potential disruptions in the long-term reliability of the strategic planning process. Moreover, it can also be difficult to get people involved and interested to participate in the planning process.

2.1.3 Practical Applications

By doing strategic planning, municipalities can identify their strengths, weaknesses, opportunities and threats. They can figure out what their local community needs and wants, and how they can best allocate their resources to meet those demands.

One example for the application of strategic planning in municipalities is public transportation. Challenges such as traffic congestion, pollution, and escalating fuel consumption in urban areas need well-thought-out solutions. Many cities face these issues due to population growth and inadequate transportation infrastructure. To address these challenges, strategic transportation planning is of high importance. It involves evaluating various alternatives through extensive decision-making methods based on strategic planning. This is necessary to make sure that all environmental, economic, technical, and social factors are considered. Enhancing public transit infrastructure, optimizing bus networks, and adopting cleaner technologies like electric buses are strategies. By reducing reliance on private vehicles, public transportation not only mitigates traffic congestion but also contributes to a cleaner environment and improved quality of life. Strategic planning for public transport aligns with sustainability goals, addressing the complex challenges of urbanization and population growth. It facilitates efficient mobility and enhances accessibility, making cities more liveable and sustainable. (Hamurcu, 2020)

By making use of strategic planning, local governments can also predict and prepare for any challenging events that they might be confronted with in the future, like a pandemic or flooding. Strategic planning helps municipalities to have an emergency plan ready with clear responsibilities about who is in charge to care about the well-being of all citizens. This means that the municipal administration's capabilities to set up an effective and proactive risk management is significantly improved by strategic planning.

2.1.4 Summary

Strategic planning is about setting goals and creating a plan to achieve them. It helps public administrations to figure out what they want to accomplish and how to do it. Strategic planning is important because it helps prioritize efforts, maximize the outcome reached with limited resources, and adapt to changes. It involves defining a vision, setting goals, analysing the current situation, developing strategies and ideas to

reach the goals set, involving stakeholders, implementing the plan, and monitoring the progress of implementation.

References

BEA, F. X., HAAS, J. (2017). *Strategisches Management*. München : UVK Verlag.

BOTZENHARDT, F., PÄTZMANN, J. U. (2012). *Die Zukunft der Werbeagenturen. Strategische Planung als Innovationsmotor.*

Chiquita (2023): Die Folgen des strategischen Managements. Online. [20/06/2024]. Available at: <https://datei.wiki/artikel/die-folgen-des-strategischen-managements/>.

HAMURCU, M. (2020). Strategic Planning Based on Sustainability for Urban Transportation: An Application to Decision-Making. In: *Sustainability.* 2020, 12(9), article ID 3589. DOI: <https://doi.org/10.3390/su12093589>.

JUNEJA, P. (2023). *Steps in Strategy Formulation Process*. Online. [20/06/2024]. Available at: <https://www.managementstudyguide.com/strategy-formulation-process.htm>.

OVERGAAG, D. (2022). *6 Elements of effective strategic planning.* Online. [20/06/2024]. Available at: <https://spur-reply.com/blog/the-6-elements-of-effective-strategic-planning>.

REISINGER, S. et al. (2013). *Strategisches Management. Grundlagen für Studium und Praxis.*

SCHEDLER, K., SIEGEL, J. P. (2005). Strategisches Management in Kommunen. Ein integrativer Ansatz mit Bezug auf Governance und Personalmanagement. In: *Edition der Hans-Böckler-Stiftung*, No. 116.

WIECHMANN, T. (2018). Strategische Planung. In: *ARL – Akademie für Raumforschung und Landesplanung (Ed.): Handwörterbuch der Stadt – und Raumentwicklung*, pp. 2609-2621.

2.2 Process Management as a Prerequisite for Digitalisation

Author: Dominik Prüller

2.2.1 General Introduction

Broadly speaking, the term "process" describes the actions that create a wanted outcome from a predefined input. A process is a collection of interconnected actions that transform inputs into outcomes (Wagner and Patzak, 2020).

An example is the process of "beer production". This process involves the conversion of predefined inputs like water and hops into the desired output, which is beer. The process also includes the suppliers, such as farmers supplying the required ingredients, and the customers, who ultimately receive the product. This approach provides an overview of the essential resources, information, suppliers, and customers engaged in the entire process (Wagner and Patzak, 2020).

The defining elements of a process include its purpose, starting point, inputs, outcome and outputs. The process consists of a series of steps, guided by interfaces and driven by a clear objective. Process responsibility, shared by the process owner and his or her team, ensures the process' efficient execution (Wagner and Patzak, 2020).

Its main purpose is the reason why a process exists. If a process doesn't have a good reason to exist, it is useless. The purpose of a process should show what that process is supposed to achieve and explain why it's important and needed. Writing down a detailed description of the purpose can help keeping apart processes that are similar (Wagner and Patzak, 2020).

It is also important to look at the difference between the input and the trigger of a process. The trigger is what starts a process, it is an event that gets the process going. For instance, when a broken car is brought to a car repair shop, that's the trigger that starts the "car repair" process. On the other hand, the input of a process is what we need to actually carry out the process. In the car example, it's like the car itself – the physical object that is needed to get the process of fixing it going. So, the trigger is the event that says, "Start!", and the input is what we need to actually carry out the process (Wagner and Patzak, 2020).

The process flow is like mapping out how things happen step-by-step. It's often shown using flowcharts, which are like visual guides. When a process is broken down into smaller pieces, those pieces are called process steps. Each step is a mix of actions and choices, such as "writing document" or "checking invoice". These steps give a close look at how the process works. If more details are needed, they can be written down in more detail (Wagner and Patzak, 2020).

Apart from that, interfaces are like points where responsibilities shift. It's when one person hands over something to another person, like passing a document on to another

office. This could be information, things we need, or work that's partly done (Wagner and Patzak, 2020).

Process objectives are the goals that are set for how a process should go. These goals come from the main goals of the organization. They cover things like doing the work well, and also keeping track of time and money (Wagner and Patzak, 2020).

Process management is about systematically improving processes to achieve strategic goals, focusing on efficiency, effectiveness, and cost-effectiveness. It ensures structured and goal-oriented activities by different individuals and integrates and coordinates processes while considering cost, quality, and time factors. (Wagner and Lindner, 2013)

In process management, there are three key perspectives: focus on meeting customer expectations, process orientation for cross-departmental optimization, and employee engagement to enhance work value and motivation. Customer focus means an organization bases its decision on whether a process creates value on the customers. A product's value is solely what customers are willing to pay. Therefore, it's vital to align all activities with customer preferences, and effective work requires employees to understand customer service requirements (Wagner and Lindner, 2013).

Traditional organizations have hierarchical structures with distinct departments, like purchasing, HR, finance, and production. They often focus on optimizing their own performance, which may not be the best for the entire organization or supply chain. Process optimization aims to break down departmental barriers and improve workflows, but it can strain employees lacking expertise in certain areas, leading to time and information losses. This affects both customers and the organization's image (Wagner and Lindner, 2013).

Process management breaks barriers, prioritizes workflows, and emphasizes service delivery over departmental ties. It enhances transparency in organization activities and allows each employee to understand their role in the organization (Wagner and Lindner, 2013).

Compared to an organizational structure, the goal of a process-oriented structure is to break down isolated departments and encourage people from different departments to work together. Instead of working alone in their own departments, employees are encouraged to collaborate and share knowledge to make things work better and achieve the organization's goals. In this structure, the focus is on looking at how things work from start to finish, involving all different departments that are responsible for the process. Each process has someone in charge who makes sure it goes smoothly and keeps finding ways to make it even better. This change helps to clarify tasks and responsibilities for any person involved in the process. It reduces redundancies doing the same process steps multiple times without adding value to the process results. Moreover, it makes sure everyone keeps the needs of customers in mind throughout the whole process.

The process manager is a key role in process management within an organization. Their responsibilities include overseeing multiple processes, serving as an intermediary between top management and process owners, and ensuring that processes are aligned

with the organization's strategic goals. They are responsible for establishing and continuously improving the process management system, implementing IT systems to support it, and enforcing process management standards and conventions. Additionally, process managers handle conflict resolution, establish and operate process reporting, and provide training and development for process owners. They also coordinate process-related projects and have the authority to assign tasks within the process management system. Important skills for a process manager include strategic thinking, communication, conflict resolution, and proficiency in process management tools and office software (Wagner and Lindner, 2013).

A process owner is the individual primarily responsible for defining, managing, and ensuring the successful execution of a specific process within an organization. Their key responsibilities include daily process management, team leadership, process documentation, coordination of team meetings, aligning process goals with overall objectives, reporting on process performance, continuous process improvement, and optimizing interfaces with other processes. Process owners play a crucial role in ensuring the efficiency and effectiveness of their assigned processes and are accountable for their outcomes (Wagner and Lindner, 2013).

A process coach is an individual who acts on behalf of and in alignment with the process manager. Their primary role is to provide methodological support, assist with process design, and facilitate continuous improvement efforts within an organization's processes. They ensure that the process management system's learning transfer is successful and consistent. Process coaches support multiple processes within a process group or even an entire process category (e.g., management, core, or support processes). Their responsibilities include methodically guiding process stakeholders, ensuring that process optimizations align with the given methodologies, offering suggestions for process improvements, participating in process team meetings, gathering and sharing insights from their own experience, and maintaining communication with local process stakeholders. Process coaches may also request resources (such as time) from the organization and have a say in approving improved process descriptions as part of their role. Overall, a process coach plays a vital role in enhancing the efficiency and quality of an organization's processes (Wagner and Lindner, 2013).

A process team member is an individual within an organization who plays a specific role in a team dedicated to improving and optimizing various processes. Their primary goals include utilizing their expertise and process knowledge to identify and implement potential improvements in the assigned processes. They are responsible for tasks such as contributing their specialized knowledge, participating in the development of process optimization measures, suggesting improvements, and adapting guidelines as per the guidance of the process coach. They also attend internal team meetings and have the competencies and rights to gather process-related information and advocate for the interests of their respective responsibilities. Overall, their role is to actively contribute to process enhancement efforts within the team (Wagner and Lindner, 2013).

A process participant is an individual involved in a specific process, contributing their expertise, actively participating in process improvement efforts, suggesting enhancements, and following guidelines set by process coaches. They have the responsibility of representing their area of responsibility within the process and may have the authority to initiate changes to improve process performance (Wagner and Lindner, 2013).

The process lifecycle outlines the various stages a process goes through, from its introduction into the process map to its potential redesign or termination. It consists of four phases and transitions between these phases. Phases 1 and 2 deal with the initial planning and conceptualization of processes, while Phases 3 and 4 focus on the practical implementation and execution of processes. The entire process lifecycle can be seen as the primary process of "Managing Processes", which can be further divided into two substeps: "Designing Processes" and "Controlling Processes", based on the described phases. Moreover, the process lifecycle can be segmented based on different perspectives. Phases 2 and 3 primarily concentrate on individual processes and their development, monitoring, and enhancement, whereas Phases 1 and 4 highlight the interconnectedness and interdependencies among all the processes within an organization (Wagner and Patzak, 2020).

In Phase 1, a process is admitted into the process map. This involves evaluating the process's suitability by weighing its costs and benefits, ensuring its clear distinction from other processes, and assessing its impact on other processes. Processes deemed suitable are categorized and placed within the process map, but any future modifications may require updates to the process map and other related processes. (Wagner and Patzak, 2020, p. 74) Following Phase 1, Transition 1 deals with structuring and organizing processes. Once a new process is identified and categorized, its compatibility and suitability are examined in detail. This assessment is only possible after Phase 1, as it requires more comprehensive information. If the process is deemed suitable, Phase 2 proceeds with the full definition of the process. If not, the idea of creating a distinct process is abandoned, and there is an opportunity to assign relevant activities or steps to other existing processes (Wagner and Patzak, 2020).

Phase 2 is the development from initial outlines to defining a specific process using a 4-step methodology. The first step involves identifying and separating the process from others while determining its key elements. Step 2 entails describing the current state of the process and analysing it for potential improvements. Step 3 produces a process description outlining the structured flow and performance goals. In Step 4, the defined concept is prepared for implementation using a measure plan. After defining and approving the process, Transition 2 continues to implement the process (Wagner and Patzak, 2020).

Phase 3 centers on daily process management. Adherence to process guidelines, goals, and regular measurement for control is crucial. The process owner assumes coordination and intervenes if necessary. Identified improvement opportunities lead to optimization measures. In Transition 3, periodic evaluation of process goals is essential, with results

shared in process reports to inform the management in order to enable them to decide about the next steps and possible adjustments (Wagner and Patzak, 2020.

In Phase 4, all company processes are monitored and controlled using all available data. This includes aligning goals, making adjustments, and conducting process audits for targeted development. Transitions to other phases are guided by monitoring outcomes. When a process nears the end of its life cycle due to significant changes, a transition back to Phase 1 is necessary. This is called Transition 4. Interactions with other processes are examined, and necessary adjustments are identified using the process map, which is updated accordingly (Wagner and Patzak, 2020).

A useful approach to visualize processes is the so-called swimlane model. It helps to show processes and responsibilities clearly. It uses a visual layout to display different tasks, documents, and decisions related to each responsible organizational entity or department. The model also shows how these groups interact with each other. It can identify problems in the process, like unclear responsibilities or duplication, and can even simulate different ways of doing things. Creating a swimlane model is not too complicated if you have the right tools like pinboards, large sheets of paper, pins, coloured cards, sticky notes, and pens. You start by drawing a table on the paper and writing the names of the organizational entities at the top or at the left. Then you enter the tasks in each group's section, starting from the left. It's a good idea to use cards or sticky notes at first because they're easy to change or move around. The project leader or moderator makes sure that everything is clear and easy to understand. Once the model is done, you can take a picture of it and include it in reports or save it as a digital file. Tools like Microsoft Visio or PowerPoint can be helpful for creating electronic versions of the swimlane model. These programs have templates available, and even Excel can be used to make a basic swimlane. The advantage of using these programs is that they're commonly available and most staff members can use them without much training, which makes the work more efficient and effective for everyone involved (Streicher, 2020).

The main advantage of process management is waste reduction, applicable to both production and administrative operations. Organizations must analyse their processes and find the sources of waste to tackle them. There are at least seven types of waste that can occur in nearly any organization (Wagner and Lindner, 2013). Firstly, there's an information overload, like too many emails and copies of things that aren't needed. Secondly, there's too much moving of materials between offices, like sending papers around the organization and needing lots of approvals. People also take long and inefficient paths to find documents they need. Waiting for approvals, dealing with slow office equipment setup, and managing confusing file storage can make things even slower. People often do work that isn't of use for anyone, like making reports that nobody reads or copying things needlessly. Mistakes happen because things aren't consistent, like when data changes between formats or when notes are hard to read. Lastly, employees can't use their creative ideas because they do the same things all the time and don't get special

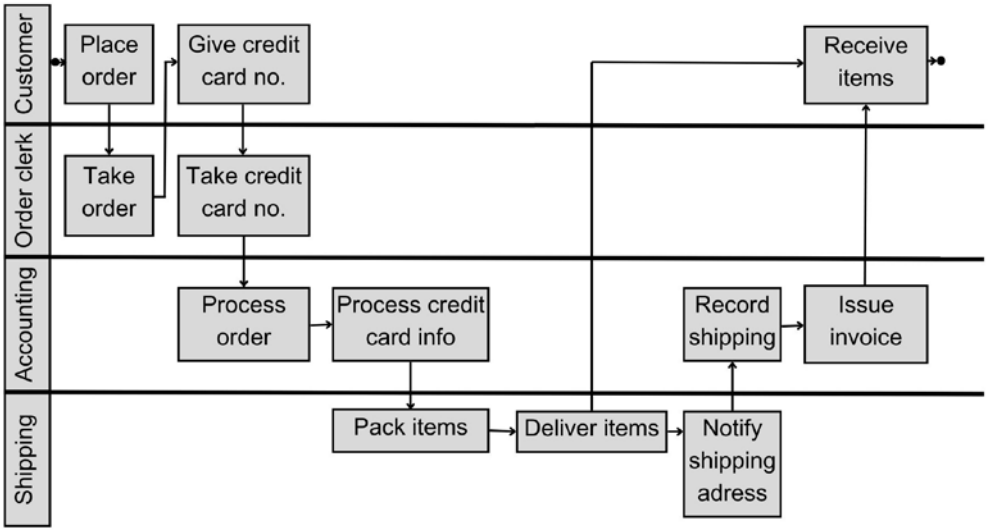

Figure 2.2.1 **A swimlane model visualization**
Source: officetimeline.com (2023).

training to be more innovative (Wagner and Lindner, 2013). Process management seeks to eliminate or minimize these forms of waste to improve efficiency and productivity.

Waste within organizations can be attributed to several factors. Poor organization, the absence of standardized workflows, weak connections between work steps, inefficient workspaces and processes, complex material flows, disorder, and a lack of cleanliness, as well as insufficient training, all contribute to this problem. The consequences of waste are significant. It results in financial costs, uses up valuable resources, consumes storage space, and leads to the accumulation of excess inventory. Additionally, it conceals issues related to storage and errors, disrupts the smooth flow of production, prolongs lead times, reduces overall productivity, and poses a risk of damage and accidents. Therefore, addressing and minimizing waste is essential for the efficiency and success of any organization (Wagner and Lindner, 2013).

Managing processes isn't solely about achieving shorter processing times and optimizing process flows. Morover, the motivation to manage processes can be found in many other aspects (Wagner and Patzak, 2020).

One important aspect is, that process management can help to enhance the output quality which leads to a higher satisfaction of customer expectations. Customer clearly have expectations about the quality of the output. Moreover, they have expectations for the process itself, such as adhering to laws. Additionally, there are expectations about the input, where customers might desire sustainable resources. Customers might also hold expectations about fair working conditions for suppliers' employees. Furthermore, different customers of the same process can have varying expectations.

Also, timely delivery is an important factor. This demonstrates that customers may have diverse expectations for various aspects of a process, and multiple customers might have conflicting or contradicting expectations. Managing processes is crucial to satisfying all customers' expectations (Wagner and Patzak, 2020).

Also, improvement of process interfaces is an important factor. Transitions between individual process steps constitute interfaces where resources, information, and responsibilities are transferred. Processes typically have numerous interfaces involving multiple stakeholders. Notably, the more diverse the partners in an interface, the higher the risk of misunderstandings and information or knowledge loss, potentially negatively affecting the process or its outcomes. Efficient and effective process management is essential to ensure smooth operations at these interfaces (Wagner and Patzak, 2020).

Apart from the absence of proof backing the claimed advantages of process management, there's evidence that process management might, in certain instances, have negative effects on organizations. This is because process management tends to limit innovations. The innovations that come from process management are usually small improvements. As a result, big, groundbreaking changes are unlikely to happen in an organization that heavily relies on process management. Studies propose that companies using process management might face difficulties during times of swift change, unlike companies that don't use process management (Clark, 2017).

Process management can have negative effects because sometimes it does not allow processes to be repeated, and because it has a tendency to stifle innovations within its inflexible structure. Its limited flexibility for employees to explore solutions according to their own judgment is a serious disadvantage. Additionally, the implementation of process management often relies on external consultants with expertise in the necessary tools. When executed inadequately, it can lead to wasted time and resources (Kissflow, 2022).

2.2.2 Relevance for Municipalities

Public administration faces a multitude of challenges in fulfilling its official duties, including ensuring public safety, police presence, and disaster readiness, all while maintaining cost-effectiveness. Adapting and implementing EU law into national regulations is a complex and crucial task. Unlike private companies, public agencies often lack direct operational control over processes, hampering their ability to manage workflows efficiently. The complexity of existing legal norms, such as social security and tax laws, presents implementation challenges. Each agency possesses autonomy to shape its structures and processes, making standardization dependent on mutual agreement. Limited public resources and fixed formulas for fund distribution among departments impose budget restrictions and limit flexibility for investments and structural reforms. The identification of a public agency's primary target group is often unclear, influencing service delivery. Furthermore, long-term strategic decisions are frequently hampered by

political cycles and short-term priorities dominating decision-making within the legislative period (Rodenhagen, 2009).

Process management in the public sector differs significantly from the private sector. In the public sector, services are mandated by law, there is no competition, and adaptability is primarily driven by changes in regulations. The main objective is to deliver services economically, as opposed to private sector businesses, which set their own goals, face competition, adapt to market changes, and aim for profitability through effectiveness and efficiency (Rodenhagen, 2009).

Process optimization in the public sector involves pursuing several key objectives to enhance efficiency and effectiveness. These goals include a strong focus on customer orientation, ensuring that processes are consistently aligned with the needs and preferences of the public. Another crucial aspect is reducing complexity by eliminating redundant legal norms and regulations, such as excessive laws and unnecessary traffic signs. Furthermore, achieving common standards is essential, which involves integrating customers into internal processes and reaching consensus on shared interfaces, media, and data formats. By doing so, the public sector can enhance communication and streamline operations. Additionally, a strategic emphasis on the core activities is vital. This entails distinguishing between essential functions and support processes that could be outsourced to external service providers, thereby potentially reducing costs and improving service quality. Lastly, fostering cultural integration within the public sector is essential. This includes promoting a collaborative spirit, encouraging cooperation among various departments and agencies, and transcending political and personal sensitivities. By addressing these objectives, process management in the public sector aims to enhance overall performance and better serve the needs of the community (Rodenhagen, 2009).

While process management in municipalities can have significant advantages, it can also lead to some negative effects. One downside is that it can make tasks too complicated and slow if the processes itself are not designed efficiently. This is due to the fact that implementing process management doesn't necessarily mean that the processes are of high quality. Another issue is that, while in fact intending to reduce bureaucracy, setting up and managing process management can involve a lot of administrative work as well, which consumes the resources of the local administration. Sometimes, focusing too much on following processes in place can hinder creativity to find solutions for a certain problem that might be solved easily with a less standardized approach. Lastly, if processes are not regularly updated, they can become outdated and fail to keep up with changing needs and technology.

2.2.3 Practical Applications

One example for using process management in the public sector is the Dog Tax in the Austrian city of Linz. When dog owners submit registration forms for their dog, the process continues to be handled by the relevant department, which processes the dog's registration. Then they need to check documentation and other relevant factors and inform the dog owner about the tax that needs to be paid. Payment collection is part of this process too. In case the dog is deregistered, the process instance is being terminated. The main goal of this process is to give new staff members a quick overview over all relevant tasks. In Figure 2.2.2, the process map of this process for the collection of dog taxes is being displayed.

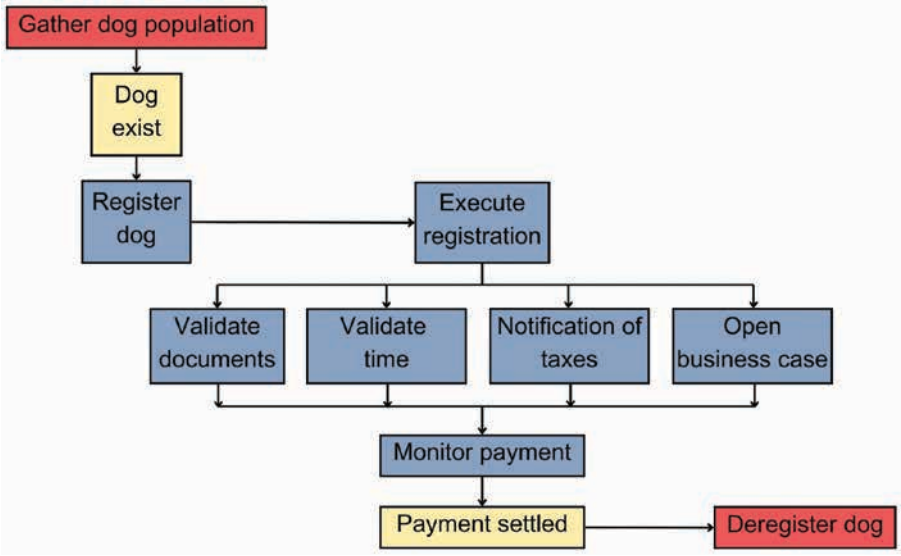

Figure 2.2.2 **Process map example**
Source: Authors, simplified process map for dog registration, City of Linz.

2.2.4 Summary

Process management is about organizing monotonous, repetitive tasks in an organization to ensure efficiency and quality. It involves defining clear steps, responsibilities, and resources needed for a process. In the public sector, process management can help governments become more efficient, reduce costs, and improve citizen satisfaction. It allows municipalities to streamline processes, handle citizen requests faster, and provide consistent quality of service. By continuously monitoring and improving processes, municipalities can adapt to changing needs.

References

CLARK, W. (2017). *The Disadvantages of Business Process Management.* Online. [20/06/2024]. Available at: <https://bizfluent.com/info-7943270-nonfinancial-benefits-strategic-management.html>.

KISSFLOW (2022). *BPM vs Case Management – Which is a Better Solution?* Online. [20/06/2024]. Available at: <https://kissflow.com/workflow/case/bpm-vs-case-management/>.

Officetimeline.com. (2023). Swimline Model Visualization. Online. [20/06/2024]. Available at: <https://img.officetimeline.com/website/Content/website/swimlane-diagram/swimlane-activity-diagram-example.svg>.

RODENHAGEN, J. (2009). *Prozessmanagement in der Öffentlichen Verwaltung. Diskussionsgrundlage auf Basis eigener Erfahrungen*. Online. [20/06/2024]. Available at: <http://bpmb.de/images/2009-08-14-Rodenhagen.pdf>.

STREICHER, H. W. (2020*). Digitale Transformation in der öffentlichen Verwaltung. Praxishandbuch für Projektleiter und Führungskräfte.* Springer-Verlag.

WAGNER, K., LINDNER, A. (2013). *Wertstromorientiertes Prozessmanagement. Effizienz steigern – Verschwendung reduzieren – Abläufe optimieren*. München : Carl Hanser Verlag GmbH & Co. KG.

WAGNER, K., PATZAK, G. (2020). *Performance Excellence - Der Praxisleitfaden zum effektiven Prozessmanagement.* München : Carl Hanser Verlag GmbH & Co. KG.

2.3 Empowering Municipalities with Effective Knowledge Management

Author: Davide Maffei

2.3.1 General Introduction

Knowledge management refers to the process of capturing, organising, storing, and utilising knowledge within an organisation to enhance decision-making, problem-solving, innovation, and overall performance. Knowledge management bears great strategic significance for organisations and contributes to establishing sustainable competitive advantages (Ferreira et al., 2018; Zack, 2002). It involves the systematic management of both explicit knowledge (codified and documented information) and tacit knowledge (personal expertise and insights) to create a valuable organisational asset.

The primary goals of knowledge management are to facilitate knowledge sharing, collaboration, and learning across individuals, teams, and departments. Organisations can avoid redundant work by effectively managing knowledge, capitalise on past experiences, foster innovation, and improve productivity.

Knowledge management typically involves several key activities that build what is known as knowledge cycle, depicted in Figure 2.3.1 These activities usually involve:

- **Knowledge Capture:** Gathering and documenting knowledge from various sources, including experts, documents, databases, and organisational processes.
- **Knowledge Organization:** Categorizing, classifying, and structuring knowledge for easy retrieval and understanding. This may involve the creation of taxonomies, ontologies, or knowledge bases.
- **Knowledge Storage and Retrieval:** Knowledge is stored in repositories such as databases, content management systems, or knowledge-sharing platforms. Retrieval mechanisms like search engines or indexing systems help users find relevant knowledge efficiently.
- **Knowledge Sharing and Collaboration:** Promoting knowledge sharing among employees through collaboration tools, social platforms, communities of practice, or internal communication channels. This allows individuals to access and contribute to the organisation's collective knowledge.
- **Knowledge Transfer and Learning:** Facilitating knowledge transfer from experienced employees to new or less-experienced ones through mentoring, training programs, workshops, or documentation.
- **Knowledge Maintenance and Updating:** Review and update knowledge regularly to ensure accuracy, relevance, and currency. This includes retiring outdated knowledge and capturing new insights.

Figure 2.3.1 **The Knowledge Management Cycle**
Source: Authors.

Effective knowledge management practices can lead to improved decision-making, faster problem-solving, increased innovation, enhanced employee engagement, and a competitive advantage for organisations in their respective industries. Particularly at the Human Resources level, knowledge management holds great potential. It can contribute to a stimulating organisational environment and prevent the loss of precious knowledge due to employee turnover. Moreover, thanks to effective knowledge exchange, training costs can be reduced.

2.3.2 Importance and Benefits

Knowledge management is equally relevant and beneficial for the public sector. Alvarenga et al. (2020), Massaro et al. (2015), and Cong & Pandya (2003) argue that knowledge management can yield considerable advantages for the public sector, even if its implementation might be more difficult compared to the private sector, this is imputable to difficulties in measuring organisational goals and political interference. Particularly interesting aspects of knowledge management for the public sector are connected to:

- **Improved Policy Development:** Knowledge management helps public sector organisations capture and analyse valuable insights, data, and research to inform policy development. It enables policymakers to access relevant information, best practices, and lessons learned from similar initiatives, leading to more informed and effective policy decisions.

- **Enhanced Service Delivery:** Public sector agencies provide a wide range of services to the public. Knowledge management enables the sharing and dissemination of best practices, standardised procedures, and lessons learned among employees, leading to more efficient and effective service delivery. It also promotes consistency and reduces duplication of efforts across different departments or agencies.
- **Knowledge Sharing among Government Agencies:** Different government agencies and departments often work on interconnected issues in complex governance structures. Knowledge management facilitates sharing of knowledge and expertise across these agencies, promoting collaboration, reducing silos, and enabling a holistic approach to problem-solving and decision-making.
- **Crisis and Emergency Response:** During crises, such as natural disasters or public health emergencies, knowledge management plays a critical role in sharing real-time information, best practices, and lessons learned across different response agencies. It helps coordinate efforts, make informed decisions, and optimise resources to manage the crisis effectively.
- **Capacity Building and Training:** Public sector organisations need to invest in the continuous development of their workforce. Knowledge management supports capacity building by providing a platform for sharing expertise, organising training materials, and fostering learning communities. It helps transfer knowledge from experienced employees to new recruits, ensuring institutional memory and competency development.
- **Evidence-Based Decision-Making:** Knowledge management promotes evidence-based decision-making by making relevant data, research, and evaluations easily accessible to policymakers. It enables them to base their decisions on sound evidence and analysis, leading to more informed and effective governance.
- **Transparency and Citizen Engagement:** Effective knowledge management can support transparency initiatives by making information and knowledge accessible to the public. It allows citizens to access relevant data, policies, and reports, promoting accountability and fostering citizen engagement in public affairs.

Knowledge management has the potential to improve the overall efficiency, effectiveness, and transparency of public sector organisations, enabling them to serve better the needs of the society they represent, yet the blind implementation of private sector tools and models is unlikely to work (Massaro et al., 2015).

2.3.3 Practical Applications

Knowledge management is valuable for municipalities. If we think at the previously listed aspects, we can immediately derive areas where knowledge management can be of great help:

- **Efficient Service Delivery:** Municipalities provide various services to their residents, such as waste management, transportation, utilities, and public safety. Knowledge management facilitates sharing best practices, standard operating procedures, and lessons learned among municipal employees. This leads to more efficient service delivery, reduced duplication of efforts, and improved customer satisfaction.
- **Urban Planning and Development:** Knowledge management enables municipalities to leverage existing knowledge and expertise in urban planning and development. It allows them to access data, research, and successful case studies from other municipalities or urban planning organisations. This information can inform decision-making, help design sustainable and inclusive cities, and avoid repeating mistakes.
- **Collaboration and Interdepartmental Coordination:** Municipalities typically have multiple departments and units working on various aspects of city management. Knowledge management fosters collaboration and interdepartmental coordination by providing a platform for sharing information, insights, and expertise. It breaks down silos and promotes a holistic approach to addressing urban challenges.
- **Governance and Policy-making:** Effective knowledge management supports evidence-based governance and policy-making at the municipal level. It enables access to data, research, and analysis relevant to local issues, empowering policymakers with valuable insights. This leads to informed decision-making and the development of policies that align with the needs and aspirations of the community.
- **Community Engagement:** Knowledge management can foster community engagement and participation in municipal affairs. By making information, policies, and decisions transparent and easily accessible to residents, municipalities can empower citizens to contribute to decision-making processes. Knowledge management platforms can facilitate dialogue, collaboration, and knowledge sharing between municipalities and their communities.
- **Continuity and Succession Planning:** Municipalities often face challenges related to staff turnover, retirements, or leadership changes. Knowledge management helps preserve institutional memory by capturing and organising critical knowledge, processes, and expertise. This ensures continuity in service delivery, decision-making, and governance, even as personnel change over time.
- **Performance Improvement and Learning:** Municipalities can use knowledge management to monitor and evaluate the effectiveness of their programs,

initiatives, and policies. By capturing lessons learned and analysing performance data, municipalities can identify areas for improvement and implement evidence-based changes. This promotes a culture of continuous learning and innovation within the municipality.

Knowledge management is essential for municipalities as it enhances service delivery, urban planning, collaboration, governance, community engagement, continuity planning, and performance improvement. It enables municipalities to leverage knowledge resources, make informed decisions, and better serve the needs of their residents.

2.3.4 Summary

Knowledge management is crucial for achieving a successful digital transition. It supports sharing knowledge and collaboration, enabling organisations to leverage best practices and expertise in adopting digital technologies. Knowledge management facilitates learning and skill development, driving innovation and digital transformation. It helps manage and utilise data effectively, ensuring informed decision-making. Additionally, knowledge management supports change management efforts and fosters collaboration with external partners in the digital ecosystem. By harnessing knowledge and digital tools, organisations can navigate the digital landscape, drive transformation, and seize new growth opportunities.

Moreover, knowledge management plays a vital role in achieving green and sustainable goals. It enables the sharing of best practices, fosters collaboration and learning, enhances data and insights, supports green innovation, promotes continuous improvement, engages employees, and facilitates collaboration with stakeholders. By leveraging knowledge and collaboration, organisations can drive sustainability initiatives, adopt eco-friendly practices, and work towards a more sustainable future.

References

ALVARENGA, A. et al. (2020). Digital transformation and knowledge management in the public sector. In *Sustainability*, 12(14), 5824. DOI: <https://doi.org/10.3390/su12145824>.

CONG, X., PANDYA, K. V. (2003). Issues of knowledge management in the public sector. In *Electronic journal of knowledge management*, 1(2), 181-188.

FERREIRA, J. et al. (2018). Strategic knowledge management: theory, practice and future challenges. In *Journal of knowledge management,* 24(2), 121-126. DOI: <https://doi.org/10.1108/JKM-07-2018-0461>.

MASSARO, M. et al. (2015). Public sector knowledge management: a structured literature review. In *Journal of knowledge management*, 19(3), 530-558. DOI: <https://doi.org/10.1108/JKM-11-2014-0466>.

ZACK, M. H. (2002). Developing a knowledge strategy. In *California Management Review,* 41(3), 125-223. DOI: <https://doi.org/10.2307/41166000>.

2.4 Public Engagement in Modern Municipalities and Cities

Author: Miroslav Fečko

2.4.1 General Introduction

Today's society is facing many challenges at all levels of governance. Developing universal policy responses is very ambitious because governments, regions, and cities usually create specific policies and solutions that strongly depend on socio-economic context. Executing public institutions' competencies directly or indirectly affects public services and the quality of citizens´ lives. The responses of public institutions at all levels of governance should reflect the voice of people directly affected by contemporary challenges, climate change, energy transition, sustainable use of natural resources, urban and international migration, wealth distribution, labour market trends, skills requirements, coexistence issues, etc.

The voice of citizens is getting more important for public institutions and policymakers. This goes beyond a one-off participation in an election. In this regard, public institutions at all levels of governance have different possibilities for continuously considering citizen's ideas, viewpoints, opinions and needs. Public institutions by themselves intend to give room for the citizens to engage and jointly realise activities of public interest. Citizens also show interest in public activities and issues, even without the intention of the public institutions to involve the citizens. Citizens' voice is important in contemporary public policy, regardless of how or who initiates this unique and mobilising dialogue.

2.4.2 Relevance for Municipalities

Public engagement, public involvement, and participation have the same or similar meanings. These terms are often used interchangeably because they are all connected with the ambition of public institutions to allow the expression of opinions.

Participation can come from citizens only and can be described as participating in public institutions' activities. Passive participation refers to the passive consumption of information and data from policymaking, while active participation leads to actions thanks to existing participation tools. Participation can take several forms, from basic informing and consulting to partnership and citizen control of public institutions.

The term involvement corresponds with the intentional collaboration of both public institutions and the public. The citizens have the right to be involved in decision-making, particularly in issues that potentially affect the communities and the areas they live and work (Ismail & Said, 2015). Controlled and partnership-based involvement leads to the co-production of value for citizens and other entities (Hereźniak & Florek, 2018).

Involved citizens should be included in the strategies of public institutions in general or in particular spheres of social life (Izdebska & Knieling, 2020; McComas et al., 2010). Involved stakeholders perform activities because they were asked to do something and were involved in some activity by public institutions.

Public engagement requires active and intentional dialogue between stakeholders and decision-makers. Public engagement can be seen as the same activity as involvement but is based on beliefs, values, and individuals´ awareness of those who want to be engaged. The main goal of public engagement is to ensure the public vision is represented in policymaking (Goodman et al., 2020). Meaningful public engagement can be seen as a process focused on identifying and prioritising the goals of the wider public (Campbell-Arvai & Lindquist, 2021). In this regard, public engagement improves the outcomes and outputs of public policies.

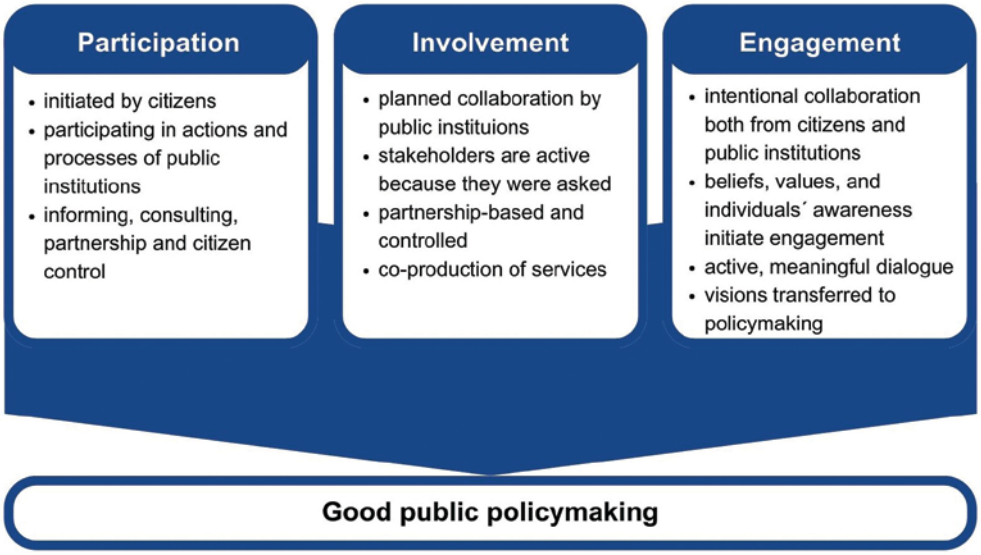

Figure 2.4.1 **Public engagement, public involvement, and participation – impact on public policy**

Source: Authors.

Public engagement, public involvement, and participation must be seen as a process rather than an outcome of policymaking. The voice of the relevant stakeholders is important for policymakers, and there are no signs that this trend will change in the coming years. The mentioned approaches may have different views on the intention and intensity of actions performed by public institutions and stakeholders. Still, their mutual benefit is giving public institutions opportunities to improve the quality of life. Public engagement can be seen as the highest possible qualitative level of co-production of policies´ outcomes and outputs.

Public engagement is also important at the communal level of governance because municipalities and cities are considered the closest to citizens' everyday activities. Public engagement at the local level helps municipalities and cities respond to various types of challenges, such as climate change adaptation (Hügel & Davies, 2020), building resilience to extreme situations (Robertson et al., 2021), energy transition (Armstrong, 2021), as well as infrastructure planning (Nickdoost et al., 2024; Campbell-Arvai & Lindquist, 2021). The engagement of community members in the communities´ issues transforms the overall sustainable development planning and governance at the local level (Ismail & Said, 2015).

The accelerated digital transition is also transforming the process of public engagement. Digital technologies offer municipalities and cities a space to develop an intelligent digital ecosystem that emphasises stakeholders´ engagement in identifying, suggesting, designing, and implementing innovative solutions (Becker et al., 2023; Anthopoulos et al., 2019). In this regard, digital technologies give municipalities and cities opportunities to enhance equity in the engagement of citizens through meaningful solutions (Levenda et al., 2020).

2.4.3 Practical Applications

Types and forms of public engagement tools vary among municipalities and cities. The diversity of engagement tools results from different factors, mainly the management's vision, socio-economic factors, the level of digitalisation, trust, communication and interactions between cities and citizens, public awareness of the importance of engagement, and the culture of transparency and openness in local self-government units.

The local democracy tool called participatory budgeting helps local communities transform their ideas into practical results. Municipalities and cities allow communities to decide how a designated part of the public budget should be spent. Local communities design and propose projects that could potentially increase the quality of communal life. Citizens directly vote for particular project proposals. Digital technologies make participatory budgeting more citizen-friendly and help utilise the benefits of this innovative democratic tool, mainly thanks to the sharing of proposals, video presentations of proposals that might even be stored, and online voting on proposals.

Municipalities and cities also benefit from the exclusive activities of engaged local communities. Engaged individuals and groups have the potential to mobilize other members of local communities, helping municipalities and cities improve the quality of life. Social services, environmental issues, community development, order and safety, and local circular economy are spheres of communal life that are positively affected by engaged members of communities.

The contribution of local stakeholders is also essential for the urban planning of modern municipalities and cities. Urban planners should consider the opinions and

ideas of citizens and private and non-governmental organisations on the future development of the territory. Contemporary urban planning benefits from the digital transition, mainly thanks to the online availability of information, open data, and documents. Besides, the whole planning process can be done online, complementing traditional face-to-face meetings and communication.

2.4.4 Summary

Public engagement can take different forms and goes far beyond attending periodic elections. Public and local governments should create opportunities and allow intentional and continuous collaboration between public institutions and citizens. Modern municipalities and cities should also utilise the potential and benefits of public engagement through various digital solutions.

References

ANTHOPOULOS, L. et al. (2019) A Unified Smart City Model (USCM) for Smart City Conceptualization and Benchmarking. In Khosrow-Pour, M. (eds.) *Smart Cities and Smart Spaces: Concepts, Methodologies, Tools, and Applications,* Hershey: IGI Global, 247-264. DOI: <https://doi.org/10.4018/978-1-5225-7030-1.ch011>.

ARMSTRONG, J. H. (2021). People and power: Expanding the role and scale of public engagement in energy transitions. In *Energy Research & Social Science* 78(8), 102136. DOI: <https://doi.org/10.1016/j.erss.2021.102136>.

BECKER, J. et al. (2023). City 5.0: Citizen involvement in the design of future cities. In *Electronic markets* 33, 10. DOI: <https://doi.org/10.1007/s12525-023-00621-y>.

CAMPBELL-ARVAI, V., LINDQUIST, M. (2021). From the ground up: Using structured community engagement to identify objectives for urban green infrastructure planning. In *Urban Forestry & Urban Greening* 59(3), 127013. DOI: <https://doi.org/10.1016/j.ufug.2021.127013>.

GOODMAN, N. et al. (2020). Public engagement in smart city development: Lessons from communities in Canada's Smart City Challenge. In *Canadian Geographies* 64(3), 416-432. DOI: <https://doi.org/10.1111/cag.12607>.

HEREŹNIAK, M., FLOREK, F. (2018). Citizen involvement, place branding and mega events: insights from Expo host cities. In *Place Branding and Public Diplomacy* 14, 89-100. DOI: <https://doi.org/10.1057/s41254-017-0082-6>.

HÜGEL, S., DAVIES, A. R. (2020). Public participation, engagement, and climate change adaptation: A review of the research literature. In *WIREs Climate Change* 11(4), 1-20. DOI: <https://doi.org/10.1002/wcc.645>.

ISMAIL, W. A. W., SAID, I. (2015). Integrating the Community in Urban Design and Planning of Public Spaces: A Review in Malaysian Cities. In *Procedia - Social and Behavioral Sciences* 168(4), 357-364. DOI: <https://doi.org/10.1016/j.sbspro.2014.10.241>.

IZDEBSKA, O., KNIELING, J. (2020). Citizen involvement in waste management and circular economy in cities: Key elements for planning and implementation. In *European spatial research and policy* 27(2), 115-129. DOI: <https://doi.org/10.18778/1231-1952.27.2.08>.

LEVANDA. A. M. et al. (2020). Rethinking public participation in the smart city. In *Canadian Geographies* 64(3), 344-358. DOI: <https://doi.org/10.1111/cag.12601>.

MCCOMAS, K. A. et al. (2010). Linking Public Participation and Decision Making through Risk Communication. In: Heath, R. L, O´Hair, H. D. (eds.) *Handbook of Risk and Crisis Communication*, 364-385. New York : Routledge. DOI: <https://doi.org/10.4324/9781003070726>.

NICKDOOST, N. et al. (2024). Identification and prioritization of multidimensional resilience factors for incorporation in coastal state transportation infrastructure planning. In *Natural Hazards* 120(2), 1603-1663. DOI: <https://doi.org/10.1007/s11069-023-06251-z>.

ROBERTSON, T. (2021). Theory and practice of building community resilience to extreme events. In *International Journal of Disaster Risk Reduction* 59(8), 102253. DOI: <https://doi.org/10.1016/j.ijdrr.2021.102253>.

2.5 Evidence-Based Policymaking as a Means of Improving Communal Life

Author: Miroslav Fečko

2.5.1 General Introduction

Public policy has evolved to include sophisticated activities by different types of stakeholders. Public policies aim to achieve a wide range of societal goals at all levels of governance. Public institutions have started collecting data to help them identify the aspects of existing social reality. Municipalities and cities usually communicate and collaborate with stakeholders, mainly with an ambition to recognise and satisfy stakeholders' needs. However, different types of stakeholders may identify different needs and issues that have to be solved by municipalities and cities. The actual and exact informational basis for relevant public policy decisions can be seen as an irreplaceable part of good public policies at all levels of governance.

Theoreticians, politicians, and practitioners often consider evidence-based policymaking an important ideal. At the turn of the millennium, "evidence-based policymaking" was generally described as vague and aspirational. For some experts, evidence-based policymaking represents an ideal that local governments fail to reach. Still, in other words, exact information can help policymakers select the most effective and evidence-based solution (Cairney, 2016). Evidence-based policymaking is a set of methods, data, and knowledge that help policymakers identify the truth in policymaking (Smith-Merry, 2020; Lancaster et al., 2017).

Evidence can affect the outcome and outputs of public policies. Many authors have aimed to identify the aspects or parts of evidence relevant to policymaking. Evidence usually includes experience and expertise, resources, values and interests, habits and traditions, lobbyists and pressure groups, pragmatics, policy content, and political objectives (Sanni et al., 2016; Jones & Walsch, 2008; Davies 2005). Regardless of the different theoretical approaches used to explain the meaning of evidence, authors across the scientific disciplines argue that appropriate evidence is necessary for good public policies.

2.5.2 Relevance for Municipalities

Municipalities and cities tend to integrate digital technologies that help them increase the quality of governance. Digital technologies implemented by municipalities and cities usually can collect data, but some solutions naturally accumulate data. Municipalities and cities should perceive these data as having the potential to be utilised.

Municipalities and cities use local public policies to secure sustainable and balanced development of their territories across all spheres of society. Evidence-based policymaking

can be seen as an appropriate platform that helps policymakers make the right decisions (Sutcliffe & Court, 2005). In this regard, local public policies can potentially improve different aspects of communal life, such as health, environment, education, and social and technical infrastructure. Each sphere of life requires different types of evidence to be considered by the policymakers. Besides, different types of evidence enter into specific moments in the policymaking process (Mosley & Gibson, 2017). Evidence-based policymaking requires critical thinking to use evidence to help achieve public policy goals, which will have lasting effects over time (Parkhurst, 2017). Put differently, evidence is just a first step, because the policymakers must critically assess it. The main benefit of the evidence-based policymaking approach is that it provides a necessary informational basis for policymakers rather than directly answering the key questions and issues. Evidence-based policymaking at the local level improves the quality of communal life (Figure 2.5.1).

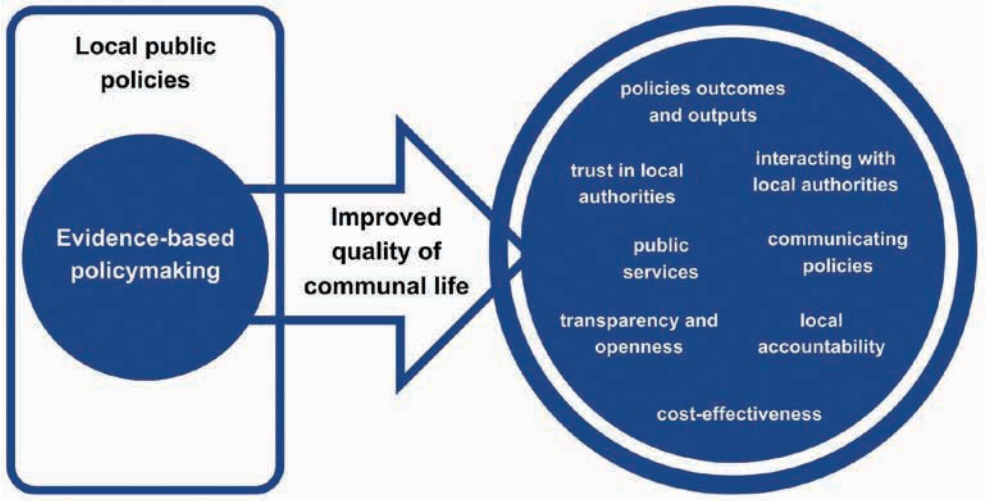

Figure 2.5.1 **Evidence-based policymaking at the communal level**
Source: Authors.

Evidence helps policymakers identify the needs of different stakeholders. Thus, appropriately identifying the community´s needs may result in better outcomes and outputs of local policies. Good policymakers pay attention to collecting and sharing information and data with relevant stakeholders. In this regard, communicating policies and interacting with local authorities is very important for any kind of stakeholder. Evidence-based policymaking is closely connected to other principles of the good governance approach, mainly transparency, openness, and local accountability. An adequate level of information can also improve trust in local authorities. In summary, evidence-based policymaking generates higher-quality public services for local communities.

Evidence-based policymaking can also be defined as a continuous process of improving the outcomes and outputs of public policies. Municipalities and cities should systematically create and revise evidence relevant to local policies. Collaboration with stakeholders can also be seen as an essential part of effective evidence-based policy-making at the communal level of governance.

2.5.3 Practical Applications

Evidence-based policymaking helps municipalities and cities minimise uncertainty and risk in a dynamically changing environment. The digitalisation of evidence-based policymaking can be perceived as a necessary direction for future good policies. Thus, digital transition reformulates key aspects of evidence-based policymaking (Figure 2.5.2).

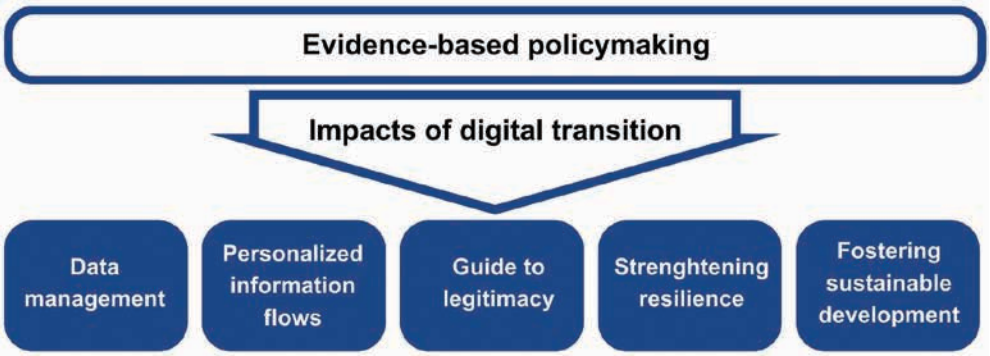

Figure 2.5.2 **Evidence-based policymaking and digital transition**
Source: Authors.

Digitalised information and data are used both for evidence-based policymaking and in the context of an open data approach. In this regard, the digital transition also creates another perspective of policymaking based on evidence. Municipalities and cities use evidence for decision-making. Thus, the informational overload requires clear processes of data management:

- management of data and information necessary for the decisions, including collection, storage, back-up, processing, and sharing of gathered evidence,
- information and data do not necessarily always lead to policymakers' decisions, but sharing collected evidence also creates opportunities for other stakeholders to benefit from it and develop innovative solutions, applications, services, etc.

Thanks to digital technologies, information and data required for evidence-based policy-making are gathered more effectively. Using ICTs helps municipalities and cities gather evidence through questionnaires, polls, and other feedback-focused tools at lower costs and in a shorter time. Besides, smart applications represent a platform that allows

cities to utilise personalised information flows between local authorities and citizens. In this regard, digital technologies transform evidence-based policymaking from a simple collection of evidence to a sophisticated approach involving stakeholders in policymaking.

Evidence-based policymaking doesn´t have to be seen as a process for itself. Elected representatives of municipalities and cities naturally have their legitimacy drawn from the election process at the communal level. The evidence-based policymaking approach is not contrary to their legitimacy but can be seen as a guide throughout the entire term of office. Thus, elected representatives can see evidence-based policymaking as a kind of fact check or reality check on what needs to be targeted, what issues to fix, and which areas of communal life to focus on.

Evidence-based policymaking also helps cities in responding to crises and unpredictable situations. Gathered evidence allows policymakers to make the best-fit solution under the pressure of natural disasters, man-made attacks, threats, and fiscal and economic instability. Municipalities and cities can identify optimal stakeholders for collaboration in a particular type of crisis. Thus, evidence helps the community to be more resilient. Digital solutions help municipalities and cities to evaluate vast amounts of evidence in a short time. Simultaneously, digital communication platforms help local authorities share data and information with citizens with minimal delay.

Evidence-based policymaking also contributes to the sustainable development of municipalities. Policymakers and collaborating stakeholders understand local conditions and the specific needs of the local community. On one hand, evidence-based policymaking requires input from different stakeholders, which is necessary for good public policies. On the other hand, policy outcomes and outputs must be evaluated systematically, which helps policymakers identify possible abnormalities and apply corrections. These aspects of evidence-based policymaking can be done in a much shorter time and with better resource management.

2.5.4 Summary

Evidence-based policymaking is focused on improving communal life. Stakeholders can actively influence the outcomes and outputs of public policies thanks to digital technologies. Summing it up, digital transition positively affects stakeholders and local authorities in their effort to create a more sustainable future for municipalities and cities.

References

CAIRNEY, P. (2016). *The Politics of Evidence-Based Policy Making.* London : Palgrave Macmillan.

DAVIES, W. (2005). *Evidence-based policy and democracy.* Online. [20/6/2024]. Available at: <https://www.opendemocracy.net/en/policy_3056jsp/>.

JONES, N. AND WALSH, C. (2008). *Policy briefs as a communication tool for development research.* Online. [20/6/2024]. Available at: <https://odi.cdn.ngo/media/documents/594.pdf>.

LANCASTER, K. et al. (2017). The productive techniques and constitutive effects of 'evidence-based policy' and 'consumer participation' discourses in health policy processes. In *Social Science & Medicine*, 176(March 2017), 60-68. DOI: <https://doi.org/10.1016/j.socscimed.2017.01.031>.

MOSLEY, J. E., GIBSON, K. (2017). Strategic use of evidence in state-level policymaking: matching evidence type to legislative stage. In *Policy Sciences* 50(4), 697-719. DOI: <https://doi.org/10.1007/s11077-017-9289-x>.

PARKHURST, J. (2017). *The politics of evidence: from evidence-based policy to the good governance of evidence*. Abingdon : Routledge.

SANNI, M. et al. (2016). Evaluation of the quality of science, technology and innovation advice available to lawmakers in Nigeria. In *Palgrave Communications* 2(2016), 16095. DOI: <https://doi.org/10.1057/palcomms.2016.95>.

SMITH-MERRY, J. (2020). Evidence-based policy, knowledge from experience and validity. In *Evidence & Policy: A journal of research, debate and practice* 16(2), 305-316. DOI: <https://doi.org/10.1332/174426419X15700265131524>.

SUTCLIFFE, S., COURT, J. (2005). *Evidence-Based Policymaking: What is it? How does it work? What relevance for developing countries?* Online. [20/6/2024]. Available at: <http://cdn-odi-production.s3-website-eu-west-1.amazonaws.com/media/documents/3683.pdf>.

2.6 From Crisis to Continuity: Enhancing Public Administration Resilience

Author: Peter Decarli

2.6.1 General Introduction

The notion of resilience is rapidly gaining influence in public administration practice and research. "Resilience of the Public Administration" refers to the ability of public administration systems to withstand, adapt, and recover from disruptions such as natural disasters, economic crises, demographic changes, health epidemics and others while maintaining their essential functions (Figueiredo et al., 2018). It involves planning and investing for disruption and being able to adapt, endure, and rebound quickly.

Resilience in public administration was introduced by Wildavsky (1988). He argued that societies face daily risks and increasingly do so as social and technical systems become more intertwined and interdependent. He called for an investment, not just in prevention but in resilience. Societies, in his view, should focus on mitigating and absorbing shocks as well as prevention. However, resilience is not just about recovery from large-scale incidents. It also involves recognising risk and preventing a routine emergency from escalating or cascading into a more significant crisis. In the field of crisis management, resilience is now a well-established concept (Aldrich, 2012; Boin et al., 2010).

Some examples of challenges faced by cities and towns include industrial structural change (e.g. the relocation or closure of a city's major companies), economic crises (e.g. the global financial crisis of 2007/08 and the European debt crisis of 2009), population migration, disasters (e.g. earthquakes, floods, and hurricanes), energy supply disruptions, and leadership changes (Figueiredo et al., 2018).

While earlier debates about the design of public administrations often focused on values such as efficiency and equity, contemporary debates show an increasing concern with the robustness, flexibility and adaptability of public governance. (Duit & Galaz, 2008; Hood, 1991).

Personal resilience refers to an individual's ability to adapt to stress, adversity, or change, bouncing back from challenges with strength and resolve. It involves emotional, psychological, and physical aspects and is deeply rooted in one's mindset and coping mechanisms. On the other hand, organisational resilience is the capacity of a company or group to withstand disruptions and maintain continuous business operations. It encompasses the ability to recover from crises, adapt to change, and grow in adversity (Shmul et al., 2022). This type of resilience is built through strategic planning, robust systems, and a culture that encourages adaptability and learning. While personal resilience is about individual capabilities, organisational resilience is about creating a resilient infrastructure that supports its members and thrives despite external pressures

(Maor et al., 2022). Both forms of resilience are interconnected; a resilient organisation can foster personal resilience among its employees, and resilient individuals can contribute significantly to the robustness of their organisation.

As an archetype, a resilient public administration differs from a traditional Weberian bureaucracy in many ways: it consists of multiple organisational units in non-hierarchical networks with overlapping jurisdictions and cross-scale linkages; it has spare capacity to deploy in times of crisis; it draws on multiple types of knowledge (e.g., scientific and experiential) and sources of information; it encourages stakeholder participation; and it uses trial-and-error policy experimentation and social learning to keep the policy system within a desirable range of stability (Duit, 2016).

2.6.2 Relevance for Municipalities

In policy documents emanating from all levels of government and many different policy contexts, the concept of resilience is rapidly gaining ground. For example, the European Commission recently adopted an Action Plan for Resilience in Crisis Prone Countries (European Commission, 2013). The Organisation for Economic Cooperation and Development (OECD) has published a series of policy briefs and working papers that use the concept of resilience to discuss issues of economic development, urban development, and disaster management (OECD, 2014; Mitchell, 2013). The OECD has also developed a resilience toolkit to assist practitioners in implementing resilience strategies in local communities (Duit, 2016).

In an increasingly complex and unpredictable world, these examples point to a perceived need for government reliability and robustness. Irrespective of the policy area, the primary motivation behind the emergence of all these examples of resilience policies seems to be a recurring need for a more holistic, robust, inclusive and responsive public administration (Duit, 2016).

Resilience can be referenced at the scale of countries, regions, urban areas, cities, communities, or households (Figueiredo et al., 2018). This distinction is essential for policymakers, as the scale at which resilience is framed reflects the privileged arena for discussion and action. However, these approaches are not mutually exclusive but complementary, which means, for example, that action at the local level needs to be complemented by a national policy framework (Figueiredo et al., 2018).

Table 2.6.1 **The three main approaches to resilience**

Approach	Sample definition of resilience	Typical scale of analysis	Most commonly adopted concepts
Disaster risk reduction	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. (United Nations, 2017a)	Global and national	Hazard Disaster Disaster risk
Socio-ecological	The amount of change the system can undergo and still retain the same controls on function and structure; the degree to which the system is capable of self-organisation; and the ability to build and increase the capacity for learning and adaptation. (Holling and Walker, 2003)	Cities and communities	Shocks Stresses
Sustainable livelihoods	A capacity that enables households and communities to maintain a minimum threshold condition when exposed to shocks and stresses. (Freudenberg et al., 2014)	Households and communities	Vulnerability

Source: Figueiredo et al. (2018).

Being part of the DiGreen project concerned with the Digital Government for Green Municipalities and Cities, this exploration will focus on resilience at the scale of cities and communities.

2.6.3 Practical Applications

Resilient municipalities can withstand and adapt to challenges such as natural disasters, economic fluctuations, and social changes. Key success factors for resilience include robust governance, diverse economies, inclusive societies, and sustainable environments.

For instance, the OECD highlights the importance of clear leadership, strategic approaches, and transparent government in governance. In terms of the economy, a mix of industries and conditions that foster innovation is crucial. Socially, cities should aim for inclusivity and active community networks. Environmentally, sound ecosystems and infrastructure that meet basic needs are fundamental (OECD, 2024). Specific measures for building resilience can be seen in initiatives like the United Nations' Making Cities Resilient 2030 (MCR2030), which provides a clear roadmap and tools for cities to enhance their resilience. This includes implementing disaster risk reduction, climate

change adaptation plans, and fostering city-to-city learning networks (UN Office for Disaster Risk Reduction, 2021).

Therefore, resilience is relevant to most, if not all, of the public services provided by a community, as well as the very organisation and structure of the community:

On the one hand, the concept of resilience can be applied to the resilience of a particular societal function, such as water supply, health services, electricity supply, traffic flow, or sustainable natural resources. In essence, this is the resilience of the outcomes of policies and public services (Figueiredo et al., 2018).

The second point of intervention for resilience is the structure of the public administration, organisation, or community. In other words, how well can an institution maintain its internal lines of command, information flow, and capacity for action in times of crisis, and how well can communities maintain their cultural identity and social capital in times of rapid and fundamental change (Figueiredo et al., 2018)?

There is considerable overlap between these two alternative aspects of resilience, as maintained structure is often a prerequisite for the uninterrupted production of political outcomes. At the same time, it's important to note that resilience is not an absolute state – e.g., a community is resilient or not – but a gradual process from less to more resilient:

First, resilience can be understood in terms of the ability to respond to sudden shocks like natural catastrophes. In this view, being resilient is fundamentally about managing disasters (Manyena, 2006; Paton & Johnston, 2006). Resilient communities and organisations are those that are capable of coping with a crisis situation and preventing its escalation. Boin and van Eeten (2013) have termed this precursor resilience.

The second meaning of resilience relates to the ability of communities to recover from shocks. Boin and van Eeten refer to this as recovery resilience. In his recent book on social capital and resiliency in disaster response, Aldrich describes resiliency as "a neighbourhood's capacity to weather crises such as disasters and engage in effective and efficient recovery through coordinated efforts and cooperation" (Aldrich, 2012). Wildavsky's notion of resilience as the "capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back" (Wildavsky, 1988) is another example of this way of defining recovery resilience.

A third possible type can be added: adaptive resilience, or the extent to which a society or organisation can learn from past experiences and make changes to increase its chances of surviving future crises. This type of conceptualisation is similar to ecological resilience, popular in social-ecological systems (SES) studies, which sees resilience as "the ability to build and increase the capacity for learning and adaptation" (Berkes et al., 2003). Related ideas are also found in theories of double-loop learning in organisations (Argyris, 1976) and crisis learning (Stern, 1997).

As resilience is a multidimensional phenomenon, local authorities should design and implement urban resilience strategies that integrate economic, social, environmental and institutional dimensions. To monitor progress towards resilience, local authorities

should use indicators that measure resilience along these dimensions (Figueiredo et al., 2018). Guidelines and examples can be found in the OECD report on indicators for resilient cities (Figueiredo et al., 2018).

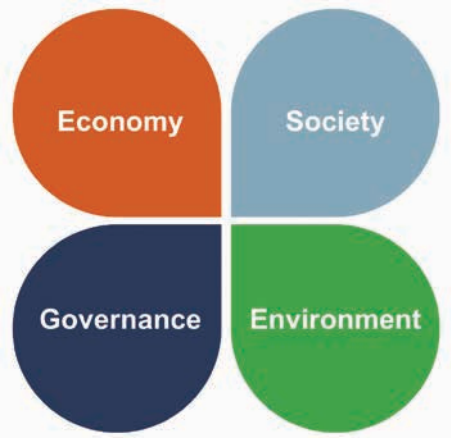

Figure 2.6.1 **Measuring city resilience**
Source: Authors based on OECD (2024).

2.6.4 Summary

When tackling the resilience paradigm, researchers, as well as practitioners, should be aware of a couple of notions and pitfalls. Of particular interest for municipalities and other public administrations are the following:

The first aspect is the necessity of formulating and empirically testing multiple, not single, models for building resilience in government. There is no single way to create a resilient public administration, just as there is no "silver bullet" policy reform that will always produce a legitimate and effective public administration (John, 2011).

On the contrary, the response diversity hypothesis assumes that the only way to strengthen resilience is to increase redundancy and flexibility in the governance system. In doing so, it relies on an essentially monocausal explanation of resilience. However, there is little evidence that increased diversity in public administration creates a more resilient governance system (Comfort, 1994).

Thus, an important part of adopting the concept of resilience for broader use in public administration is to develop and explore competing models of how resilience is created and eroded. For example, Aldrich (2012) shows that resilience can be a zero-sum game between different groups in society, demonstrating that social capital can positively and negatively affect marginalised groups' resilience. Institutional redundancies, polycentric governance, stakeholder involvement, and policy experiments are not the only factors to consider when building resilient public governance systems (Comfort, 1994; Wildavsky, 1988; Landau, 1969).

It also shows how important it can be to explore possible trade-offs between resilience and other dominant values in government. Hood (1991) identified resilience as one of three values that any system of governance can maximise. More importantly, he identified that these three values are potentially in conflict. Hood criticised the NPM policy paradigm for prioritising the effectiveness of public administration over legitimacy and resilience. Likewise, the contemporary resilience paradigm consistently privileges flexibility, robustness, and diversity of public administration over efficacy and legitimacy. However, all organisations must balance flexibility and adaptability with the equally important needs for stability, predictability, and efficiency (March 1991; Wilson, 1989; Wildavsky, 1988; Selznick, 1957).

Most public organizations are charged with dealing with surprises and shocks and providing day-to-day services to a community. Moreover, being organised to be resilient over time creates routines, norms, and path dependency, reducing flexibility (Stark, 2014). Trade-offs between resilience, effectiveness, and legitimacy will always be present in any public administration, and municipalities must manage them carefully.

A third lesson is to move beyond the close association of the resilience paradigm with crisis and disaster management. The sub-disciplines of public administration that focus on the ability of organisations and administrations to cope with unforeseen crises, disasters, and shocks are where the concept of resilience has appeared most often. But the concept has the potential to be used far more broadly, focusing not only on the ability of a community to cope with and recover from extraordinary events but also on how well public organisations can maintain desirable levels of stability within a given policy area despite a variety of different types of disruptions.

One particular aspect is the so-called "slow variables" or "slow-burning emergencies", which involve gradually increasing changes that can undermine the community's resilience to external shocks (LaPorte, 2007).

While the resilience of a public administration system becomes more apparent in the face of dramatic, catastrophic or unforeseen events, the fundamental idea of the adaptability and robustness of public administration in the face of long-term change, such as staff shortages due to the ongoing demographic change, has much more sophisticated implications. Public administrations, particularly municipalities, should work on their capacity to reform themselves and use lessons learned from the past to reverse unsustainable developments.

References

ALDRICH, D. P. (2012). Building Resilience: Social Capital, In *Post-Disaster Recovery*. Chicago : University of Chicago Press.

BOIN, A. et al. (2010). The Rise of Resilience, In COMFORT, L. K. (eds.), *Designing Resilience*. Pittsburgh : Pittsburgh University Press, pp. 1-13.

COMFORT, L. K. (1994). Risk and Resilience: Inter-Organizational Learning Following the Northridge Earthquake of 17 January 1994. In *Journal of Contingencies and Crisis Management,* 2, 3, 157–70. DOI: <https://doi.org/10.1111/j.1468-5973.1994.tb00038.x>.

DUIT, A. (2016). Resilience thinking: Lessons for public administration. In *Public Administration*, 94(2), 364-380. DOI: <https://doi.org/10.1111/padm.12182>.

DUIT, A., GALAZ, V. (2008). Governance and Complexity: Emerging Issues for Governance Theory. In *Governance – An International Journal of Policy and Administration,* 21(3), 311-35. DOI: <https://doi.org/10.1111/j.1468-0491.2008.00402.x>.

European Commission. (2013). *Action Plan for Resilience in Crisis Prone Countries, 2013 – 2020.* SWD (2013) 227 final. Brussels : European Commission.

FIGUEIREDO, L. et al. (2018). *Indicators for resilient cities. OECD Regional Development Working Papers 2018/02.* DOI: <https://dx.doi.org/10.1787/6f1f6065-en>.

FREUDENBERG, N. et al. (2006). The impact of New York City's 1975 fiscal crisis on the tuberculosis, HIV, and homicide syndemic. In *American Journal of Public Health,* 96(3), 424-434, DOI: <http://dx.doi.org/10.2105/AJPH.2005.063511>.

HOLLING, C. S., WALKER, B. (2003). *Resilience Defined, Entry prepared for the Internet Encyclopaedia of Ecological Economics.* Online. [20/06/2024]. Available at: <http://isecoeco.org/pdf/resilience.pdf>.

HOOD, C. (1991). A Public Management for All Seasons? In *Public Administration,* 69(1), 3-19. DOI: <https://doi.org/10.1111/j.1467-9299.1991.tb00779.x>.

JOHN, P. (2011). *Making Policy Work.* Abingdon : Routledge.

LANDAU, M. (1969). Redundancy, Rationality, and the Problem of Duplication and Overlap. In *Public Administration Review*, 29, 4, 346-58. DOI: <https://doi.org/10.2307/973247>.

MAOR, D. et al. (2022). *Raising the resilience of your organization. McKinsey & Company.* Online. [20/06/2024]. Available at: <https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/raising-the-resilience-of-your-organization#/>.

MARCH, J. G. (1991). Exploration and Exploitation in Organizational Learning. In *Organization Science*, 2(1), 71-87.

MITCHELL, A. (2013). *Risk and Resilience – From Good Idea to Good Practice*. Paris : OECD.

OECD (2014). Boosting Resilience through Innovative Risk Governance. Paris : OECD Publishing.

OECD. (2024). *Resilient Cities. How is Resilience measured?* Online. [20/062024]. Available at: <https://www.oecd.org/cfe/regionaldevelopment/resilient-cities.htm>.

SHMUL, Y. et al. (2022). *Building a Mutually Reinforcing System of Organizational and Personal Resilience.* BCG Henderson Institute. Online. [20/06/2024]. Available at: <https://www.bcg.com/publications/2022/building-organizational-personal-resilience-reinforcing-system>.

SELZNICK, P. (1957). *Leadership in Administration: A Sociological Interpretation. Evanston*, IL: Row, Peterson.

STARK, A. (2014). Bureaucratic Values and Resilience: An Exploration of Crisis Management Adaptation. In *Public Administration*, 92, 3, 692-706. DOI: <https://doi.org/10.1111/padm.12085>.

UN Office for Disaster Risk Reduction (2021). Making Cities Resilient 2030 (MCR2030). Online. [20/06/2024]. Available at: https://mcr2030.undrr.org/sites/default/files/2021-<04/MCR2030%20in%20English%20ver.2%20%2820210302%29.pdf>.

United Nations, General Assembly. (2017a). Report of the open-ended intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction, A/71/644, United Nations General Assembly. Online. [20/06/2024]. Available at: <www.un.org/ga/search/view_doc.asp?symbol=A/71/644>.

WILDAVSKY, A. (1988). *Searching for Safety*. Piscataway, NJ : Transaction Publishers.

WILSON, J. Q. (1989). Bureaucracy: *What Government Agencies Do and Why They Do It.* New York : Basic Books.

2.7 Public Integrity as a Complex Communal Level Guide

Author: Ondrej Mital'

2.7.1 General Introduction

Public integrity is becoming an essential aim for governments, local self-government units, and their citizens. The relevancy of high standards of public integrity principles is the logical consequence of their (non)compliance in contemporary democratic and legal states of the 21st century. Public integrity and ethical behaviour are important aspects of good governance (Hoekstra et al., 2023; Fourie and Kimaro, 2020). Put differently, public integrity represents the set of rules, values, and principles that guide individuals and organisations in the cases of different ethical issues and problems.

Two generally accepted approaches can solve ethical issues in public administration. The compliance and integrity approaches can be perceived as hard and soft approaches, as opposite ends of a spectrum. Both approaches need different initiation, planning, implementation, control, and more profound research (Lartney, 2021; Lawton et al., 2013). Ethical issues in public administration were primarily managed by a compliance approach. This approach can be perceived as dominant, mainly at the turn of the century. The compliance approach combines formal laws and regulations that strictly control and punish unethical behaviour. However, the last decade can be characterised by a shift to integrity-based ethics. By contrast, the integrity approach aims to create a sustainable ethical environment based on a high internal level of self-control supported by ethical training, education, and ethical values that go beyond compliance with laws, especially in ethical issues not defined by existing laws.

Experts from various scientific disciplines have different interpretations of the concept of public integrity, while the most common aspect is its fight against corrupt behaviour and increasing public trust (Kirby, 2021; Herasymiuk, 2020). OECD defines public integrity as the consistent alignment and adherence to shared ethical values, principles, and norms for upholding and prioritising the public interest over private interests in the public sector (OECD, 2017). At the same time, the OECD realises a wide range of activities focused on awareness building on public integrity or analysing public integrity strategies in member states. A universal public integrity framework applicable across the member states was published in 2017 (Figure 2.7.1).

Figure 2.7.1 **Public integrity framework**
Source: Authors based on OECD (2017).

OECD's public integrity framework describes aspects of public integrity and offers very clear recommendations for activities and processes of practitioners at all levels of governance.

2.7.2 Relevance for Municipalities

Municipalities and cities, represented by the official and elected representatives, professionals working in the municipality's administration offices, and overall employees of organisations established by the municipalities and cities, should reflect aspects of the public integrity framework in executing their competencies. An integrity-based approach to the management of public institutions combines two key dimensions: individual and organisational.

Integrity-based ethical management and ethical culture are essential for organisational integrity, leading to higher acceptance among the public (Dahl Rendtorff, 2024). The organisational level of public integrity can be seen as a precondition for the ethical behaviour of individuals at the city´s office. However, the organisational level of public integrity in municipalities and cities cannot exist without accepting high standards of integrity across society.

Individual level of public integrity must relate to values, such as ethical conduct, honesty, honour, discipline, reporting misconduct, and discretion (Rothstein, Sorak, 2017). The conduct of individuals led by integrity principles is a behaviour that is considered morally correct by a significant majority of people (Heywood, Rose, 2013).

The higher level of public trust in individuals representing local authorities, affected by individual behaviour encouraged by the principles of integrity, naturally leads to an increased trust in local authorities. The effective system of public integrity can be a positive factor leading to a higher level of trust or an increased tendency to trust local authorities. The impact of the integrity-based approach affects trust tendencies both during regular conditions and in different crisis scenarios.

The public integrity approach at the communal level represents a basic factor that helps to achieve a public administration with public interests and citizens' needs at its forefront. Public integrity can also be seen as a tool that prevents violations of legal responsibilities and minimises risks threatening the functionality of local government units (Dargay, 2019).

2.7.3 Practical Applications

Public integrity at the communal level can be perceived as a complex guide that leads individuals and cities in ethically complicated situations rather than abstract standards for behaviour and decision-making. The integrity-based approach uses internal control mechanisms to stimulate behaviour, such as training, education, ethical culture, and communication.

Municipalities and cities have a wide range of integrity-based approach tools to choose from. Creating specialised ethical instances of organisational structure is an effective way to manage ethical aspects in municipalities and cities, such as ethical managers, representatives, boards, and commissions. The main role of these entities is to implement a public integrity framework at the communal level. Education and training are usually considered essential parts of an integrity-based approach to ethical management. Education is mainly perceived as a long-term process of acquiring knowledge and organisational context. On the contrary, training represents a short and intensive event or process focusing on obtaining the specialised skills required to solve ethical dilemmas. Consultations and good practice examples focus on guiding individuals in different types of ethical dilemmas. Ethical climate and communication utilise the positive impacts of an integrity-based approach at the communal level. The integrity-based approach is effective mainly thanks to face-to-face communication and interaction. However, the digitalisation of processes in municipalities and cities also affects the implementation of integrity-based approach tools (Figure 2.7.2).

Digitalisation offers new opportunities for ethical managers, ethical representatives, ethical boards, and ethical commissions in the implementation of public integrity principles. Digital technologies improve transparency and openness of the whole ethical management in many ways, mainly through the accessibility of sources, case studies, and good practice examples. Smart applications open new dimensions in identifying and reporting unethical behaviour. Despite the benefits, the digital aspect of

Figure 2.7.2 **Digitalisation of integrity-based approach tools**
Source: Authors.

the integrity-based approach should still be considered complementary to face-to-face forms of interaction and communication.

The main benefit of the integrity-based approach is that it leads to positive spill-over effects. Cities' systematic effort to improve the implementation of integrity principles has the potential to improve other dimensions of good governance. Higher standards of public integrity cannot be perceived as the primary goal because public integrity helps cities create a solid ground for long-term effects in various areas of communal life, resulting in a higher quality of life and satisfied citizens.

2.7.4 Summary

The effective public integrity framework at the local level tends to reduce the social deformities of contemporary democracies. Integrity-based management is still an evolving approach that helps public institutions fight against corruption and other types of negative behaviour at all levels of governance.

References

DAHL RENDTORFF, J. (2024). Organisational integrity, citizenship, and legitimacy. In KAPTEIN, M (eds.) *Research Handbook on Organisational Integrity*, 497-510. Northampton : Edward Elgar Publishing. DOI: <https://doi.org/10.4337/9781803927930.00039>.

DARGAY, E. (2019). The Implementation and Experience of Integrity Management in Public Administration. In *Academic and Applied Research in Military and Public Management Science* 18(2), 17-29. DOI: <https://doi.org/10.32565/aarms.2019.2.2>.

FOURIE, D., KIMARO, J. (2020). The Interrelationship between Ethics and Integrity in Public Administration. In *Administratio Publica* 28(2), 76-93.

HERASYMIUK, K. et al. (2020). Principles of Integrity and Good Governance in Public Administration. In *International Journal of Management*, 11 (4), 545-555.

HEYWOOD, P., ROSE, J. (2013). Political science approaches to integrity and corruption. In *Human Affairs*, vol. 23, n. 2, pp. 148-159. DOI: <https://doi.org/10.2478/s13374-013-0116-6>.

HOEKSTRA, A. et al. (2023). Content and Design of Integrity Systems: Evaluating Integrity Systems in Local Government. In *Public Integrity* 25(2), 137-149. DOI: <https://doi.org/10.1080/10999922.2021.2014204>.

KIRBY, N. (2021). An 'institution-first' conception of public integrity. In *British Journal of Political Science*, 51(4), 1620-1635. DOI: <https://doi.org/10.1017/S000712342000006X>.

LARTNEY, F. M. (2021). Integrity-based and Compliance-based Ethics Programs: A Critical Analysis of Key Differences. In *International Journal of Economics, Business and Management Research,* 5(5), 43-53.

LAWTON, A. et al. (2013). Ethics and Management in the Public Sector. Abingdon : Routledge.

OECD, 2017. OECD Recommendation of the Council on Public Integrity: Public Integrity. Online. [20/6/2024]. Available at: <https://www.oecd.org/gov/ethics/OECD-Recommendation-Public-Integrity.pdf>.

ROTHSTEIN, B., SORAK, N. (2017). Ethical codes for the public administration. In *QoG Working Paper Series* 12, 1-53.

2.8 Effective Municipal Communication with the Stakeholders

Authors: Alina Cerasela Avram and George Cornel Dumitrescu

2.8.1 General Introduction

To understand communication with the stakeholders, the two concepts should be explained in detail. Cobley (2008) underlines that "The Latin root of "communication" – communicare – means "to share" or "to be in relation with." Through Indo-European etymological roots, it further relates to the words "common," "commune," and "community," suggesting an act of "bringing together".

According to the German Association for Project Management, (GPM) "Stakeholders are people or groups of people who are involved in the project, are interested in project performance, or are constrained by it (DIN 69905). Examples of stakeholders are clients, contractors, project managers, project team members, company employees, users of project results, residents, environmental associations, press, municipal authorities and banks". Stakeholders could also be customers, suppliers, investors, community members, government agers, government agencies, non-governmental organisations (NGOs), and the media (Pannenbäcker et al., 2003).

From the municipality's standpoint, communication with stakeholders means achieving consensus among all involved parties, per the definition above, so that the municipality's projects are successfully finalised. Price & Cybulski (2004) argue that achieving consensus implies communication, negotiation, conflict management, bilateral understanding, power dynamics, knowledge exchange, trust, corporate culture, collaboration, cooperation, and compromise. Therefore, consensus is based on open, controlled, and effective communication.

Communication with stakeholders refers to exchanging information and engaging with individuals or groups interested in or affected by a particular project, policy, or decision.

Scholars and experts have different views on what communication with stakeholders is and what its aim is. Thus, Koschmann & Kopczynski (2017) emphasise that stakeholder communication refers to any form of interaction or exchange of information between an organisation and individuals, groups, other organisations, or broader constituencies with an interest or stake in the matter. Any communication scenario can be considered stakeholder communication because the parties involved have some vested interest in the matter that prompted the interaction.

Besides being effective, as Price & Cybulski (2004) mentioned, the experts from the Project Management Institute (PMI, 2021) emphasise that communication with the stakeholders should be efficient. They argue that effective and efficient communication and engagement implies determining how, when, how often, and under what

circumstances stakeholders want to be engaged. They also state that communication is an essential aspect of engagement. Still, engagement goes deeper to include understanding others' ideas, assimilation of other perspectives, and collective shaping of a shared solution. Engagement involves building and maintaining strong relationships through frequent, two-way communication. It promotes collaboration through interactive meetings, face-to-face conversations, informal dialogue, and knowledge-sharing activities (PMI, 2021).

Bourne (2016) argues that effective communication and stakeholder engagement are not mechanical processes such as developing lists, gathering information, and sharing project data. Projects are made possible by people for the benefit of other people. Therefore, effective relationships built and maintained through communication are essential for project success. Bourne insists on communication competence. For municipalities, that means recognising that a project team must develop and implement communication strategies based on understanding the unique characteristics of their stakeholders. Planning to factor these differences into directed or targeted messages is important in engaging stakeholders more effectively. This targeted communication with stakeholders includes sharing information, using it in decision-making, building relationships, listening to their feedback, resolving conflicts constructively, and providing feedback mechanisms.

Therefore, communication is the basis for understanding the stakeholders' needs, expectations, and concerns. Understanding them is important for developing strategies and providing solutions to address these issues. The result is a better relationship between the representatives of municipalities and the stakeholders.

2.8.2 Relevance for Municipalities

During the projects municipalities develop, communication with stakeholders is the key to finalising them as planned. Several researchers wrote on the importance of communicating with stakeholders. According to Butt et al. (2016), ineffective communication creates confusion that leads to additional problems. In a large project, efficient communication improved the change management process and encouraged a culture of innovation. Leadership changes impact communication and stakeholder engagement during the change management process.

Scholes & Clutterbuck (1998) argue that companies should treat their stakeholders as separate and unrelated since their interests might differ. They suggest that projects should apply methods and systems to help prioritise the relationship with the stakeholders, work more closely with them, communicate clearly and consistently, and foster connections.

Communicating with the stakeholders can help the decision-making process by considering their opinions on different aspects of the ongoing projects. A decision made considering stakeholders' insights can be easily implemented and accepted.

Good communication with stakeholders has other advantages for municipalities. Keeping communication channels open can facilitate conflict-free cooperation by aligning stakeholders with project or policy objectives, thus increasing the likelihood of successful implementation. If conflicts still emerge, the municipalities can sort them out with the stakeholders. Unterhitzenberger et al. (2021) argue that "a challenging situation involving stakeholders can threaten the successful achievement of the outcomes. Hence, project managers are not only interested in how they can best deal with it, but due to their accountability, they feel a sense of responsibility to put measures in place for the project to cope with this challenging situation as well". A communication strategy in place could help resolve this challenge.

A good track record of communication with stakeholders helps maintain a good reputation for the public administration, thus increasing its public image.

In municipalities, communication with stakeholders is sometimes compulsory when it involves citizens or communities, and organisations are legally required to address all possible concerns. This can reduce stakeholders' resistance and ensure support for new initiatives, especially during times of change.

A good example is the Romanian Rosia Montana project, considered one of the most controversial projects related to gold exploitation worldwide. A public consultation was required since its implementation raised deep concerns regarding the environmental impact and damaging cultural heritage by Romanian and EU law.

2.8.3 Practical Applications

Communication among people, public or private organisations, has always been the basis for progress. Over time, how we communicate has changed, but people's psychology remains the same. Regardless of the communication tools available, the stakeholders must be informed to help achieve the project's goals or at least not hamper them.

Technological change has improved how people communicate and track their interactions and information exchanged. Municipalities have also adopted this change. Using digital tools (email, newsletters, social media, and virtual meeting platforms) for communication became the norm within the public administration. This use is expected to increase, allowing larger audiences and real-time engagement and involvement of stakeholders in the projects' information environment.

According to Statista (2024a), the number of e-mail users will increase by 5.6% from 2024 to 2026, from 4.371 to 4.730 million (Figure 2.8.1).

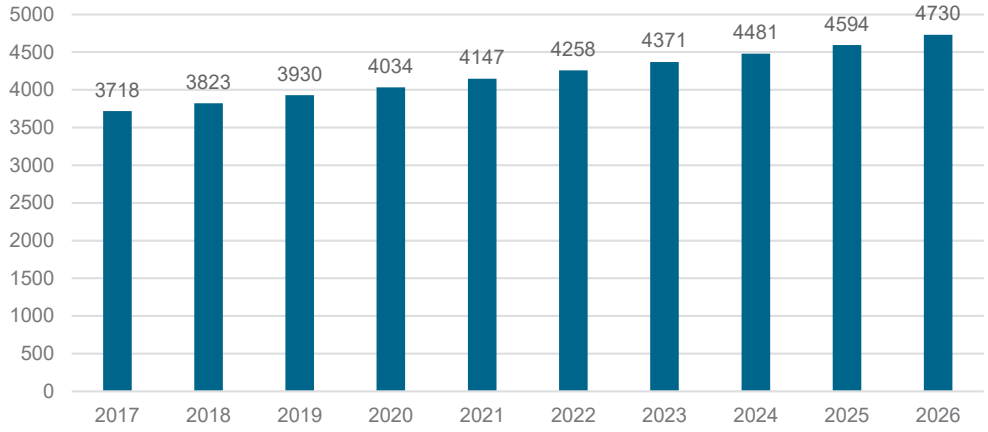

Figure 2.8.1 **Number of e-mail users worldwide from 2017 to 2026 (in millions)**

Source: Statista, (2024a).

In 2022, the value of the global video conferencing market reached 10.6 billion U.S. dollars (Figure 2.8.2). By 2027, it is forecast to increase to 19.1 billion U.S. dollars (Statista, 2024b).

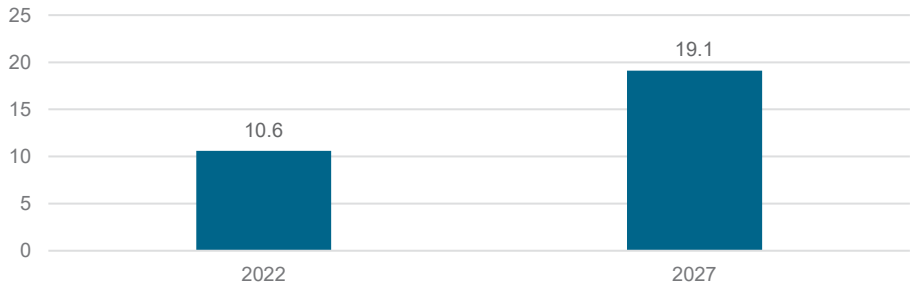

Figure 2.8.2 **Video conferencing market value worldwide in 2022 and 2027 (in billion U.S. dollars)**

Source: Statista, (2024b).

Other prospects (Statista, 2024c) underline that in 2025, the number of mobile phone messaging app users worldwide will reach 3.51 billion, an increase of 3% in just one year (Figure 2.8.3).

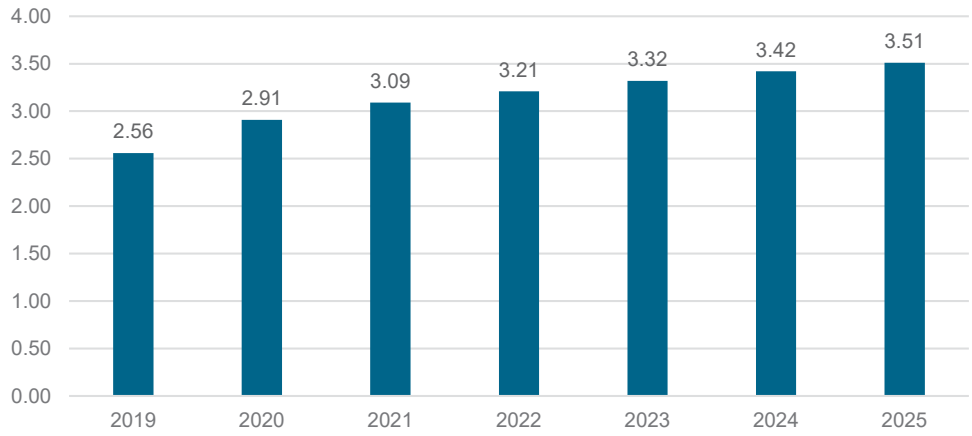

Figure 2.8.3 **Number of mobile phone messaging app users worldwide from 2019 to 2025 (in billions)**

Source: Statista, (2024c).

Since the conditions for real-time communication are already met technologically, the stakeholders expect to be kept informed about the challenges, setbacks, and progress. Therefore, organisations will have to have the infrastructure to communicate with stakeholders via smart devices that allow such interactions and acquire services that make communication easier and more inclusive (advanced computers, cloud access, software and applications, subscriptions to Zoom and similar platforms, incorporate virtual reality and augmented reality in their interactions with the stakeholders, apply to online forums, surveys, and virtual town halls among others). Using these technologies according to the stakeholder preference and making them available at the organisational level would be a plus.

Private companies are more advanced in using alternative methods to engage with their stakeholders and followers through interactive platforms. These platforms require companies to adapt their operational processes and resources (dynamic capabilities) to meet their stakeholders' evolving demands and needs. The so-called Internet of Things (using social media, 3D virtual reality, and artificial intelligence) has made it possible for any device to become a 'smart' device that can communicate, store and interact with other devices, enabling companies to build strong partnerships (Loureiro, 2021).

According to Statista (2024d), the artificial intelligence market exceeded 184 billion U.S. dollars in 2024, with an increment of nearly 50 billion from 2023. Such substantial growth is expected to continue, with the market exceeding 826 billion U.S. dollars in 2030 (Figure 2.8.4).

Using AI to interact with stakeholders presents several advantages for municipalities, such as getting real-time, around-the-clock support via AI chatbots, managing concerns through sentiment analysis and predictive analytics, and providing tailored messages, to mention just a few.

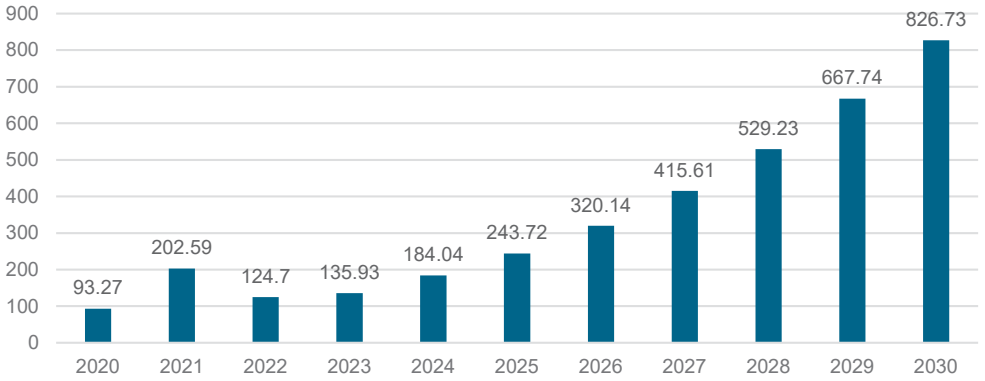

Figure 2.8.4 **Artificial intelligence (AI) market size worldwide from 2020 to 2030 (in billion U.S. dollars)**

Source: Statista, (2024d).

Artificial intelligence improves communication with all stakeholders at the municipal level of governance and acts as a cognitive and social agent. Among its essential functions is that it helps organise content, interact with the stakeholders, fact-check, generate automatic summaries and map concepts. These potentials can help streamline the communication processes so that each interaction is more effective and time-efficient (Escoubès et al., 2017).

Using data analytics will improve communication with stakeholders, develop new ways to involve and engage different groups and determine how to get the best result from interacting with them. Using data analytics will improve communication with stakeholders, develop new ways to involve and engage different groups and determine how to get the best result from interacting with them. Data analytics is important for integrating municipalities' databases and making them interoperable, enabling an informed decision-making process that benefits the relationship with the stakeholders (Cruz et al., 2020). Classical ways of communication (print, face-to-face meetings, phone calls) will still be used, but to a lesser degree, for older citizens who need to become more familiar with the new technologies.

Communication should consider cultural and linguistic differences and sensitivities in a globalised world. Nowadays, rapid developments imply a higher ability of organisations to adapt and react to various crises quickly. In this situation, communication strategies and previously designed plans should be considered so that when a crisis emerges, people involved know whom to contact and which action to take. Since most communication will be via smart devices and technologies, this environment is expected to be increasingly regulated. Being informed about legislative changes would provide users with flexibility. Ethical considerations in data usage and communication are also critical.

A good example of good communication with stakeholders is the Smart City project started by the municipality of Cluj Napoca (Romania) in 2018. The project aimed to

improve urban life through technology. Engaging stakeholders was a priority, and public consultations and town hall meetings were conducted so that all citizens could hear their ideas and opinions about the project. To ensure good communication, involve a wide range of people and keep everyone updated, the municipality communicates through its official website, social media, and local media outlets.

The relationship with local businesses and universities involved regular meetings and workshops to align goals and offer expertise. The project activities were conducted transparently, and there was a steady stream of progress updates during its implementation. City officials regularly communicated to the media about the project's progress. An online platform allowed residents to report problems and suggest enhancements, thus fully engaging with the community (ClujBusiness, 2024; Stardust project, 2023; The Mayor.EU, 2023; Smart Cities Council, 2018).

Modern communication tools involving the use of IOT and AI have several limitations. Since the electronic environment might have safety and security issues, all these devices, platforms, cloud solutions, etc., must be able to protect stakeholder data and comply with regulations such as the General Data Protection Regulation. The value of the global cyber security market stood at almost 222 billion dollars in 2022. The forecast for 2030 indicates the market will exceed 657 billion dollars (Statista, 2024e). These changes require modern solutions also. The platform maintenance and the need for an IT department are now mandatory for big companies and public bodies.

The development of modern communication tools has also determined important changes in citizens' behaviour. Considering that people have ceased to be passive recipients of information, involving stakeholders via interactive communication in discussions on multiple aspects of projects conducted by municipalities will be a plus.

To ensure a good project implementation and an appropriate dissemination of the results, the municipalities should consider other topics, such as environmental awareness and social benefits, that can sensitise and make them more cooperative in achieving project goals.

Another important aspect is to avoid being silent. Stakeholders expect to be constantly informed and receive the message adapted to their level of knowledge. In this context, misleading information should not be an option when communicating with stakeholders. Transparency and accuracy of information conveyed help build durable relationships with the project environment, including the stakeholders.

2.8.4 Summary

Communication with stakeholders allows municipalities and cities to implement their projects efficiently by involving the interested parties and collecting feedback from each beneficiary type. Stakeholders such as citizens, businesses, NGOs, government agencies, and mass media have diversified interests and priorities; addressing them helps achieve project goals. The example of the Smart City project in Cluj Napoca,

which used public consultations and provided regular updates on the progress recorded, showed that efficient communication allows for better decision-making, project acceptance, and further successful implementation.

Digital tools increase real-time interactivity and inclusivity and show a high rate of adoption by the population. However, traditional interactions are still used mainly by people who need to be more literate in modern communication technologies. When the priority is effective stakeholder communication, municipalities can enhance the project outcomes and eventually build closer relations with the communities.

IoT, AI, and data analytics personalise and optimise communication and bring novelty to the users periodically. In the context of rapid transformation, robust ethical guidelines should ensure that empathy and transparency are not lost in communication and the data is protected.

Strong cybersecurity must be implemented to safeguard stakeholders' information and bring stakeholders into compliance with regulations.

Each municipality should know that various cultural perspectives and sensitive communication can help mitigate conflicts and foster cooperation, which is necessary for project success and sustainable development.

References

BOURNE, L. (2016). Targeted communication: the key to effective stakeholder engagement. Procedia-Social and Behavioral Sciences, 226(14 July 2016), 431-438. DOI: <https://doi.org/10.1016/j.sbspro.2016.06.208>.

BUTT, A. et al. (2016). Project change stakeholder communication. In *International Journal of Project Management*, 34(8), 1579-1595. DOI: <https://doi.org/10.1016/j.ijproman.2016.08.010>.

ClujBusiness. (2024). Cluj-Napoca: Fostering Creativity & Innovation for a Smart City. Online. [20/06/2024]. Available at: <https://clujbusiness.ro>.

COBLEY, P. (2008). Communication: Definitions and concepts. In DONSBACH, W. et al. (eds.) *The International Encyclopedia of communication.* DOI: <https://doi.org/10.1002/9781405186407.wbiecc071>.

CRUZ, M. et al. (2020). Interoperabilidade e Integração de Sistemas e Dados para Apoio à Tomada de Decisão pela Gestão da Prefeitura de Volta Redonda-RJ: Perspectivas e Desafios. In:*Anais do VIII Workshop de Computação Aplicada em Governo Eletrônico*, pp. 148-155. Porto Alegre : Sociedade Brasileira de Computação. DOI: <https://doi.org/10.5753/wcge.2020.11266>.

ESCOUBÈS, F. et al. (2017). The Role of (augmented) Collective Intelligence for Municipal Governance. Interview of Frank Escoubes by Nicolas Miailhe & Arohi Jain. In KOSCHMANN, M. A., & KOPCZYNSKI, J. (eds.). *Stakeholder communication. The international encyclopedia of organizational communication,* 1-13. New Jersey : John Wiley & Sons. DOI: <https://doi.org/10.1002/9781118955567.wbieoc193>.

LOUREIRO, S. M. C. (2021). Creative Communications and Interactions among Stakeholders. In *Journal of Creative Communications*, 16(3), 231-232. DOI: <https://doi.org/10.1177/09732586211020204>.

PANNENBÄCKER et al. (2003). *Project Management – English (GPM).* German Association for Project Management (GPM).

PMI. (2021). *A Guide to the Project Management Body of Knowledge (PMBOK Guide).* Seventh Edition and The Standard for Project Management. Project Management Institute, Inc. ISBN 978-1-62825-664-2.

PRICE, J., CYBULSKI, J. L. (2004). *Influence of stakeholder communication on consensus making in requirements negotiation*. Proceedings of AWRE, Adelaide, Australia.

SCHOLES, E., CLUTTERBUCK, D. (1998). Communication with stakeholders: An integrated approach. In *Long range planning*, 31(2), 227-238. DOI: <https://doi.org/10.1016/S0024-6301(98)00007-7>.

Smart Cities Council. (2018). Cluj-Napoca: the "Silicon Valley" of Eastern Europe. Online. [20/06/2024]. Available at: <https://www.smartcitiescouncil.com/article/cluj-napoca-silicon-valley-eastern-europe>.

Stardust Project. (2023). Cluj-Napoca recognised by the European Commission for its climate-neutral efforts. Online. [20/06/2024]. Available at: <https://stardustproject.eu>.

Statista. (2024a). Number of e-mail users worldwide from 2017 to 2026 (in millions). Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/255080/number-of-e-mail-users-worldwide/>.

Statista. (2024b). Video conferencing market value worldwide in 2022 and 2027. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/1293045/video-conferencing-market-value-worldwide/>.

Statista. (2024bc). Number of mobile phone messaging app users worldwide from 2019 to 2025 (in billions). Online. [20/06/2024]. Available at: <https://internal.statista.com/statistics/483255/number-of-mobile-messaging-users-worldwide/>.

Statista. (2024d). AI market size worldwide from 2020-2030 (in billion U.S. dollars). Online. [20/06/2024]. Available at: <https://www.statista.com/forecasts/1474143/global-ai-market-size>.

Statista. (2024e). Size of cyber security market worldwide from 2021 to 2030. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/1256346/worldwide-cyber-security-market-revenues/>.

TheMayor.EU. (2023). Cluj-Napoca is Creating a City of "Smart Citizens." Online. [20/06/2024]. Available at: <https://www.themayor.eu/en/a/view/cluj-napoca-is-creating-a-city-of-smart-citizens-1184>.

UNTERHITZENBERGER, C. et al. (2021). The stakeholder challenge: dealing with challenging situations involving stakeholders. In *Production Planning & Control,* 32(11), 926-941. DOI: <https://doi.org/10.1080/09537287.2020.1776907>.

ZHOU, Z. M. (2013). The role of the integrated management of spatial data in urban management. Applied Mechanics and Materials, 241, 3063-3066. DOI: <https://doi.org/10.4028/www.scientific.net/AMM.241-244.3063>.

3 Digitalisation at the Communal Level

3.1 Open Data for Local Governments

Author: Silvia Ručinská

3.1.1 General Introduction

Governments historically collected a wide range of essential and non-essential data at all levels of governance. Data are constructed to understand something or make decisions (Olson, 2021). Data refers to basic facts about some specific phenomenon and are often processed as a record in a database (Wolski, Gomolińska, 2020). In this regard, data is necessary for public institutions to make informed administrative and policy decisions.

The digital transition has transformed collecting, storing, processing, backing up, and sharing data. The amount of data necessary for functioning and decision-making is rising exponentially, and the sophisticated use of digital solutions can be perceived as a necessary step for public institutions to strengthen democratic governance.

Open data can be accessed, used, and shared by governments, businesses, and individuals, mainly to create additional social, economic, or environmental benefits (European Union, 2024). It enables governments, citizens, civil society, and the private sector to make better-informed decisions and develop new insights and innovative ideas, mainly thanks to timely and effective access to data (International Open Data Charter, 2015). Open data represents an important improvement in informational flows between public institutions and stakeholders.

3.1.2 Importance and Benefits

Open data are very closely connected to open government. The Open Government Partnership represents the importance of this trend. The initiative Open Government Partnership combines the ambition of governments and civil society to promote transparent, participatory, inclusive, and accountable governance (Open Government Partnership, 2024). The initiative includes 75 countries and more than 100 municipalities and cities. Open Government Partnership represents the general concept based on universal recommendations and sharing good practice examples. However, municipalities and cities have developed their approaches to open data, which aim to utilise the benefits of open data at the communal level.

Open data are usually created to improve transparency by focusing on partial factors like participation, trust, user interface, user experience, and data quality (Matheus & Janssen, 2020). The benefits of open data are more complex than just improving transparency. Open data transforms the role of citizens from passive informed service recipients to active co-producers of public services and users of open data, which fosters networked collaborative governance (Moon, 2020). Municipalities and cities create

open data ecosystems to develop and maintain sustainable, citizen-centred, and socially resilient local communities (Lnenicka et al., 2022). Open data, among other important factors, helps municipalities and cities achieve sustainable development of the local environment (Neves et al., 2020). The implementation of open data offers municipalities and cities several positive impacts on the local community (Figure 3.1.1).

Figure 3.1.1 **Open data benefits**
Source: European Union (2024).

Implementing open data also positively impacts the principles of good governance. The benefits of open data can be seen across public, private, and non-governmental sectors of society.

3.1.3 Practical Applications

Open data presents a qualitative level of traditional processes that strengthen the resilience of local communities, such as quality of public services, transparency, participation, and accountability. Municipalities and cities expand spheres of life that are covered by open data, which is available to everyone.

Once data is constructed, different stakeholders use it for specific purposes and actions (Currie, 2020). Municipalities and cities share open data with the public through open data portals, which are becoming increasingly common and serving as the primary interaction point between data providers and users (Nikiforova & McBride, 2021). Open data portals offer different types of open data (Figure 3.1.2).

Open data published at open data portals is usually categorised mainly to better guide local community members. Open data are published as datasets that can be reused for different purposes.

Figure 3.1.2 **Spheres of social life covered by open data**
Source: Authors.

3.1.4 Limitations and Challenges

Open data brings many benefits, but it can be perceived as a big challenge for municipalities and cities. The complexity of open data is underlined by the open data intermediaries instrumental in the supply and use of open data (Shaharudin et al., 2023). Open data intermediaries include mainly organisations' technical and social capital and the cultural setting of organisational policies and processes.

Local governments should implement strategies to monitor who uses data and for what purposes and foster coordinated initiatives for better digital equity and inclusion (Wilson & Cong, 2021). Open data is still a rapidly developing issue. Adopted solutions by municipalities and cities offer many good practice examples, but open data is not implemented as a common solution.

Municipalities and cities should implement open data carefully because even the best idea may have bad execution. Municipalities and cities should avoid the creation of open data portals that offer traditional forms of data, such as PDF files or scanned pictures of documents. Open data and open data portals should support the reuse of data, mainly based on machine processing and using universally accepted data formats. If not, municipalities and cities publish data just to publish it. Open data's main purpose is to implement solutions that go beyond the legal requirements for making documents public.

References

CURRIE, M. (2020). Data as performance – Showcasing cities through open data maps. In *Big Data & Society.* 7(1), 1-14. DOI: <https://doi.org/10.1177/2053951720907953>.

European Union. (2024). What is open data? Online. [20/06/2024]. Available at: <https://data.europa.eu/elearning/en/module1/#/id/co-01>.

International Open Data Charter. (2015). Online. [20/06/2024]. Available at: <https://opendatacharter.org/wp-content/uploads/2023/12/opendatacharter-charter_F.pdf>.

LNENICKA, M. et al. (2022). Transparency of open data ecosystems in smart cities: Definition and assessment of the maturity of transparency in 22 smart cities. In *Sustainable Cities and Society,* 82 (7), 103906. DOI: <https://doi.org/10.1016/j.scs.2022.103906>.

MATHEUS, R., JANSSEN, M. (2020). A Systematic Literature Study to Unravel Transparency Enabled by Open Government Data: The Window Theory. In *Public Performance & Management Review*, 43(3), 503-534. DOI: <https://doi.org/10.1080/15309576.2019.1691025>.

MOON, J. M. (2020). Shifting from Old Open Government to New Open Government: Four Critical Dimensions and Case Illustrations. In *Public Performance & Management Review,* 43(3), 535-559. DOI: <https://doi.org/10.1080/15309576.2019.1691024>.

NEVES, F. T. et al. (2020). The impacts of open data initiatives on smart cities: A framework for evaluation and monitoring. In *Cities,* 106 (11), 102860. DOI: <https://doi.org/10.1016/j.cities.2020.102860>.

NIKIFOROVA, A., MCBRIDE, K. (2021). Open government data portal usability: A user-centred usability analysis of 41 open government data portals. In *Telematics and Informatics*, 58(3), 101539. DOI: <https://doi.org/10.1016/j.tele.2020.101539>.

OLSON, K. (2021). What Are Data? Qualitative health research, 31(9), 1567-1569. DOI: <https://doi.org/10.1177/10497323211015960>.

Open Government Partnership. (2024). About Open Government Partnership. [20/03/2024]. Available at: <https://www.opengovpartnership.org/about/>.

SHAHARUDIN, A. et al. (2023). Towards a Common Definition of Open Data Intermediaries. Digital Government: Research and Practice, 4(2), 1-21. DOI: <https://doi.org/10.1145/3585537>.

WILSON, B., CONG, C. (2021). Beyond the supply side: Use and impact of municipal open data in the U.S. In *Telematics and Informatics*, 58(3), 101526. DOI: <https://doi.org/10.1016/j.tele.2020.101526>.

WOLSKI, M., GOMOLIŃSKA, A. (2020). Data meaning and knowledge discovery: Semantical aspects of information systems. In *International Journal of Approximate Reasoning*, 119(4), 40-57. DOI: <https://doi.org/10.1016/j.ijar.2020.01.002>.

3.2 Building Smart Cities: The Role of IoT in Urban Development

Author: Peter Decarli

3.2.1 General Introduction

Internet of Things (IoT) is a future communication paradigm where everyday objects will be equipped with microchips, digital communication transceivers, and appropriate protocol stacks that enable them to not only communicate with the users, but among themselves as well. This communication is facilitated through the internet and will shape its future as well (Atzori et al., 2010).

The IoT concept, therefore, aims to make the Internet even more commonplace and ever-present. Furthermore, by enabling easy access and interaction with a wide range of devices, such as household appliances, surveillance devices, sensors of all kinds, cars and other vehicles, etc., the IoT will foster the development of a range of applications that use the potentially vast amount and variety of data. In turn, this will lead to new services offered by both the private and the public sector (Zanella et al., 2014).

Indeed, the IoT paradigm has applications in many different domains. Beginning with home and industrial automation to the public domain, such as smart grids and intelligent energy and traffic management, health care and elderly assistance (Bellavista et al., 2013).

The application of the IoT paradigm in the public domain, especially in an urban context, is particularly interesting to the DiGreen project. This is a response to the push for digitalisation in public administration and where IoT intersects with and forms the basis for the so-called Smart City concept (Schaffers et al., 2011). While widely used, the Smart City concept still lacks a universally accepted definition. However, the general goal of making better use of public resources and improving the quality of services provided to citizens while reducing the operating costs of public administrations is widely accepted (Zanella et al., 2014).

Urban IoT sets out to achieve this goal by deploying a communications infrastructure that provides uniform, simple and economical access to various public services, thus unlocking potential synergies and increasing transparency for citizens (Zanella et al., 2014). Partnerships with startups can significantly accelerate the implementation of urban IoT by infusing innovative solutions and agility into the process. Startups often bring cutting-edge technologies and fresh perspectives that can address specific urban challenges. These partnerships can also foster an environment of co-creation, where startups work closely with city planners and citizens to tailor IoT solutions that meet the unique needs of each urban area. Moreover, startups can play a crucial role in bridging knowledge gaps and offering training programs to educate government employees and other stakeholders about the potential of IoT to transform city services. By leveraging

the dynamism and innovative spirit of startups, cities can implement IoT solutions that are both technologically advanced and economically viable and scalable, ensuring a sustainable urban future.

3.2.2 Importance and Benefits

Urban IoT can bring several benefits in the management and optimisation of traditional public services. Examples include individual and public transportation, parking management, public lighting and surveillance, maintenance of public spaces, preservation of cultural heritage, waste collection, public health care and education (Zanella et al., 2014).

Figure 3.2.1 **Internet of Things for the smart cities**
Source: Abid et al. (2017).

In addition, the data collected by urban IoT can also be used to increase transparency and promote the actions of local government towards citizens, increase people's awareness of the state of their city, stimulate active citizen participation in the management of public administration, and also inspire the creation of new services based on those provided by the IoT (Cuff et al., 2008).

This makes the urban IoT concept particularly attractive to local and regional governments. These governments can become early adopters of such technologies and, in turn, be recognized by the DiGreen project as good practice examples.

3.2.3 Practical Applications

IoT technologies allow for a wide range of use cases. Some good practice examples include:

- Amsterdam (Netherlands) uses IoT to promote sustainability via a smart lighting system that uses sensors to adjust lighting levels based on occupancy, saving energy and reducing light pollution. Additionally, a smart parking system detects available parking spots and directs drivers to them, reducing traffic congestion and emissions.
- Turin (Italy) has developed a storytelling application called City Teller that uses crowdsourced literature and technology to help tourists learn about the city, supporting its mobility and sustainability goals.
- Barcelona (Spain) has been using IoT technology to improve waste management and irrigation. Sensors in waste bins detect when they are full and need to be emptied, and a smart irrigation system uses sensors to monitor soil moisture levels and adjust watering schedules accordingly.

This section gives an overview of possible services that could be realised through an urban IoT paradigm. It is important to note that IoT has significantly different applications and challenges in urban and rural settings. In big cities, IoT is often integrated into the fabric of smart city initiatives, focusing on enhancing efficiency in transportation, energy management, and infrastructure maintenance. These densely populated areas benefit from high connectivity and close-range solutions that cater to the structural characteristics of the urban environment. Conversely, rural areas, with their unique challenges, such as limited infrastructure and access to technology, require IoT solutions that provide ample area coverage and address issues of dispersion and deficiency. Despite these differences, both environments aim to leverage IoT to improve the quality of life for their inhabitants. For instance, smart villages, akin to smart cities, utilise IoT to manage natural resources and energy, albeit with a context-based approach that reflects the rural setting. The adoption of IoT in rural areas is still emerging, but it holds the potential to transform these communities by offering innovative solutions to long-standing issues.

While the approach and implementation must be tailored to the specific needs of the urban or rural landscapes, IoT applications have in common that they realise the win-win situation of increasing the quality and improving the services offered to citizens while at the same time providing an economic benefit to the city administration in terms of reducing operational costs:

- **Monitoring the structural health of buildings:** Proper maintenance of a city's historic buildings requires continuous monitoring of the actual condition of each building and identification of the areas most exposed to the effects of external agents. The urban IoT can provide a distributed database of measurements of the structural integrity of buildings collected by appropriate sensors located in the buildings. For example, vibration and deformation sensors could monitor

building stress, while atmospheric agent sensors monitor pollution levels, and temperature and humidity sensors complete the characterisation of the environmental conditions. Such a monitoring system can reduce the need for costly periodic structural testing by human operators and enable targeted and proactive maintenance and remediation (Lynch & Kenneth, 2006).

- **Smart waste management:** Waste management is a major issue in many modern cities because of the service's cost and the problem of storing waste in landfills. However, greater penetration of ICT solutions in this area can lead to significant savings and economic and environmental benefits. For example, the use of intelligent waste bins, which detect and communicate the level of load to the collecting agency, allows for route optimisation for the collection vehicles, reducing the cost of waste collection and improving the quality of recycling (Nuortio et al., 2006)
- **Air quality:** An urban IoT can monitor air quality in specific areas by deploying air quality and pollution sensors around the city. A service could use the measurements for parks and fitness trails to guide joggers via connecting health and fitness applications on the healthiest route for outdoor activities (Al-Ali et al., 2010).
- **Noise pollution monitoring:** Noise can be considered acoustic pollution, just as CO2 is for air. An urban IoT can provide a noise monitoring system to measure the amount of noise generated at all times. This allows for creating a space-time map of noise pollution in specific areas, identifying areas where noise reduction can improve the citizens' health and quality of life. Furthermore, such a service can also be used to enforce public safety by using sound detection algorithms that can, for example, detect the sound of gunshots, breaking glass, or fights. On the other hand, installing sound detectors or environmental microphones is quite controversial due to the obvious privacy concerns associated with this type of monitoring (Maisonneuve et al., 2009).
- **Traffic management:** Like air quality and noise monitoring, sensors can be deployed to monitor the traffic congestion in the city. Although camera-based traffic monitoring systems are already available and deployed in many cities, low-power, pervasive communications can provide a denser source of information. In addition, data can be gathered from the sensing capabilities and GPS installed on modern vehicles and smartphones. To complete the picture, data from air quality and acoustic sensors can be included, making traffic management a prominent example of smart city services based on a multitude of IoT devices (Li et al., 2009).
- **Smart grid:** Urban IoT can be used to monitor the energy consumption of the whole city. Such a service increases transparency, providing the public administration and the citizens with a clear and detailed view of the energy requirements of public services. Examples could be street lighting, public transport, traffic lights, surveillance cameras and heating and cooling of public buildings. This can help

to identify the main sources of energy consumption and primary areas of intervention to reduce the overall energy consumption. Urban IoT facilitates this by integrating electricity consumption monitoring devices into the city's electricity network. It will also be possible to extend this service with active functionalities to control local energy production structures (e.g. photovoltaic panels) (Zanella et al., 2014).

- **Smart parking:** Closely interlinked with a Smart City's traffic management, a smart parking service is based on parking area sensors and intelligent displays that guide drivers on the best way to park (Lee et al., 2008). In addition, an electronic verification system for parking permits in spaces reserved for residents or the disabled can be implemented, thus providing a better service to citizens who can legitimately use these spaces and an efficient tool to detect violations quickly (Zanella et al., 2014).
- **Smart lighting:** Optimising the efficiency of street lighting is an important feature related to the smart grid. In particular, IoT sensors and devices can optimise the intensity of street lighting according to the time of day, weather conditions, and people's presence. In addition, a fault detection system can easily be implemented, enhancing street lighting maintenance by the public administration (Zanella et al., 2014).
- **Automation and health of public buildings:** Urban IoT can be used to monitor the energy consumption and environmental health of public buildings through various types of sensors and actuators that control lighting, temperature, humidity, etc. By optimising these parameters, it is possible to improve the comfort of the people living, working, or visiting in these environments. This can, in turn, positively impact productivity while reducing the costs of heating/cooling for the public administration (Kastner et al., 2005).

3.2.4 Limitations and Challenges

While the Smart City concept based on urban IoT has been around for many years, in practice, the Smart City market has yet to take off due to several political, technical and financial barriers (Dohler et al., 2011):

On the **political side**, the main obstacle is allocating decision-making power to the different stakeholders. One possible way to overcome this obstacle is to institutionalise the entire decision-making and implementation process by concentrating smart city aspects' strategic planning and management in a single, dedicated department (Vilajosana et al., 2013). Professionals in the field of strategic planning and management for smart cities typically require a diverse set of qualifications that blend technical knowledge with strategic thinking. A strong educational background in urban planning, architecture, engineering, or a related field is often essential. Additionally, expertise in sustainable development, smart technology, and data analysis is highly valued. Familiarity with

energy systems, urban infrastructure, and project management can also be crucial for success in this role. As smart cities evolve, professionals may need to continuously learn to keep up with new technologies and approaches to urban challenges. Leadership skills and the ability to work within multi-disciplinary teams are also important, as is the capacity for innovative thinking to develop solutions that enhance urban liveability while ensuring environmental sustainability.

Under the **technical dimension**, the main challenge is the missing interoperability of the various technologies and protocols currently in use. This can also be seen as an opportunity, with urban IoT becoming the building block to develop a city-wide ICT platform and enabling the Smart City concept (Hernández-Muñoz et al., 2011; Mulligan & Olsson, 2013). Implementing urban IoT in existing buildings presents a unique set of challenges. The primary concern is integrating modern technology into structures not originally designed for such advancements. This often requires creative retrofitting solutions to install IoT sensors and devices without compromising the building's integrity or aesthetic value. Additionally, the existing electrical and network infrastructure may not support IoT systems' high power and connectivity demands, necessitating significant upgrades or workarounds. Security is another critical issue, as older buildings may lack the necessary frameworks to support the advanced cybersecurity measures required for IoT devices.

Finally, regarding the **financial dimension**, a clear and universal business model for urban IoT and Smart Cities is still lacking. The adverse global economic state exacerbates the situation, which has led to a general reduction in investment in public services. A potential solution could be to initially focus on services that combine social benefits with an evident return on investment, such as smart parking and smart buildings, and thus act as catalysts for the other value-added services (Walravens & Ballon, 2013).

Integrating IoT solutions in urban environments brings a host of **privacy concerns**, primarily due to IoT devices' extensive data collection capabilities. These devices can collect detailed information about individuals' movements, habits, and preferences, often without explicit consent or awareness. This data can be vulnerable to unauthorised access and misuse, leading to potential privacy breaches. To mitigate these risks, it is essential to implement robust security measures such as encryption, regular software updates, and secure authentication protocols. Additionally, there should be transparency in data collection practices, and individuals should have control over their data, including the right to access, rectify, and delete their information. Policies and regulations need to be in place to ensure that IoT deployments comply with privacy standards and that violations have consequences. Furthermore, public awareness campaigns can educate citizens on the privacy implications of IoT technologies and their rights concerning data privacy.

Finally, the successful implementation of IoT hinges significantly on the collective mindset of the populace. It requires a forward-thinking, innovation-embracing attitude open to change and adaptation. As urban areas evolve into smart cities, integrating IoT

technologies necessitates public understanding and support for the data-driven initiatives that these technologies enable. The community's willingness to engage with and trust in IoT solutions, from environmental monitoring to traffic management, plays a crucial role in their effectiveness. Moreover, a mindset geared towards sustainability and efficiency can drive the adoption of IoT applications that improve urban living, ultimately fostering a more connected and responsive city environment.

References

ABID, A. et al. (2017). Data analysis and outlier detection in smart city. In *2017 International Conference on Smart, Monitored and Controlled Cities (SM2C),* 17-19 February 2017, Sfax, Tunisia, pp. 1-4. DOI: <https://doi.org/10.1109/SM2C.2017.8071256>.

AL-ALI, A. R. et al. (2010). A mobile GPRS-sensors array for air pollution monitoring. In *IEEE Sensors Journal*, 10(10), 1666-1671. DOI: <https://doi.org/10.1109/JSEN.2010.2045890>.

ATZORI, L. et al. (2010). The internet of things: A survey. In *Computer Networks*, 54(15), 2787-2805. DOI: <https://doi.org/10.1016/j.comnet.2010.05.010>.

BELLAVISTA, P. et al. (2013). Convergence of MANET and WSN in IoT urban scenarios. In *IEEE Sensors Journal*, 13(10), 3558–3567. DOI: <https://doi.org/10.1109/JSEN.2013.2272099>.

CUFF, D. et al. (2008). Urban sensing: Out of the woods. Communications of the ACM, 51(3), 24-33. DOI: <https://doi.org/10.1145/1325555.132556>.

DOHLER, M. et al. (2011). Smart Cities: An action plan. In *Proc. Barcelona Smart Cities Congress,* Barcelona, Spain, pp. 1-6.

HERNÁNDEZ-MUÑOZ, J. M. et al. (2011). Domingue, J. et al. The Future Internet. FIA 2011. In *Lecture Notes in Computer Science*, vol 6656, pp. 447-462, Springer, Berlin, Heidelberg. DOI: <https://doi.org/10.1007/978-3-642-20898-0_32>.

KASTNER, W. et al. (2005). Communication systems for building automation and control. In *Proceedings IEEE*, 93(6), 1178-1203. DOI: <https://doi.org/10.1109/JPROC.2005.849726>.

LEE, S. et al. (2008). Intelligent parking lot application using wireless sensor networks. In *2008 International Symposium on Collaborative Technologies and Systems,* Chicago, May 19 – 23 2008, pp. 48-57. DOI: <https://doi.org/10.1109/CTS.2008.4543911>.

LI, X. et al. (2009). Performance evaluation of vehicle-based mobile sensor networks for traffic monitoring. In *IEEE Transactions on Vehicular Technology,* 58(4),1647-1653. DOI: <https://doi.org/10.1109/TVT.2008.2005775>.

LYNCH, J. P., KENNETH, J. L. (2006). A summary review of wireless sensors and sensor networks for structural health monitoring. In *Shock and Vibration Digest,* 38(2), 91-130.

MAISONNEUVE, N. et al. (2009). Citizen noise pollution monitoring. In *Proc. Proceedings of the 10th Annual International Conference on Digital Government Research: Social Networks: Making Connections between Citizens, Data and Government*, Puebla, Mexico, pp. 96-103. Digital Government Society of North America.

MULLIGAN C. E. A., Olsson, M. (2013). Architectural implications of smart city business models: An evolutionary perspective. In IEEE *Communications Magazine*, 51(6), pp. 80-85. DOI: <https://doi.org/10.1109/MCOM.2013.6525599>.

NUORTIO, T. et al. (2006). Improved route planning and scheduling of waste collection and transport. In *Expert Systems with Applications*, 30(2), 223-232. DOI: <https://doi.org/10.1016/j.eswa.2005.07.009>.

SCHAFFERS, H. et al. (2011). Smart cities and the future internet: Towards cooperation frameworks for open innovation. In DOMINGUE, J. et al. (eds.) *The Future Internet. FIA 2011. Lecture Notes in Computer Science,* vol. 6656, pp. 431-446, Springer, Berlin, Heidelberg. DOI: <https://doi.org/10.1007/978-3-642-20898-0_31>.

VILAJOSANA, I. et al. (2013). Bootstrapping smart cities through a self-sustainable model based on big data flows. In *IEEE Communications Magazine,* 51(6), 128-134. DOI: <https://doi.org/10.1109/MCOM.2013.6525605>.

WALRAVENS, N., BALLON, P. (2013). Platform business models for smart cities: From control and value to governance and public value. In *IEEE Communications Magazine*, 51(6), 72-79. DOI: <https://doi.org/10.1109/MCOM.2013.6525598>.

ZANELLA, A. et al. (2014). Internet of things for smart cities. In *IEEE Internet of Things Journal,* 1(1), 22-32. DOI: <https://doi.org/10.1109/JIOT.2014.2306328>.

3.3 Data Management for Smooth Technological and Sustainable Growth

Author: Andreea-Emanuela Drăgoi

3.3.1 General Introduction

Data management encompasses data's systematic organisation, storage, and maintenance to ensure its accuracy, accessibility, reliability, and security (Pansara, 2023; Bialkova, 2024). In modern economies, data management is crucial as it underpins decision-making, enhances operational efficiency, supports compliance with regulations, and fosters innovation (Bammidi et al., 2024). Effective data management is especially critical in the era of big data, where vast volumes of structured and unstructured data are generated at high velocity from diverse sources (Adewusi et al., 2024). Harnessing big data allows businesses to gain insights, predict trends, and improve customer experiences, giving them a competitive edge. However, the increased data volume also brings heightened risks of security breaches and unauthorised access to sensitive information. Protecting users' identity and personal data has become paramount, as data breaches can lead to significant financial losses, reputational damage, and legal consequences.

Presently, robust data management practices are crucial in safeguarding personal information, maintaining user trust, and ensuring modern economies' secure and efficient operation. Effective data management not only mitigates risks associated with data breaches but also ensures compliance with legal standards, thus protecting both organisations and individuals in the digital age. Effective data management has been critical to economic success for several decades. It helps companies improve the accuracy of information reporting while fuelling digital transformation and powering new technologies and business models. In the modern economy, data has become a new kind of capital, and forward-thinking organisations always look for new and better ways to use data to their advantage. The literature in the field states that data management is the practice of collecting, organising, and accessing data through a wide range of procedures (Figure 3.3.1) to support productivity, efficiency, and decision-making (Dayal, 1988).

Big Data is regulated in the EU through The Regulation on Harmonised Rules on Fair Access to and Use of Data, also known as the Data Act, which entered into force on 11 January 2024 (European Commission, 2024). This act is considered a key pillar of the European data strategy, significantly contributing to the advancement of digital transformation in all Member States.

The Data Act establishes clear and fair data access and rules for accessing and using data within the European data economy while enabling users to get more control over the data generated by their connected devices.

In addition, the Data Act reviews certain aspects of the Database Directive (European Commission, 1996), mainly focusing on clarifying the role of the sui generis database.

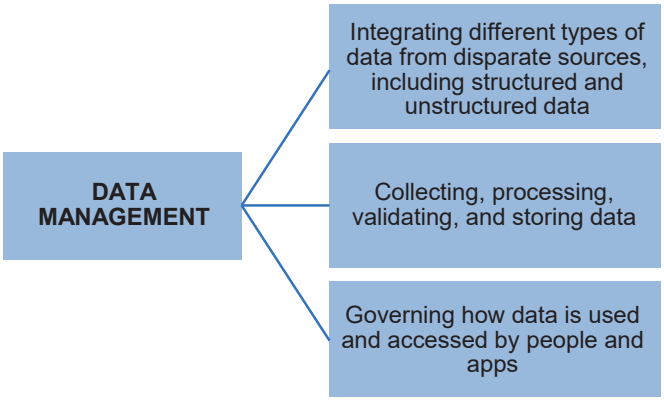

Figure 3.3.1 **Data management procedures**
Source: Author.

This right pertains to safeguarding the content of specific databases and extends its application to databases derived from data generated or acquired through Internet of Things (IoT) devices. The objective is to guarantee that the fair balance between the interests of data holders and users aligns with the overarching goals of the EU data policy.

The Data Act regulates the impact on Internet-of-Things devices' data access and use. For instance, when acquiring a 'traditional' product, you receive all its components and accessories. However, in the case of connected devices [specifically within the Internet of Things (IoT)], new data is generated during normal usage. This adds up to the product, becoming one of its essential components. The Data Act strengthens user empowerment by streamlining data transfer ('porting'). This gives individuals and businesses higher control over the data produced through their utilisation of smart objects, machines, and devices, allowing them to fully leverage the advantages of digitising products.

To improve data management across the EU's economy, in December 2023, the Commission allocated €41 million to develop the necessary infrastructure for Common European Data Spaces to create data ecosystems that users in similar sectors can access. Such a platform could allow data providers complete control over who accesses their data while exchanging information between cloud infrastructures, systems, and applications that will be trustworthy and secure.

3.3.2 Importance and Benefits

In an era of globalisation, businesses operate in diverse markets with varying customer preferences and behaviours. Effective data management allows organisations to gain deeper insights into their target audiences, understand customer needs and preferences, and deliver personalised experiences. Businesses can build stronger customer relationships and drive loyalty and retention by tailoring products, services, and marketing efforts to specific customer segments.

In the digital age, data is abundant and valuable. Effective data management enables organisations to collect, analyse, and interpret vast amounts of data to make informed decisions. By leveraging insights derived from data, businesses can optimise processes, identify market trends, and tailor products and services to meet customer needs more effectively. Moreover, organisations that excel in data management gain a competitive edge by harnessing the power of data to innovate, differentiate themselves, and stay ahead of the competition. Whether improving operational efficiency, enhancing customer experiences, or developing data-driven strategies, effective data management is essential for maintaining a competitive advantage in today's marketplace.

Data management is essential for organisations' economic success in globalisation. It enables data-driven decision-making, fosters innovation and growth, enhances customer-centricity, mitigates risks, and maintains a competitive advantage in an increasingly digital and interconnected world.

Data management fuels innovation and drives economic growth by enabling organisations to unlock new business opportunities, develop groundbreaking products and services, and enter new markets. By harnessing the power of data analytics, artificial intelligence, and machine learning, businesses can identify emerging trends, anticipate customer needs, and pioneer disruptive technologies that drive industry transformation and economic prosperity.

3.3.3 Practical Applications

Nowadays, it is commonly accepted (Divaio et al., 2021) that every application, analytics solution, and algorithm used in a business (the rules and associated process that allow computers to solve problems and complete tasks) depends on access to data. Hence, a data management system helps ensure that data is secure, available, and accurate. However, the benefits of data management don't end there since, with the right tools, Big Data can be harnessed and, through data management, can be used to empower companies while providing a better understanding of what customers want. Data management can also help drive new data-driven business models – such as service offerings based on real-time Internet of Things (IoT) and sensor data – that wouldn't be evident or obvious without the ability to analyse and interpret big data.

Data management, coupled with IoT and sensor technologies, enables the development of innovative business models that deliver value-added services based on real-time data insights. For instance, fleet management solutions utilise IoT sensors installed in vehicles to track their location, speed, fuel consumption, engine health, and driver behaviour in real time. Also, smart home automation systems integrate IoT devices such as thermostats, lighting controls, security cameras, and smart appliances to create interconnected ecosystems within homes. These systems collect data from sensors embedded in various devices and analyse it to understand occupants' behaviours, preferences, and usage patterns. This data shows smart home automation systems can automatically

adjust settings to optimise energy efficiency, enhance security, and improve comfort levels.

It should be noted that many industries, such as manufacturing, transportation, and utilities, rely on machinery and equipment to operate efficiently. Predictive maintenance services leverage IoT sensors embedded in these assets to monitor their real-time performance continuously.

This enables businesses to schedule proactive maintenance interventions before costly breakdowns occur, minimise downtime, and optimise asset performance. It also allows providers to offer subscription-based maintenance services, ensuring predictable revenue streams and fostering long-term customer relationships.

Data management is crucial for digital transformation, especially since artificial intelligence (AI), machine learning, Industry 4.0, advanced analytics, the Internet of Things, and intelligent automation require large amounts of timely, accurate, and secure data to function correctly.

Currently, there are several procedures for data management, such as:

- Relational database management system that contains data definitions so that programs and retrieval systems can reference data items by name;
- Object-oriented database management system where data is stored as objects, self-contained and self-described entities;
- The so-called in-memory database may store data in a computer's main memory (RAM) instead of on a disk drive.

The EU data management is governed by the General Data Protection Regulation (GDPR) (European Commission, 2016), which sets strict guidelines for collecting, storing, processing, and sharing personal data. Some of the most common data management procedures in the EU include:

- **Data Minimization:** Collect only the personal data necessary for the specified purpose while limiting the amount of data collected and processed to what is essential.
- **Consent Management:** Obtaining explicit consent from individuals before processing their data for specific purposes. Consent must be freely given, specific, informed, and unambiguous.
- **Data Security:** Implementing appropriate technical and organisational measures to ensure the security of personal data against unauthorised access, disclosure, alteration, or destruction. Organisations can use encryption techniques to safeguard personal data in transit and at rest. By encrypting data, even if unauthorised parties gain access, they cannot decipher the information without the encryption key. An example of an organisational measure is access control. Implementing strict access controls ensures that only authorised personnel can access personal data. This can include measures such as role-based access control (RBAC), where individuals are granted access based on their roles within the organisation, and regular access rights reviews to ensure they are appropriate and current.

- **Data Retention:** Establishing clear policies for retaining personal data only for as long as necessary for the purpose it was collected. Data should be securely deleted or anonymised when no longer needed. In practice, organisations typically establish data retention policies outlining specific timeframes for retaining personal data based on the purposes for which it was collected. When implementing data management, these policies often consider legal requirements, industry standards, and the organisation's operational needs. When personal data is no longer needed for its original or legitimate purpose, organisations are responsible for securely deleting or anonymising it. To comply with these requirements, organisations often implement data management systems or tools that can automatically identify and flag data that has reached the end of its retention period. This can involve scheduled reviews and audits to ensure data is managed appropriately throughout its lifecycle. Additionally, organisations may train employees on data retention policies and procedures to ensure compliance at all levels. Failure to comply with these rules can result in significant consequences for organisations. Under the GDPR, for example, regulatory authorities can impose fines of up to €20 million or 4% of the organisation's annual global turnover, whichever is higher. Additionally, non-compliance can damage an organisation's reputation, leading to loss of customer trust and potential legal action from affected individuals. Therefore, organisations must take data retention requirements seriously and implement robust processes to ensure compliance.
- **Data Subject Rights Management:** Providing individuals the right to access, rectify, erase, restrict processing, and port their data. Data controllers must have procedures in place to facilitate these rights.
- **Data Breach Notification:** Establishing procedures for promptly detecting, investigating, and reporting data breaches to the appropriate supervisory authority and affected individuals when necessary. By having robust incident response plans and processes, organisations can effectively manage data breaches in compliance with the GDPR and minimise the impact on affected individuals and their reputations. Organisations are required to keep records of all data breaches, including the facts surrounding the breach, its effects, and the remedial action taken. Supervisory authorities may review these records during audits or investigations. Moreover, organisations must take immediate steps to mitigate the effects of the breach and prevent further unauthorised access to personal data. This may involve patching security vulnerabilities, resetting passwords, or implementing additional security measures.
- **Data Transfer Mechanisms:** Ensuring that any transfer of personal data outside the EU complies with GDPR requirements, such as using standard contractual clauses or other approved transfer mechanisms.
- **Privacy by Design and Default:** Incorporating data protection measures into the design and implementation of systems, products, and services from the

outset. Default settings should prioritise privacy and limit the processing of personal data. Organisations often involve multidisciplinary teams comprising data protection experts, engineers, designers, and legal advisors to ensure that privacy considerations are integrated throughout development. Regular audits, reviews, and assessments are conducted to verify compliance with data protection principles and identify areas for improvement. Organisations can build user trust, mitigate privacy risks, and demonstrate a commitment to data protection compliance by embedding privacy-enhancing measures into their systems, products, and services. Also, various organisations may use anonymisation techniques to reduce the risk of re-identification when processing personal data. This can involve removing or encrypting identifiable information from datasets, thereby minimising privacy risks. Moreover, all companies must enforce purpose limitations and limited data collection. The purpose limitation refers to the obligation of clearly defining the purposes for which personal data is collected and processed, ensuring data is not used for unrelated activities. Limited data collection requires that systems are designed to collect only the minimum amount of personal data necessary to achieve the specified purpose. For example, a website may only require an email address for user registration rather than requesting additional personal information.

- **Data Processing Agreements:** Establishing contracts with third-party data processors that clearly outline their obligations, including compliance with GDPR requirements, security measures, and data protection standards. These procedures are crucial for organisations operating in the EU to ensure compliance with GDPR and protect individuals' rights and privacy concerning their data. Failure to comply with these procedures can result in significant fines and penalties imposed by the European authorities.

3.3.4 Limitations and Challenges

Nowadays, new types of databases and tools have been developed for data management. These tools use highly efficient processing techniques and cloud-based facilities to handle the volume and velocity of Big Data. At the same time, new approaches to interpreting and managing the data variety have been created. For example, new pre-processing processes are used to identify and classify data items to facilitate storage and retrieval so that the data management tools can understand and work with different kinds of unstructured data.

A risk related to data management is the storage of data in the cloud, as cloud databases and database services may be subjected to hackers' attacks and need more advanced security solutions (Kossmann & Schlosser, 2020; Mousa et al., 2020). Also, a new trend called augmented data management has significant disruptive potential because it uses

AI and machine learning to make the data management process self-configuring and self-tuning (Bormida, 2021).

Since the proper functioning of the digital economy requires the free movement of personal data, data should not be restricted except to prevent threats to public security (such exceptions apply, for instance, in the framework of anti-money laundering or the activities of forensic laboratories).

However, it should be noted that developing some emerging technologies will provide new challenges for data management. Those challenges relate to topics such as artificial intelligence, blockchain technology, and 'deep fake' technology. The development of quantum computing can also pose a challenge to the protection of personal data. In view of these challenges, the right of privacy should remain crucial in data management, as the protection of natural persons should be technologically neutral and should not depend on the techniques used.

Our main finding is that in our digital era, effective data management remains indispensable for the smooth and secure operation of modern economies while ensuring the accuracy, accessibility, reliability, and security of data. Data management allows businesses to harness vast volumes of big data, which enables companies to gain valuable insights, predict trends, and improve customer experiences, thereby achieving a competitive edge.

Our second finding is that as large volumes of data continue to be a critical asset, robust data management practices will be essential in the future economy for driving innovation and sustaining economic growth. However, with great data flow comes important responsibility concerning user privacy protections. Hence, effective data management not only mitigates the risks related to user privacy but also ensures compliance with legal standards, protecting both organisations and individuals. Businesses can build stronger relationships with their customers by prioritising user privacy and creating a secure digital environment.

Lastly, we believe that effective data management fuels digital transformation, powers new technologies, and supports the development of novel business models while maintaining users' trust and privacy. This way, organisations can drive technological advancements and achieve sustainable growth in a rapidly evolving digital landscape.

References

ABOUREZQ, M., IDRISSI, A. (2016). Database-as-a-service for big data: An overview. In *International Journal of Advanced Computer Science and Applications*, 7(1), 157-177.

ADEWUSI, A. O. et al. (2024). Business intelligence in the era of big data: a review of analytical tools and competitive advantage. In *Computer Science & IT Research Journal*, 5(2), 415-431. DOI: <https://doi.org/10.51594/csitrj.v5i2.791>.

AGRAWAL, D. (2011). Big data and cloud computing: current state and future opportunities. In *EDBT/ICDT '11: Proceedings of the 14th International Conference on Extending*

Database Technology, pp. 530-533, New York : Association for Computing Machinery. DOI: <https://doi.org/10.1145/1951365.1951432>.

AVRAM, A. et al. (2023). *DiGreen Handbook of DIGITAL good Practice: Solutions for cities and municipalities.* Online. [20/06/2024]. Available at: <https://hdl.handle.net/10863/36754>.

BAMMIDI, T. R. et al. (2024). The Crucial Role of Data Quality in Automated Decision-Making Systems. In *International Journal of Management Education for Sustainable Development*, 7(7), 1-22.

BIALKOVA, S. (2024). Data management. In BIALKOVA, S. (eds.) *The rise of AI user applications: Chatbots integration foundations and trends* (pp. 167-186). Cham: Springer Nature Switzerland. DOI: <https://doi.org/10.1007/978-3-031-56471-0_10>.

BORMIDA, M. D. (2021). The Big Data World: Benefits, Threats and Ethical Challenges. In IPHOFEN, R., O'MATHÚNA, D. (eds.) *Ethical Issues in Covert, Security and Surveillance Research* (Advances in Research Ethics and Integrity, Vol. 8), Leeds : Emerald Publishing Limited, pp. 71-91. DOI: <https://doi.org/10.1108/S2398-601820210000008007>.

DAYAL, U. (1988). Active database management systems, In BEERI, C. et al. (eds.) *Proceedings of the Third International Conference on Data and Knowledge Bases: Improving Usability and Responsiveness*, pp. 150-169. Morgan Kaufmann. DOI: <https://doi.org/10.1016/B978-1-4832-1313-2.50019-6>.

DI VAIO, A. et al. (2021). The role of digital innovation in knowledge management systems: A systematic literature review. In *Journal of business research,* 123(February 2021), 220-231. DOI: <https://doi.org/10.1016/j.jbusres.2020.09.042>.

ELDAHSHAN, K. et al. (2022). Handling Big Data in Relational Database Management Systems. Computers. In *Materials & Continua,* 72(3), 5149-5164. DOI: <https://doi.org/10.32604/cmc.2022.028326>.

GADEPALLY, V. et al. (2016). Storage and database management for big data. In HU, FEI. (eds.) *Big Data: Storage, Sharing, and Security*, pp. 28. New York : Auerbach Publications.

GILLENSON, M. L. (2023). *Fundamentals of database management systems.* New Jersey : John Wiley & Sons.

GUNASEKARAN, K. P. et al. (2023). *Deep learning based Auto Tuning for Database Management System.* arXiv preprint arXiv:2304.12747.

European Commission (1996). Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases. Online. [20/06/2024]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31996L0009>.

European Commission (2016). Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Online. [20/06/2024]. Available at: <https://eur-lex.europa.eu/eli/reg/2016/679/oj>.

European Commission (2024). Data Act. Online. [20/06/2024]. Available at: <https://digital-strategy.ec.europa.eu/en/policies/data-act>.

KOSSMANN, J., SCHLOSSER, R. (2020). Self-driving database systems: a conceptual approach. In *Distributed and Parallel Databases*, 38(4), 795-817. DOI: <https://doi.org/10.1007/s10619-020-07288-w>.

LEMAHIEU, W. et al. (2018). *Principles of database management: the practical guide to storing, managing and Analyzing big and small Data.* Cambridge : Cambridge University Press.

MOUSA, A. et al. (2020). Database security threats and challenges. In *8th International Symposium on Digital Forensics and Security (ISDFS),* Beirut, Lebanon, 2020, pp. 1-5. DOI: 10.1109/ISDFS49300.2020.9116436.

PANSARA, R. (2023). Navigating data management in the cloud-exploring limitations and opportunities. In *Transactions on Latest Trends in IoT,* 6(6), 57-66.

PAVLO, A. et al. (2017). Self-Driving Database Management Systems. In *8th Biennial Conference on Innovative Data Systems Research (CIDR '17)* January 8-11, 2017, Chaminade, USA, vol. 4, 1-6.

YAQOOB, I. et al. (2021). Blockchain for healthcare data management: opportunities, challenges, and future recommendations. In *Neural Computing and Applications,* 34, 11475-11490. DOI: <https://doi.org/10.1007/s00521-020-05519-w>.

3.4 Safeguarding Digital Governance: Balancing Technology and Human Factors

Author: Davide Maffei

Security and safety in public administration's digitalisation are fundamental for safeguarding data, systems, and infrastructure against unauthorised access and cyber threats while ensuring the confidentiality, integrity, and availability of information and services. In today's digital era, where public administration heavily relies on information systems, ensuring security is essential. This not only protects citizens' data but also ensures the continuity of service provision and safeguards national and European interests.

However, addressing this challenge requires more than just adopting technical solutions. The human element, represented by public personnel, poses a significant vulnerability to information system security and is increasingly targeted for malicious purposes (Al Salek, 2021). Despite administrations' awareness of these risks, they often prioritise technology-based solutions, overlooking the social component of information systems (Bulgurcu et al., 2010). To effectively enhance information security, administrations must adopt holistic solutions that encompass both technology-based and socio-organizational elements (Bulgurcu et al., 2010). This includes providing appropriate training to personnel to mitigate risks associated with the human element (Al-Daeef et al., 2017).

The challenges related to security and safety are manifold. While this chapter focuses on the human component, organisations are recommended to develop a viable incident response plan to be ready in case of a cyber-attack. Moreover, while communication and notification are highly encouraged to provide stakeholders with timely updates and guidance about what to do, organisations are also required by law to comply with incident reporting, notification and disclosure requirements in case of data breaches.

3.4.1 General Introduction

The widespread adoption of technology within administrations has led to increased vulnerabilities and a larger attack surface (Ghafir et al., 2018; Siponen, 2001). Hackers exploiting human behaviour is a growing threat that technical solutions alone cannot fully address. As shown in Figure 3.4.1, functional measures, legislation, regulations, and policies are also necessary to tackle security threats (Grobler et al., 2021). In addition, Grobler et al. (2021) advocate for cyber security to shift the paradigm from functional and usage-centered to a more user-centered approach.

The importance of these issues has led to the emergence of the Data Protection Officer role within public administration (Brezniceanu et al., 2017). Balancing privacy protection and expanded data sharing, necessary for integrated public services, poses significant challenges (Bellamy and Raab, 2005). Efforts to achieve these goals should

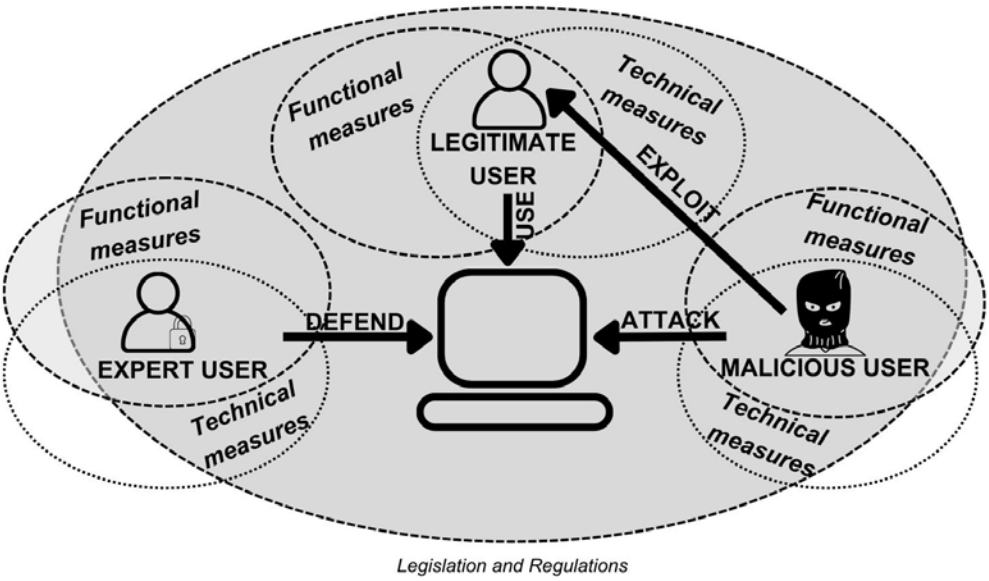

Figure 3.4.1 **Usage Perspective of Cyber Security**
Source: Grobler et al. (2021).

span horizontally across the entire public administration and vertically within public policy domains (Bellamy & Raab, 2005).

Despite efforts thus far, awareness and training remain crucial for cybersecurity and require further enhancement. Information Security Awareness Training is crucial in mitigating risks associated with human-related vulnerabilities (Safa & Von Solms, 2016). However, public employees across various EU Member States perceive their preparation for such threats as inadequate (Banciu et al., 2020).

Even individuals operating critical infrastructure often lack expertise in information security (Al Salek, 2021). Digitalisation necessitates changing demands on tasks, roles, and competencies, requiring qualified staff prepared to face emerging challenges (Mäkiö-Marusik et al., 2019; Ogonek et al., 2019; Schenk & Dolata, 2020).

Currently, the available resources are insufficient, and the entire public administration sector lacks adequate human resources at both technical and managerial levels. Such resources are rare and highly requested in the labour market by both the public and private sectors (Schmid, 2019). Smaller administrations face even more significant challenges due to resource constraints, making adopting adequate technical solutions and hiring needed competencies difficult. Moreover, smaller databases in these administrations often cannot meet security requirements, posing a considerable risk. As a potential solution, migrating smaller databases into larger ones with redundancy and robust security features could alleviate this burden while enhancing security and interoperability. However, such migrations require careful planning and support to ensure seamless integration and continuity of services.

3.4.2 Importance and Benefits

Ensuring the security of data held by public administrations, especially sensitive and personal information about citizens, is very important. This requires not only top-level instruments and support but also the right competencies among personnel.

As employees must navigate complex systems and understand digitalisation processes, technical capabilities are crucial. Proficiency in evaluating and securing cloud services, as well as contractual aspects, is essential. However, basic digital skills, such as managing information and handling documents digitally, are also needed. Therefore, comprehensive training in computer systems usage is necessary.

Training should be ongoing to keep pace with changing technologies, and turnover rates should be managed to retain expertise. It's essential to time training appropriately, avoiding introducing new systems too early when employees may forget the information. Additionally, new systems should be introduced gradually to prevent overwhelming employees.

In addition to technical proficiency, employees must be willing to embrace digitalisation. Promoting a digital culture requires substantial education and information dissemination. Overcoming resistance to change is crucial, and employees should be motivated to participate in training to enhance job security.

Desman (2003) outlined ten commandments for successful Information Security Awareness Training:

1. Information security must be viewed as a people issue, not just a technical one.
2. Training language should be tailored to users' comprehension levels.
3. All users should participate in training to raise awareness across the organisation.
4. Training should have clear goals to ensure its purpose is understood.
5. Training should be engaging and enjoyable, possibly incorporating humour.
6. Training should be concise and to the point.
7. Recipients should understand how behavioural changes will benefit them and the organisation.
8. Utilise existing resources within the organisation for training purposes.
9. Training should be formalised and habitual.
10. Training should be timely to address the latest information security developments.

These guidelines underscore the importance of comprehensive training beyond simply providing information about security risks. Completing training courses, even with certificates, may not automatically lead to behavioural changes and adherence to security policies (Bada et al., 2019). Ongoing efforts to promote a culture of security awareness and compliance are essential.

3.4.3 Practical Applications

Considering the extensive integration of information technology in public administration, the significance of security and safety issues cannot be overstated. It's imperative to raise awareness of these issues across all units utilising information technology, which essentially encompasses everyone within the administration.

In addition to traditional informative training methods lacking interactive components, administrations should explore online delivery methods, game-based training, and simulation training. Each of these approaches has its advantages and drawbacks:

Online delivery methods, though user-friendly, may result in surface-level engagement and a lack of two-way communication, potentially impeding effective learning (Al-Daeef et al., 2017; Abawajy and Kim, 2010).

Game-based training enhances interactivity and has shown positive outcomes (Al-Daeef et al., 2017; Abawajy & Kim, 2010; Cone et al., 2006).

Simulation training, also called embedded training, integrates with existing systems, offering authentic scenarios and facilitating two-way communication, demonstrating promising effectiveness (Al-Daeef et al., 2017; Kumaraguru et al., 2008; Abawajy & Kim, 2010).

These diverse training methods provide avenues for addressing security and safety concerns within public administration, offering opportunities for effective learning and skill development tailored to the needs of different personnel.

3.4.4 Limitations and Challenges

A significant challenge in security awareness programs is the lack of a well-defined methodology for delivery (Abawajy & Kim, 2010). However, recent advancements have introduced two end-user Information Security Awareness Training (ISAT) frameworks, notably featuring the concept of context-aware training (Kävrestad & Nohlberg, 2020b; Ghafir et al., 2018). Context-aware training tailors ISAT programs to the user environment, presenting training based on user activity, such as providing warnings when a suspicious email is detected during the daily workflow. This approach improves upon traditional methods by offering hands-on experience and has proven more effective in various assessments (Kumaraguru et al., 2007, 2008).

Embedded training, like context-aware training, underscores the importance of relevant training scenarios for successful ISAT programs (Kävrestad & Nohlberg, 2020b; Siponen, 2001). Training integrated into daily activities enhances user awareness when it matters most, increasing effectiveness (Kävrestad & Nohlberg, 2020b). Both context-aware training methods acknowledge the value of constructed training scenarios as complementary (Kävrestad & Nohlberg, 2020b; Ghafir et al., 2018).

Examples could be phishing simulation exercises, where employees receive simulated phishing emails and learn to recognise phishing red flags like suspicious sender

addresses, or social engineering workshops, where employees role-play typical scenarios and practice responding to such tactics. Moreover, it could also be helpful to conduct incident response exercises to be prepared when a real emergency hits. In this case, cross-functional teams can collaborate and practice incident assessment and response, also in accordance with the response plan of the organisation.

However, these methods differ in implementation. Ghafir et al.'s framework offers a reward system but cannot provide additional learning resources and may present training irrelevantly, potentially leading to user disregard (Ghafir et al., 2018). Conversely, Context-Based Micro-Training (CBMT), introduced by Kävrestad & Nohlberg (2020), is a comprehensive framework emphasising relevance, ease, and conciseness. CBMT stands out for its generalizability and has shown promising results in various implementations (Kävrestad & Nohlberg, 2020b, 2020a; Kävrestad et al., 2020).

On a final note, organisations are in general strongly advised to consult and gather information from specialised consulting firms, government agencies and security technology providers while establishing security audits to enhance their cyber security. Moreover, certification programs could also be pursued.

References

ABAWAJY, J., KIM, T. (2010). Performance analysis of cyber security awareness delivery methods, In KIM, T. H. et al. (eds.) *Security Technology, Disaster Recovery and Business Continuity: International Conferences, SecTech and DRBC 2010, Held as Part of the Future Generation Information Technology Conference, FGIT 2010*, Jeju Island, Korea, December 13-15, 2010. Proceedings, pp. 142-148, Berlin : Springer. DOI: <https://doi.org/10.1007/978-3-642-17610-4_16>.

AL-DAEEF, M. M. et al. (2017). Security awareness training: A review, In AO, S. I. et al. (eds.*), Proceedings of the World Congress on Engineering,* July 5-7 2017, London, U.K, pp. 1-6. Burnley : Newswood Limited.

BADA, M. et al. (2019) *Cyber security awareness campaigns: Why do they fail to change behaviour?,* arXiv:1901.02672. DOI: <https://doi.org/10.48550/arXiv.1901.02672>.

BANCIU, D. et al. (2020). Information security awareness in Romanian public administration: an exploratory case study. In *Studies in Informatics and Control,* 29(1), 121-129. DOI: <https://doi.org/10.24846/v29i1y202012>.

BELLAMY, C., RAAB, C. (2005). Joined-up government and privacy in the United Kingdom: managing tensions between data protection and social policy. Part II. In *Public Administration*, 83(2), 393-415. DOI: <https://doi.org/10.1111/j.0033-3298.2005.00455.x>.

BREZNICEANU, A. M. (2017). Data Protection Officer – a new profession in public administration? In *Revista de Științe Politice. Revue des Sciences Politiques,* 55, pp. 78-88.

BULGURCU, B. et al. (2010). Information security policy compliance: an empirical study of rationality-based beliefs and information security awareness. In *MIS Quarterly*, 34(3), 523-548. DOI: <https://doi.org/10.2307/25750690>.

CONE, B. D. et al. (2006). Cyber security training and awareness through game play, In FISCHER-HÜBNER, S. et al. (eds.) *Security and Privacy in Dynamic Environments: Proceedings of the IFIP TC-11 21st International Information Security Conference (SEC 2006),* 22-24 May 2006, Karlstad, Sweden 21, Boston, Springer, pp. 431-436. DOI: <https://doi.org/10.1007/0-387-33406-8_37>.

DESMAN, M. B. (2003). The ten commandments of information security awareness training. In *Information Systems Security*, 11(6), 39-44. DOI: <https://doi.org/10.1201/1086/43324.11.6.20030101/40430.7>.

GHAFIR, I. et al. (2018), Security threats to critical infrastructure: the human factor. In *The Journal of Supercomputing*. Springer, 74, 4986–5002. DOI: <https://doi.org/10.1007/s11227-018-2337-2>.

GROBLER, M. et al. (2021). User, usage and usability: Redefining human centric cyber security. In *Frontiers in big Data,* 4, article ID 583723. DOI: <https://doi.org/10.3389/fdata.2021.583723>.

KÄVRESTAD, J. et al. (2020). Can Johnny actually like security training? In BEDNAR, P. et al. (eds.) *6th International Workshop on Socio-Technical Perspective in IS development, virtual conference in Grenoble, France,* June 8-9, 2020, pp. 76-83.

KÄVRESTAD, J., NOHLBERG, M. (2020a). Assisting users to create stronger passwords using contextbased microtraining, In HÖLBL, M. et al. (eds.) *ICT Systems Security and Privacy Protection: 35th IFIP TC 11 International Conference, SEC 2020,* Maribor, Slovenia, September 21-23, 2020, Cham: Springer, pp. 95-108. DOI: <https://doi.org/10.1007/978-3-030-58201-2_7>.

KÄVRESTAD, J., NOHLBERG, M. (2020b). ContextBased MicroTraining: a framework for information security training, In CLARKE, N., FURNELL, S. (eds.) *Human Aspects of Information Security and Assurance: 14th IFIP WG 11.12 International Symposium, HAISA 2020*, Mytilene, Lesbos, Greece, July 8-10 2020, Cham: Springer, pp. 71-81. DOI: <https://doi.org/10.1007/978-3-030-57404-8_6>.

KUMARAGURU, P. et al. (2007). Getting users to pay attention to anti-phishing education: evaluation of retention and transfer, In *eCrime '07: Proceedings of the anti-phishing working groups 2nd annual eCrime researchers summit*, New York : Association for Computing Machinery, pp. 70-81. DOI: <https://doi.org/10.1145/1299015.1299022>.

KUMARAGURU, P. et al. (2008). Lessons from a real world evaluation of anti-phishing training, In *2008 eCrime Researchers Summit, researchers summit,* Atlanta, USA, 2008, pp. 1-12. DOI: DOI: <https://doi.org/10.1109/ECRIME.2008.4696970>.

MÄKIÖ-MARUSIK, E. et al. (2019) Concept and case study for teaching and learning industrial digitalization. In *Procedia Manufacturing*, 31(2019), 97-102. DOI: <https://doi.org/10.1016/j.promfg.2019.03.016>.

OGONEK, N. et al. (2019). How to Master the "E" Tools for Competence Identification, Provision and Preservation in a Digitalized Public Sector, in ICEGOV '19: Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance, New York : Association for Computing Machinery, pp. 56-64, DOI: <https://doi.org/10.1145/3326365.332637>.

SAFA, N. S., VON SOLMS, R. (2016). An information security knowledge sharing model in organization. In *Computers in Human Behavior*, 57 (April 2016), 442-451. DOI: <https://doi.org/10.1016/j.chb.2015.12.037>.

AL SALEK, A. (2021). *Information Security Awareness Training for End-user: A Survey on the Perspective of Nordic Municipalities.*

SCHENK, B., DOLATA, M. (2020). Facilitating digital transformation through education: A case study in the public administration. In *Proceedings of the 53rd Hawaii International Conference on System Sciences*, Maui, Hawaii, January 7-10 2020, Manoa: University of Hawaii at Manoa. DOI: <https://doi.org/10.24251/HICSS.2020.262>.

SCHMID, A. (2019). Verwaltungsinformatik und eGovernment im Zeichen der Digitalisierung – Zeit für ein neues Paradigma BT – Verwaltung, eGovernment und Digitalisierung: Grundlagen, Konzepte und Anwendungsfälle. In SCHMID, A. (eds.). Wiesbaden : Springer Fachmedien Wiesbaden, pp. 3-21. DOI: <https://doi.org/10.1007/978-3-658-27029-2_1>.

SIPONEN, M. T. (2001). Five dimensions of information security awareness. In *SIGCAS Computers and Society*, 31(2), pp. 24-29.

3.5 Artificial Intelligence as a Topic of Communal Interest

Author: Silvia Ručinská

3.5.1 General Introduction

Artificial intelligence (AI) is already being implemented and impacting many important sectors of our society, including finance, healthcare, data management, industry development, job performance, and education. Simultaneously, artificial intelligence represents one of the key challenges for our society, governance, and policymaking.

Artificial intelligence enhances the technological possibilities of new interactions between governments and the public, mainly in policymaking and public services (Ahn and Chen, 2020; Henman, 2020). The impacts of artificial intelligence on public institutions can be seen in competencies content, awareness of political leaders and employees, and citizens´ quality of life (Reis et al., 2019). In this regard, artificial intelligence gained significant interest thanks to the ongoing transformation of public administration because discretion is enhanced and automated across public institutions (Young, 2019). AI-based solutions should be seen as essential tools for public institutions to improve the quality of life. Implementation of AI in public services has the potential to increase service efficiency and service quality for citizens, however it is important to understand the reasons for acceptance of AI in public services in general and from a practical perspective to determine how public services should be designed (Gesk and Leyer, 2022).

3.5.2 Importance and Benefits

Artificial intelligence can potentially improve the execution of competencies at the communal level. Municipalities and cities may benefit from implementing AI-based solutions in many different aspects, mainly by automating operations, reducing human error, making effective data-driven decisions, improving the environment through intelligent systems, implementing new commercial possibilities, and automating efficient urban management (Herath and Mittal, 2022). Municipalities and cities usually generate massive amounts of data, which can be processed and interpreted using AI algorithms, that may lead to intelligent and effective governance (Baduge et al., 2022). In this regard, AI-based solutions empower IoT solutions adopted by municipalities and cities by making them ready for calculative decisions without human involvement (Bhosale, 2023). Artificial intelligence can help enhance human tasks, automating many activities and serving as a decision-making guide at the local level (Mikalef et al., 2019).

The mentioned benefits have the potential to improve the functioning of municipalities and cities and have a wider impact on the quality of life in the local community.

When introducing new AI-based solutions, practitioners should identify the relevant stakeholders impacted by their implementation, understand their opinions and perspectives, and address local needs and challenges (Vogl et al., 2020). The same AI-based solution may have different impacts on various stakeholders.

AI-based solutions must be perceived as a part of the general approach of municipalities and cities to improve local governance and quality of life. Artificial Intelligence, the Smart City concept, IoT, and Big Data contribute to the urban sustainability of municipalities and cities, which are essential to building a more inclusive and safe local environment (Allam and Dhunny, 2019). In this regard, artificial intelligence brings different positive impacts, but its implementation must be discussed and accepted by the local community and its stakeholders.

3.5.3 Practical Applications

AI-based solutions can be used in different spheres of communal life. The pace of technology development is extreme, so limitations to implementing AI-based solutions in some specific spheres of life can be overcome in the next few years. In this regard, possibilities and opportunities are far-reaching in spheres of local governance. Artificial intelligence applications are constantly discussed at local, national, and international levels (Figure 3.5.1).

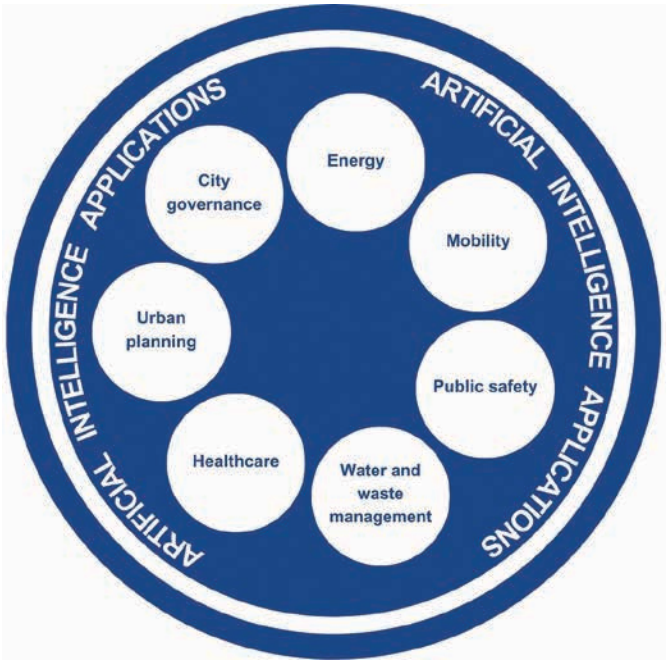

Figure 3.5.1 **Artificial intelligence applications**
Source: Authors based on Leal et al. (2022).

The sophistication of waste and water management is secured mainly through systematic monitoring, automatic evaluation of pollution, and early intervention that saves the environment and public finances. AI-based solutions generate new added values to mobility in municipalities and cities, mainly thanks to predicting traffic jams, prioritising public transport, and smart mobility systems. Public safety solutions include security systems, automatic evaluation of conflict situations, and tracking of persons or cars in the case of abuses and violations of legal norms. Stakeholders benefit from AI-based solutions, mainly in automatically processing information and data available for informed and evidence-based decision-making for citizens, businesses, and elected representatives. Energy effectiveness can be increased thanks to AI-based solutions. Lower costs and higher savings can be achieved thanks to digital communication, detection and reaction to local changes in usage, and the prediction of consumption based on historical and real-time data.

Municipalities and cities should maximize the potential benefits of AI-based solutions for public institutions and other stakeholders from local communities. Contrary to the benefits of AI-based solutions, municipalities and cities should consider their limits.

3.5.4 Limitations and Challenges

Commercially available solutions that integrate AI technology as its main component or partial tool can attract attention for being modern. Municipalities and cities should think very carefully about integrating solutions using artificial intelligence. AI tools are not an outcome in themselves or a goal for itself to be achieved.

Municipalities and cities should assess the economic efficiency of AI-based solutions. Local communities should benefit from market-ready solutions or unique solutions invented by municipalities and cities. Of course, it is hard to expect municipalities and cities to produce unique solutions for each specific condition. Small and medium-sized municipalities and cities especially do not have the personnel, financial and administrative capacities to achieve such results. Therefore, it is acceptable that the possibility of using market-ready solutions is a desirable approach for the municipalities and cities. These days, municipalities and cities can choose from various market-ready solutions. However, municipalities and cities should use market-ready solutions only in reasonable cases and to fill existing gaps in the provision of public services. The potential of its use is undoubtedly great. Therefore, tracking the market and proofcheck commercial offers and good practice examples is important.

Digital skills in understanding AI are another challenge for municipalities, cities, elected representatives, and members of local communities. All levels of governance should be skilled enough to keep up with the exponential development of technology. Employees and elected representatives should be able to formulate the needs of their local community, mainly thanks to the acquired skills and openness to new technologies.

Ignorance and misunderstanding of artificial intelligence can lead to unfulfilled expectations and misinterpreting opportunities and limits related to AI-based solutions.

Artificial intelligence can limit human error or notice potential mistakes. Municipalities and cities generate and collect massive amounts of information and data. AI can effectively analyse an increasing number of information and data. Automatic operations minimise the negative impact of human overload and failure. However, the burden of the decision-making process is still on the elected representatives or established processes deriving from the elections and the legitimacy of policymaking. Thus, shifting the burden of decision-making processes onto AI-based solutions is still a distant future. However, artificial intelligence is already an important tool for rationalisation and improving the outcome qualities of policymaking at the local level.

Municipalities and cities should understand the benefits and limits of AI-based solutions. AI-based solutions are not universally applicable in public administration, mainly because of the differences between specific AI public services and general public services (Gesk and Leyer, 2022). Increased awareness of artificial intelligence can help municipalities and cities to identify and satisfy their needs. Municipalities and cities should be aware of the automatic application of AI-based solutions because of their modernity and growing trend. Applying AI-based solutions at the communal level should primarily improve citizens´ quality of life and deal with challenges that the local community faces.

References

AHN, M. J., CHEN, Y. (2022). Digital transformation toward AI-augmented public administration: The perception of government employees and the willingness to use AI in government. In *Government Information Quarterly,* 39(2), Article ID 101664. DOI: <https://doi.org/10.1016/j.giq.2021.101664>.

ALLAM, Z., DHUNNY, Z. A. (2019). On big data, artificial intelligence and smart cities. In *Cities,* 89(6), 80-91. DOI: <https://doi.org/10.1016/j.cities.2019.01.032>.

BADUGE, S. K. et al. (2022). Artificial intelligence and smart vision for building and construction 4.0: Machine and deep learning methods and applications. In *Automation in Construction*, 141 (September 2022), 104440. DOI: <https://doi.org/10.1016/j.autcon.2022.104440>.

BHOSALE, S. A. (2023). Artificial Intelligence and loT for Smart Cities. In JABBAR, M. A. et al. (eds.) *Smart Urban Computing Applications*. New York : River Publishers, pp. 207-228. DOI: <https://doi.org/10.1201/9781003373247>.

GESK, T. S., LEYER, M. (2022). Artificial intelligence in public services: When and why citizens accept its usage. In *Government Information Quarterly,* 39(3), Article ID 101704. DOI: <https://doi.org/10.1016/j.giq.2022.101704>.

HENMAN, P. (2020). Improving public services using artificial intelligence: possibilities, pitfalls, governance. In *Asia Pacific Journal of Public Administration,* 42(4), 209-221. DOI: <https://doi.org/10.1080/23276665.2020.1816188>.

HERATH, H. M., MITTAL, M. (2022). Adoption of artificial intelligence in smart cities: A comprehensive review. In *International Journal of Information Management Data Insights,* 2(1), 100076. DOI: <https://doi.org/10.1016/j.jjimei.2022.100076>.

LEAL, A. et al. (2022). *AI and Cities: Risks, Applications and Governanc*e. Online. [20/06/2024]. Available at: <https://unhabitat.org/sites/default/files/2022/10/artificial_intelligence_and_cities_risks_applications_and_governance.pdf>.

MIKALEF, P. et al. (2019). Artificial Intelligence in the Public Sector: A Study of Challenges and Opportunities for Norwegian Municipalities. In PAPPAS, I. O. et al. (eds.) *Digital Transformation for a Sustainable Society in the 21st Century.* I3E 2019. Lecture Notes in Computer Science, vol. 11701. Cham: Springer, pp. 267-277. DOI: <https://doi.org/10.1007/978-3-030-29374-1_22>.

REIS, J. et al. (2019). Impacts of Artificial Intelligence on Public Administration: A Systematic Literature Review. In *2019 14th Iberian Conference on Information Systems and Technologies (CISTI)* 19 – 22 June 2019, Coimbra, Portugal. DOI: <https://doi.org/10.23919/CISTI.2019.8760893>.

VOGL, T. M. et al. (2020). Smart Technology and the Emergence of Algorithmic Bureaucracy: Artificial Intelligence in UK Local Authorities. In *Public Administration Review*, 80(6), 946-961. DOI: <https://doi.org/10.1111/puar.13286>.

YOUNG, M. M. et al. (2019). Artificial Discretion as a Tool of Governance: A Framework for Understanding the Impact of Artificial Intelligence on Public Administration. In *Perspectives on Public Management and Governance,* 2(4), 301-313. DOI: <https://doi.org/10.1093/ppmgov/gvz014>.

3.6 Digital Public Services: Redefining Citizen-Official Interactions

Author: Peter Decarli

3.6.1 General Introduction

Digitalisation profoundly influences public services, transforming how they operate and are offered to citizens. At the most basic level, digital public services can be defined as public services delivered or mediated through internet-based technologies (Jansen & Ølnes, 2016; Lindgren & Jansson, 2013). Digital public services are associated with and encompass several different terms, such as e-government service, e-service, public e-service, digital service, e-public service, and website channel (Lindgren & Jansson, 2013).

At the heart of both traditional analogue and new digital public services is the public encounter, defined as "the interaction of citizen and official as they communicate to conduct business" (Goodsell, 1981). Traditionally, the public encounter has referred to the purposeful interaction between the citizen and the public official as they communicate in order to transact business of some kind of mutual interest (Lindgren et al., 2019). While these interactions typically involve the exchange of information or the provision of public services, they can also involve issues of control or coercion. The actors involved have well-defined roles, and the relationships between them are asymmetric, with public officials acting as professionals with vested authority and citizens acting in their name before the sovereign state (Lindgren et al., 2019). These interactions can take place through a variety of media and channels and in a variety of settings.

The media and communication channels, the settings, and thus our understanding of the public encounter are changing with the digitisation of public services (Lindgren et al., 2019).

3.6.2 Importance and Benefits

Public sector organisations around the world are increasingly adopting digital technologies in support of public service delivery (Goodsell, 1981). Trends such as data mining, machine learning, sensor technology, and service automation have led to new opportunities for the digitisation of public service delivery (Matheus et al., 2020; European Commission, 2016). These new digital technologies have the potential to be the fulfilment of the primary goals of digital government:

One of the core ideas driving the digitisation of public services is the citizen self-service concept (Layne & Lee 2001; Madsen & Kræmmergaard, 2015). Citizens should be able to easily access government data and services from home (or elsewhere) using IT artefacts.

Another driving force behind the digitisation of public services is the need to streamline internal processes in government organisations to improve their efficiency. Thus, this development is driven by the intention to make dealing with citizens easier and dealing with governmental organisations more efficient (Axelsson et al., 2013).

Therefore, digital public services play a vital role in modernising municipalities, improving citizen interactions, and meeting sustainability targets. They turn local governments from classic bureaucratic organisations into smart cities and communities (Lindgren et al., 2019).

3.6.3 Practical Applications

The digitisation of public services has the potential to influence and even disrupt most if not all, aspects of public administration through the modernisation of the public encounter. The media and communication channels, the setting, and thus our understanding of the public encounter are changing with the digitisation of public services (Lindgren et al., 2019).

Figure 3.6.1 **The potential of digital public services**
Source: Daub et al. (2020).

Table 3.6.1 gives an overview of the main characteristics of the traditional analogue public encounter and the digital counterpart:

Table 3.6.1 **Main characteristics of the traditional public encounter and the digital encounter**

Aspect	Traditional public encounter	Digital encounter
Nature and purpose of encounter	Exchange of information. Service provision. Control or constraint.	Exchange of information. Service provision. Control or constraint.
Communication form and setting	Form: Letter, telephone call, office visit.	Form: digital channels (e.g., websites, e-mail, IP telephony or video, chat, social media, mobile apps, etc.).
	Typical setting (place): in a citizen's home, a government office, or an institutional building.	Typical setting (place): anywhere with internet access.
Central actors involved	Public official (executive or administrative personnel) and citizen.	Self-service for citizens downplays the role of the public official. The public official can be completely replaced by digital technology. Providers and designers of technology are influential actors.
Initiation, duration, and scope	Can be initiated by either actor (public official or citizen).	Can be initiated by either actor (public official or citizen), though typically by the citizen. Initiation may also be automated, without the involvement of human actors.
	Typically restricted to office hours. Can differ along longitudinal and lateral dimensions (regarding e.g., frequency and impact on citizen's life).	Can differ along longitudinal and lateral dimensions (regarding e.g., frequency and impact on citizen's life).

Source: Lindgren et al. (2019).

Nature and Purpose of the Digital Public Encounter

Digital public services serve all three of Goodsell's (1981) purposes: information exchange, public service provision, and control or constraint.

With emerging digital technologies, digital public services are no longer just about information exchange. The purpose of digitisation has shifted over time to include the provision of public services (Lindgren et al., 2019). This means that the entire service process is delivered through the digital channel. Examples include online applications for certificates and video-based meetings with public officials, such as digital medical consultations, where patients can consult with medical staff and receive medication

prescriptions through video-based conversations (Swedish National Board of Health and Welfare, 2018).

Fully automated processes and systems are also emerging, with entire services delivered digitally without the direct involvement of public officials (Wihlborg et al. 2016). In such automated digital public services, the system makes a formal decision and immediately communicates it to the user without the involvement of a human case worker (Wihlborg et al., 2016).

Finally, digital public services affect the government's ability to control and constrain (Lindgren et al., 2019). For example, when citizens use digital services to file their taxes, digitisation offers much more extensive options, such as electronic monitoring through bracelets in lieu of prison sentences, to comprehensive monitoring, such as China's social credit system (Liang et al., 2018).

Digital Public Encounter's Communication Forms and Settings

Digitalising public services has changed how citizens and public officials communicate. Internet-based technologies enable new forms of communication and facilitate communication and interaction through various channels (e.g. e-mail, digital forms, chat, IP telephony, mobile applications, etc.) (Lindgren et al., 2019). These new forms are a two-way communication street with citizens not only able to receive but also submit information through online forms. Citizens can also search for information without interacting with public officials or visiting a physical location, and information about various public services is now accessible from most devices with an Internet connection (Lindgren et al., 2019).

In addition, the framework for interaction between citizens and public officials is changing as public services are digitised. E-government solutions in the form of digital public services have changed the setting of the public encounter from an official's office to a technical device (Lindgren et al., 2019). In other words, digitisation is changing the location of public service provision (Pollitt, 2012). In the past, visiting an office at a specific time to meet with a specific public official was very much associated with providing public services. Citizen-government interaction is moving away from the traditional place of government into citizens' homes and devices (Pollitt, 2012).

Actors Involved in the Digital Public Encounter

The traditional public encounter is a dyadic interaction. The roles of the citizen and the public official are clear and scripted (Goodsell, 1981): The public official is a human professional with whom the citizen interacts, directly or indirectly.

In the context of digital public services, however, the roles seem to change: Citizens are expected to serve themselves by using the digital channel to interact with their government in the most extreme and archetypal digital public service (Madsen &

Kræmmergaard, 2015). Even if there remains some kind of human interaction, the roles and tasks of both the public official and the public service user change (Pollitt, 2012). Instead of tasks that revolve around face-to-face meetings, the public official may be faced with tasks that involve processing information on a computer, where the citizen being served is distant and there is no direct, personal interaction. The public servant may also become a support function, educating and assisting citizens with self-service applications (Pors, 2015). More importantly, technology may completely replace the traditional case worker.

In trying to understand digital public delivery, it's important to note that the public servant does not need to be just a person anymore but can also be an IT artefact. The public servant becomes a programmed system instead of a human agent with whom citizens can discuss and negotiate public provision (Lindgren et al., 2019).

In addition, new technologies are changing the user of public services (Pollitt, 2012). For citizens who previously found it difficult to interact with the public, digital public services can potentially increase access to public services. For example, citizens confined to their homes due to disability or illness can interact with the government independently, without representation from others, when using digital services (Pollitt, 2012). However, the very same technology can be used to exclude others from accessing public services, a phenomenon commonly described as the Digital Divide (Lindgren et al., 2019).

Box 3.6.1 **Digital Divide**

The term "Digital Divide" refers to the disparity between individuals, households, businesses, and geographic areas at different socio-economic levels concerning their opportunities to access information and communication technologies (ICTs). This concept encompasses not only the availability of digital resources but also the ability to use them effectively. The digital divide can mirror existing offline inequalities and is a significant factor in the transition towards sustainable, digitalised societies (Hartnett, 2019; OECD, 2001).

For a comprehensive understanding, Vassilakopoulou & Hustad's (2023) work provides an extensive literature review on the digital divide, highlighting contributing factors and measures for bridging this gap. Additionally, the OECD Digital Economy Papers offer insights into how ICTs contribute to economic growth and social well-being, further exploring the digital divide concept (OECD, 2001). Addressing the digital divide is crucial for ensuring equitable access to technology and its benefits, which is a step towards achieving digital inclusion.

3.6.4 Limitations and Challenges

Digital technologies can improve public services for the benefit of the citizens and society. However, there are also risks involved in the indiscriminate digitalisation of public services that politicians and administrators need to be aware of:

- **Control and constraint:** Digital public services have the potential to improve residents' quality of life through the convenience of service delivery. However, they can also be designed (e.g., using technologies that can generate and analyse large amounts of citizen data) for new types of control and constraint over citizens' behaviour and movements (Lindgren et al., 2019). Dealing with new technologies requires a balancing act to take advantage of new opportunities without descending into a total surveillance state similar to China's social credit system (Liang et al., 2018).
- **Actors involved in digital public services:** Since public officials can also be (represented by) IT artefacts, they can no longer be understood as merely human (Pieterson et al., 2017). The relationship between the citizen and the public official needs to be reinterpreted. These changes in the actors may affect the power balance between citizens and public officials and, consequently, citizens' trust in their government, e.g. regarding legitimacy and accountability (Wihlborg et al., 2016). Therefore, even if new technologies can perform certain tasks more efficiently or effectively, digital public services must also be discussed in terms of which tasks should be handed over to technology and which should be performed by humans (Busch & Henriksen, 2018; Lipsky, 2010). Beyond the technological challenge, there is the ethical question of whether artificial intelligence should be given the discretion to make decisions or whether this type of decision-making is something that should be left to human actors (Lindgren et al., 2019), particularly those involving complex ethical considerations, human judgment, and emotional intelligence. For instance, judicial decisions, social work, and diplomatic negotiations require a level of nuance and empathy that AI cannot replicate. Additionally, roles that demand creative problem-solving and those that involve direct human interaction, such as teaching and healthcare, benefit from the irreplaceable human touch.
- **Essential Competencies for the citizen-government interaction:** With digital public services, situations become more likely to have fewer caseworkers needed and public service encounters are shaped by IT experts (Hood & Dixon 2015). In this scenario, who will be the custodian of the knowledge necessary to understand the nature of public service delivery? Will the necessary knowledge be embedded in technology, or will this scenario lead to a situation where citizens have to be their caseworkers (Madsen & Kræmmergaard, 2016)? This becomes especially concerning for less technically savvy citizens who might be excluded entirely from public services (see Box 3.6.1 Digital Divide).

References

AXELSSON, K. (2013). Public e-services for agency efficiency and citizen benefit – Findings from a stakeholder centred analysis. In *Government Information Quarterly*, 30(1), 10-23. DOI: <https://doi.org/10.1016/j.giq.2012.08.002>.

BUSCH, P. A., HENRIKSEN, H. Z. (2018). Digital discretion: A systematic literature review of ICT and street-level discretion. In *Information Polity,* 23(1), 3-28. DOI: <https://doi.org/10.3233/IP-170050>.

European Commission (2016). eGovernment action plan 2016-2020 accelerating the digital transformation of government. Online. [09/01/2018]. Available at: <https://eurlex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0179>.

GOODSELL, C. T. (1981). The public encounter and its study. 1981 In C. T. GOODSELL (eds.). The public encounter: Where state and citizen meet, 3-20. Bloomington : Indiana University Press.

DAUB, M. et al. (2020). *Digital public services: How to achieve fast transformation at scale.* Online. [20/06/2024]. Available at: <https://www.mckinsey.com/~/media/McKinsey/Industries/Public%20and%20Social%20Sector/Our%20Insights/Digital%20public%20services%20How%20to%20achieve%20fast%20transformation%20at%20scale/Digital-public-services-How-to-achieve-fast-transformation-at-scale-vF.pdf>.

HARTNETT, M. (2019). Digital Divide and Digital Inclusion. In PETERS, M. (eds.) Encyclopedia of Teacher Education. Springer, Singapore. DOI: <https://doi.org/10.1007/978-981-13-1179-6_105-1>.

HOOD, C., DIXON, R. (2015). *A government that worked better and cost less? Evaluating three decades of reform and change in UK Central Government.* Oxford : Oxford University Press.

JANSEN, A., ØLNES, S. (2016). The nature of public e-services and their quality dimensions. In *Government Information Quarterly*, 33(4), 647-657. DOI: <https://doi.org/10.1016/j.giq.2016.08.005>.

LAYNE, K., LEE, J. (2001). Developing fully functional E-government: A four stage model. In *Government Information Quarterly*, 18(2), 122-136. DOI: <https://doi.org/10.1016/S0740-624X(01)00066-1>.

LIANG, F. et al. (2018). Constructing a data-driven society: China's social credit system as a state surveillance infrastructure. In *Policy & Internet,* 10(4), 415-453. DOI: <https://doi.org/10.1002/poi3.183>.

LINDGREN, I., JANSSON, G. (2013). Electronic services in the public sector: A conceptual framework. In *Government Information Quarterly,* 30(2), 163-172. DOI: <https://doi.org/10.1016/j.giq.2012.10.005>.

LINDGREN, I. et al. (2019). Close encounters of the digital kind: A research agenda for the digitalization of public services. In *Government information quarterly,* 36(3), 427-436. DOI: <https://doi.org/10.1016/j.giq.2019.03.002>.

LIPSKY, M. (2010). *Street-level bureaucracy. Dilemmas of the individual in public service.* (30th ann. ed.). New York : Russell Sage Foundation.

MADSEN, C. Ø., KRÆMMERGAARD, P. (2015). The efficiency of freedom: Single parents' domestication of mandatory e-government channels. In *Government Information Quarterly*, 32(4), 380-388. DOI: <https://doi.org/10.1016/j.giq.2015.09.008>.

MADSEN, C. Ø., KRÆMMERGAARD, P. (2016). Warm experts in the age of mandatory e-government: Interaction among Danish single parents regarding online application for public benefits. In *Electronic Journal of E-government,* 14(1), 87-98.

MATHEUS, R. et al. (2020). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. In *Government Information Quarterly*, 37(3), article ID 101284. DOI: <https://doi.org/10.1016/j.giq.2018.01.006>.

OECD (2001). Understanding the Digital Divide. OECD Digital Economy Papers, No. 49, Paris : OECD Publishing. DOI: <https://doi.org/10.1787/236405667766>.

PIETERSON, W. et al. (2017). New channels, new possibilities: a typology and classification of social robots and their role in multi-channel public service delivery. In JANSSEN, (eds.). *Proceedings of the 16th IFIP WG 8.5 International Conference on Electronic Government*, pp. 47-59. Springer, Berlin, Heidelberg. DOI: <https://doi.org/10.1007/978-3-319-64677-0_5>.

POLLITT, C. (2012). *New perspectives on public services: Place and technology.* Oxford : Oxford University Press.

PORS, A. S. (2015). Becoming digital – passages to service in the digitized bureaucracy. In *Journal of Organizational Ethnography*, 4(2), 177-192. DOI: <https://doi.org/10.1108/JOE-08-2014-0031>.

Swedish National Board of Health and Welfare (2018). Digitala vårdtjänster riktade till patienter. Kartläggning och uppföljning. Online. [20/06/2024]. Available at: <http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/20984/2018-6-15.pdf>.

VASSILAKOPOULOU, P., HUSTAD, E. (2023). Bridging digital divides: A literature review and research agenda for information systems research. In *Information Systems Frontiers*, 25(3), 955-969. DOI: <https://doi.org/10.1007/s10796-020-10096-3>.

WIHLBORG, E. et al. (2016). The computer says no! – A case study on automated decision-making in public authorities. In *Proceedings from 49th Hawaii International Conference on Systems Sciences (HICSS).* Washington, DC : IEEE Computer Society.

3.7 Modern Ways of Local Communication Utilizing ICT

Author: Ondrej Mital'

3.7.1 General Introduction

The importance of information in our society is exponentially rising. Thus, individuals, businesses, and governments aim to increase the effectiveness of the communication processes. One of the essential challenges shaping society's future development is how we handle the intensive flow of information and data. The sophistication of communication processes has constantly evolved, shaped by the development of digital solutions and information communication technologies (ICTs).

Modern means of communication enter our lives, changing our behaviour, and thus, the variety of ways of communicating is expanding fast (Bodea, 2020). Modern ways of communication must be perceived as part of wider social changes triggered by digital transition (Hilbert, 2020). In this regard, modern ways of communication-based on new digital technologies are changing the way we search, read, understand, store, and reuse information and data.

3.7.2 Importance and Benefits

Digital technologies have made our lives easier, mainly thanks to the availability of information and data that can be accessed anyhow, anywhere, and anytime. As a result of the digital transition and intensive use of digital technologies, municipalities and cities must implement innovative and new solutions demanded by different stakeholders. These preferences are even more complex if we consider the ambition of municipalities and cities to inform private companies and non-governmental organisations, citizens and tourists, young and older people, and many other entities.

Municipality inhabitants naturally seek to find necessary information by means they are used to using in other fields of their lives (commerce, personal life, hobbies, etc.). Among many other smart and digital solutions, modern ways of communication at the communal level include mainly the active use of social media, the development of smart apps, and the implementation of chatbots (Figure 3.7.1).

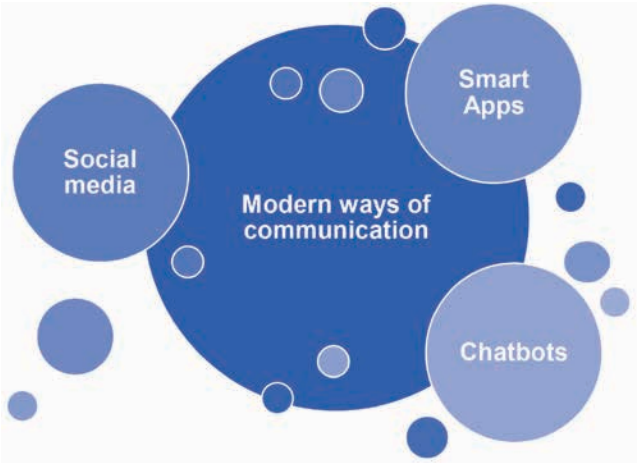

Figure 3.7.1 **Selected modern ways of communication**
Source: Authors.

The exponential rise and development of social media, digital technologies, and smart devices make communication, participation, interaction, and collaboration in real-time possible and ordinary (Lin, 2018). Social media can be perceived as a usual platform for communication and searching for information. These days, social media platforms are also being used to influence individuals' opinions and the outcomes of policymaking (Upadhyay, Verma, 2021). In this regard, social media can potentially influence the quality of information exchange between citizens and public institutions. Social media can potentially improve democratic life by ensuring citizens have easy access to political debates at all levels of governance (Karamat, Faroq, 2020). Moreover, governments and citizens should use social media to foster important aspects of democratic governance, mainly participation, negotiation, and collaboration (Brainard, 2016). However, social media represents just an additional and not the only platform for communication between public institutions and citizens.

The level of interest in using social media differs among the municipalities and cities. However, municipalities and cities should be active in using social media rather than passively using their pages after registration (Mabillard et al., 2022). In this regard, cities usually institutionalise social media use through special teams, managers, or social media policies. The sophistication of social media usage can, in the end, help cities to achieve higher-quality public policy outcomes.

Different digital activities of individuals are transforming from personal PCs or laptops to smartphones and tablets, such as mobile banking, working emails, and e-commerce. Public institutions also reflect this trend. Governments worldwide are creating citizen-oriented apps for external use, accessible to anyone who seeks to use government

services (Ganapati, 2015). Apps may be available on different levels of sophistication, from basic informational apps to full public e-service apps.

Apps help municipalities and cities involve different stakeholders in exchanging information and data. The need to plan and implement smart applications for citizens is becoming evident for better urban governance (Dutta et al., 2019). Information and data are both delivered and generated through apps. Thus, mobile apps help information and data circulate in smart cities (Rose et al., 2021). Municipalities and cities can develop their apps, or they can outsource this kind of services. Municipalities and cities should decide between universal apps that cover a wide range of public services, or they can also develop several specific apps such as informational apps, security apps, tourist apps, bike and car sharing apps, parking apps, and environmental apps.

Chatbots represent another modern way of communication used by public institutions. Chatbots usually create 24-hour informational services that operate thanks to AI-based tools. Besides, chatbots can be described as informational and user-friendly platforms available for citizens anywhere and anytime. Chatbots as conversational and virtual agents rapidly advance in complexity. However, many questions remain unanswered, such as the purposes and goals of chatbots or target stakeholders and associated interaction types (Cortés-Cediel et al., 2023).

Municipalities and cities may use chatbots to facilitate the interaction between stakeholders and policymakers (Kucherbaev et al., 2017). Chatbots still represent brand-new digital solutions for the communal level. The intention of local self-government units to implement chatbots as communication platforms is influenced by many factors, such as ease of use, leadership and innovative culture, external shock, and individual past experiences (Chen et al., 2024). The main benefits of chatbots are that this communication platform helps to achieve uniformity in response quality and timeliness in responding (Aoki, 2020), enrichment of citizens´ participation (Senadheera et al., 2024), personalisation of communication based on citizen´s needs (Zumstein Hundertmark, 2017). Considering the usual habits and conditions of a particular local community, municipalities and cities have to consider the perceived benefits of chatbot implementation. Chatbot implementation can cause additional personal and financial expenses, while its use, correctness of functioning and adaptability requirements point out existing limits.

Mentioned modern ways of communication exceed existing legal responsibilities and competencies. The intention of municipalities and cities to use these modern ways of communication is mainly affected by their benefits perceived both by cities and local communities (Figure 3.7.2).

Municipalities and cities can utilise social media, smart apps, and chatbots in their everyday functioning and can use these tools to share good practice examples.

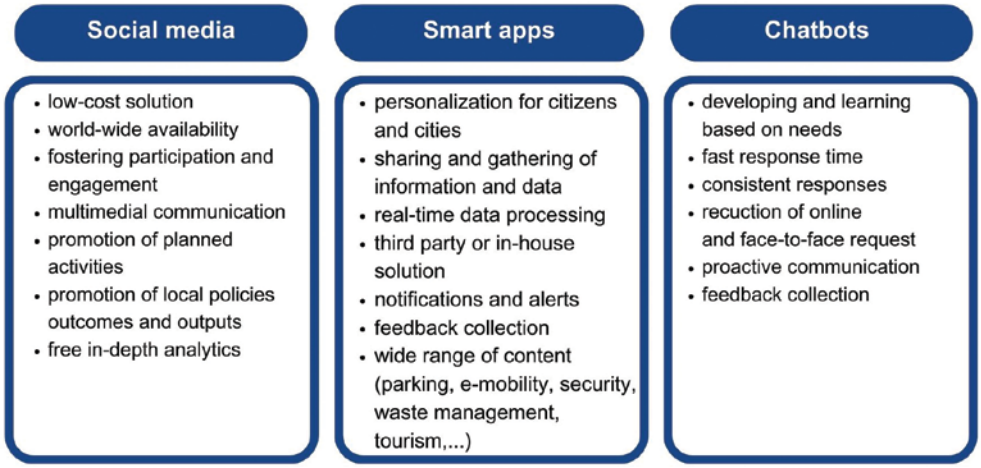

Figure 3.7.2 **Benefits of modern ways of communication – social media, smart apps and chatbots**

Source: Authors.

3.7.3 Practical Applications

Modern ways of communication are widely applicable to all spheres of communal life. Social media, smart apps, and chatbots can be perceived not only as one-way communication of municipalities and cities. The potential of these platforms is underlined by the fact that they can effectively manage the discourse, the exchange of opinions, and the collection of suggestions from inhabitants and stakeholders. Modern ways of communication make full use of their potential when they represent two-way communication between all local entities (mayor, municipal employees, inhabitants, local businesses, non-profit sector, church representatives, interest associations, etc.).

Modern ways of communication have several benefits, both for cities and stakeholders. Social media, smart apps, and chatbots are faster and quicker than traditional forms of communication. Information and data can be shared almost immediately, and individuals seeking information don´t need to wait in the queue. Social media, smart apps and chatbots are available 24 hours a day, seven days a week. Thus, they are not limited by human resources. In this regard, modern ways of communication have the potential to save administrative staff working hours. Simultaneously, the mentioned modern ways of communication foster remote two-way interaction and members of local communities can access information and data comfortably.

3.7.4 Limitations and Challenges

Using modern ways of communication at the communal level should lead to a result that utilises the opportunities of the changing information society while ensuring that no one is left behind.

The primary goal of modern ways of communication is to serve as important complementary communication platforms rather than primary ones. Municipalities and cities should be aware of the differences within the communal electorate and stakeholders. Different parts of the local community use different informational sources or a combination of such informational and communication platforms. Thus, communal policymakers should incorporate modern ways of communication into existing and more traditional communication tools. Inclusion efforts must be considered when reaching all age groups and disadvantaged inhabitants.

The use of virtual information space is significant for informational strategies in municipalities and cities. However, the prioritisation of virtual and modern communication platforms should not be perceived as the primary goal or an ideal, mainly because of the risks and limitations of their use. When taking into account the use of modern ways of communication, municipalities and cities should consider:

- all members of the local community should be targeted,
- the needs of disadvantaged groups of inhabitants should be considered,
- individuals with low levels of digital skills and digital literacy should be included,
- cost-effectiveness and benefits of implemented solutions should be considered.

Limits and risks related to the use of modern ways of communication are still evolving. Solutions that lead to the minimization of negative aspects of social media, smart apps and chatbots reflect the development of these digital communication platforms.

References

AOKI, N. (2020). An experimental study of public trust in AI chatbots in the public sector. In *Government Information Quarterly* 37(4), 101490. DOI: <https://doi.org/10.1016/j.giq.2020.101490>.

BODEA, B. (2020). The Surveillance of Modern Means Of Communication And The Authorization Of The Investigative Technique In Cases In Which The Account Holder Is Unknown. In *Curentul Juridic, The Juridical Current, Le Courant Juridique* 81, 150-155.

BRAINARD, L. A. (2016). Fostering Engagement Through Social Media? The Case of the Washington, DC. In ZAVATTARO, S., BRYER, T. (eds.) *Social Media for Government: Theory and Practice*, 117-134. New York : Routledge.

CHEN, T. et al. (2024). The Adoption and Implementation of Artificial Intelligence Chatbots in Public Organizations: Evidence from U.S. State Governments. In *The American Review of Public Administration* 54 (3), 255-270. DOI: <https://doi.org/10.1177/0275074023120052>.

CORTÉS-CEDIEL, M. E. et al. (2023). Trends and challenges of e-government chatbots: Advances in exploring open government data and citizen participation content. In *Government Information Quarterly* 40(4), 101877. DOI: <https://doi.org/10.1016/j.giq.2023.101877>.

DUTTA, J. et al. (2019). Unified framework for IoT and smartphone based different smart city related applications. In *Microsystem Technologies* 25, 83-96. DOI: <https://doi.org/10.1007/s00542-018-3936-9>.

GANAPATI, S. (2015). Using Mobile Apps in Government. Online [20/06/2024]. Available at: <https://www.businessofgovernment.org/sites/default/files/Using%20Mobile%20Apps%20in%20Government.pdf>.

HILBERT, M. (2020). Digital technology and social change: the digital transformation of society from a historical perspective. In *Dialogues in Clinical Neuroscience* 22(2), 189-194. DOI: <https://doi.org/10.31887/DCNS.2020.22.2/mhilbert>.

KARAMAT, A., FAROOQ, A. (2020). Emerging Role of Social Media in Political Activism: Perceptions and Practices. In *South Asian Studies* 31(1), 381-396.

KUCHERBAEV, P. et al. (2017). Chatbots as conversational recommender systems in urban contexts. In *CitRec '17: Proceedings of the International Workshop on Recommender Systems for Citizens*, 1-2. DOI: <https://doi.org/10.1145/3127325.3127331>.

LIN, Y. L. (2018). A comparison of selected Western and Chinese smart governance: The application of ICT in governmental management, participation and collaboration. In *Telecommunications Policy* 42(10), 800-809. DOI: <https://doi.org/10.1016/j.telpol.2018.07.003>.

MABILLARD, V. et al. (2022). Local governments' communication on social media platforms: refining and assessing patterns of adoption in Belgium. In *International Review of Administrative Sciences* 90(1), 65-81. DOI: <https://doi.org/10.1177/00208523221133229>.

ROSE, G. et al. (2021). Platform urbanism, smartphone applications and valuing data in a smart city. In *Transactions of the Institute of British Geographers,* 46(1), 59-72. DOI: <https://doi.org/10.1111/tran.12400>.

SENADHEERA, S. et al. (2024). Understanding Chatbot Adoption in Local Governments: A Review and Framework. In *Journal of Urban Technology*, 1-35. DOI: <https://doi.org/10.1080/10630732.2023.2297665>.

UPADHYAY, A., VERMA, H. (2021). *Social media platforms: Pressing need for neutrality.* Online. [20/06/2024]. Available at: <https://thedailyguardian.com/social-media-platforms-pressing-need-for-neutrality/>.

ZUMSTEIN, D., HUNDERTMARK, S. (2017). Chatbots – An Interactive Technology for Personalized Communication, Transactions and Services. In *IADIS International Journal on WWW/Internet* 15(1), 96-109.

4
Green Transition at the Communal Level

4.1 Sustainable Urban Transportation

Authors: Alina Cerasela Avram and George Cornel Dumitrescu

4.1.1 General Introduction

In the Cambridge Dictionary, sustainable means "causing, or made in a way that causes little or no environmental damage and, therefore, can continue for a long time", and transport is "the movement of people or goods from one place to another" (Cambridge Dictionary, 2024). Therefore, sustainable transportation should be the opposite of the current polluting fossil-fuel-based one and involve environmentally friendly systems, practices and modes that are environment-friendly and generate less noise and pollution.

Sustainable transportation should be economically and socially viable. As envisioned, it aims to create a better, healthier environment for all beings living on our planet, reducing dependencies on mineral fuels and other resources that are sometimes difficult to procure and whose production harms the earth. It is one of the steps required to stop global warming, a problem we all share.

The European Union has an ambition of a more sustainable, intelligent, and resilient transport system for the future – one that, today, presents significant risks to citizens' well-being in large municipalities with congested traffic. By establishing concrete milestones for 2030, 2035, and 2050 (Table 4.1.1) and focusing on ten action areas, the EU strategy seeks to foster a higher uptake of zero-emission vehicles, a better infrastructure, and more significant innovation in areas such as automation and artificial intelligence. The EU focuses on resilience, affordability, and accessibility, ensuring that a fair and inclusive transport system is put in place. This ambitious vision addresses the environmental impacts of transport. The vision is to consolidate the economic and social status of Europe's transport and connectiveness in all its regions while at the same time making it globally competitive and attractive for employment (European Commission, 2023).

Table 4.1.1 **Targets for sustainable transportation**

2030	2035	2050
• At least 30 million zero-emission cars will operate on European roads. • 100 European cities will be climate neutral. • High-speed rail traffic will double across Europe. • Scheduled collective travel for journeys under 500 km should be carbon neutral. • Automated mobility to be deployed at a large scale. • Zero-emission marine vessels will be market-ready.	• Zero-emission large aircraft will be market-ready.	• Nearly all cars, vans, buses, and new heavy-duty vehicles will be zero-emission. • Rail freight traffic will double. • A fully operational, multimodal Trans-European Transport Network (TEN-T) for sustainable, smart transport with high-speed connectivity.

Source: European Commission (2023).

Janic`s (2006) research emphasises the importance of policies focusing on environmental and human health protection and enhancing economic and social benefits. Transport sustainability should simultaneously address economic, environmental, and social dimensions to achieve a sustainable transport system supporting broader sustainable development goals.

4.1.2 Importance and Benefits

Transitioning to sustainable transportation is complex and involves significant budgets and an essential change in citizens' behaviour. In this regard, many objectives can be accomplished to ease the adoption of green transportation on a large scale. The most common way is replacing propulsion based on fossil fuels with a green one powered by renewable energy, such as electric engines, fuelled by electricity from batteries, solar panels, fuel cells, or hydrogen-based combustion. Reducing greenhouse gas emissions and particles responsible for climate change by promoting lighter, fuel-efficient, zero-emission vehicles and other transportation means, such as walking or biking, represents another greener and healthier option. In addition to that, municipalities could promote sustainable transportation by designing communities where walking is the first option, and green public transport is an alternative for longer routes. Municipalities should support ridesharing and bike-sharing programs that reduce the number of transportation means used (Figure 4.1.1).

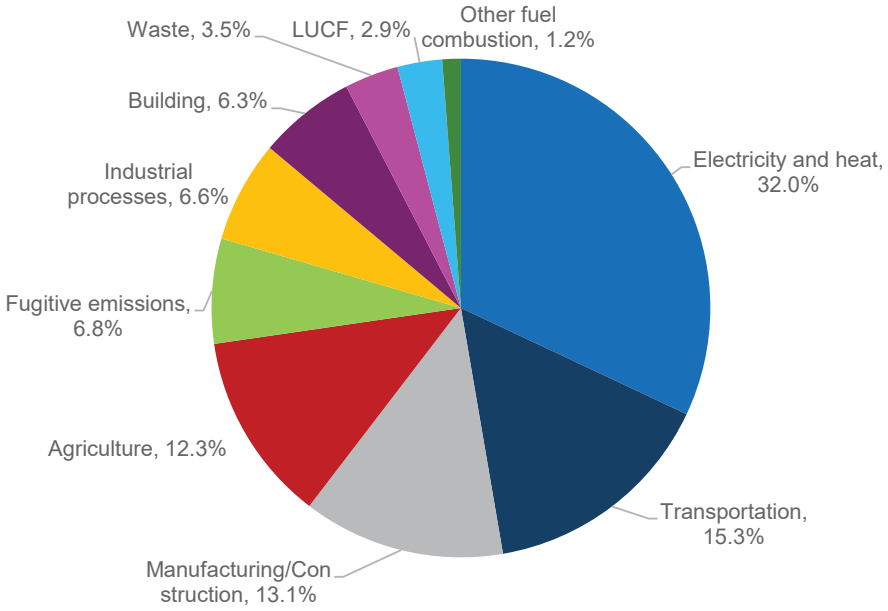

Figure 4.1.1 **Distribution of greenhouse gas emissions worldwide in 2020 by sector**
Source: Statista (2024a).

Terrestrial transport is of great importance to economic development. However, it is responsible for the negative environmental and societal impact. A country needs to mitigate this impact by assessing its costs and implementing policies favouring the transition towards sustainable transportation (Shen et al., 2011).

Green vehicles produce less greenhouse gas emissions, mainly when the required energy is provided from renewable sources. Since sustainable transportation implies a reduced number of cars on the streets, the emission of particulate matter, which harms human health, is expected to decrease (Figure 4.1.2).

If the current levels of particulate pollution persist, the world's population will lose 12.8 billion years of life (Statista, 2024b). Air pollution caused by fossil fuel-based transportation causes health issues like lung and heart diseases. Sustainable transportation promotes healthier modes of travel, such as walking and biking, contributing to better overall physical fitness.

Promoting green public transportation to various destinations of interest to all citizens, sustainable transportation reveals its inclusiveness and social equality benefits. It enables innovative urban development by reducing the need for individual polluting transportation means, freeing traffic and making the localities more attractive and liveable. Besides all the advantages of sustainable transport, the essential argument of the transition from the classical one is its impact on energy security, being known that modern transportation involves reducing fossil-fuel consumption, helping the EU achieve its open strategic autonomy.

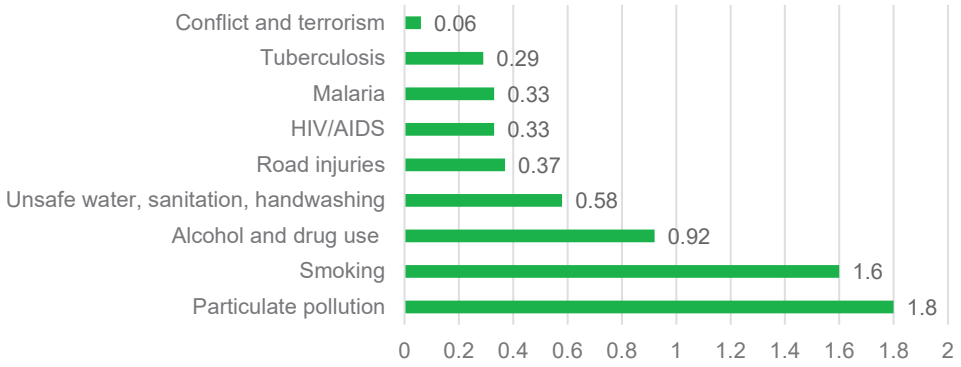

Figure 4.1.2 **Air pollution is the greatest human health risk. Average life expectancy lost per person worldwide due to the following**

Source: Statista (2024b).

4.1.3 Practical Applications

Sustainable transportation is a priority in the context of climate change and an increased dependency on hydrocarbon imports in the EU. Achieving strategic open autonomy in Europe implies changing how we report to and manage the resources. The green transformation of the transport sector is seen as a way to reduce these dependencies while reducing pollution. It is more desirable in congested municipalities with high pollution in terms of greenhouse gas emissions, particulates and noise. Therefore, such municipalities must address all the requirements of sustainable transportation by greening their fleets of buses, trolleybuses, trams, trains, and cars and developing the required infrastructure (charging stations, rails, renewable energy sources), bike lanes and pedestrian infrastructure.

For the first time since 1989, new modern trams have been introduced in Bucharest, and the number of trolleybuses has increased to 100, which are now added to the 100 electric buses. These measures have considerably increased public transport's comfort levels and accessibility.

Google Maps integration, the unified ticketing system with the metro, end-of-line inspections, outsourced cleaning service, and expanding the network to previously underserved neighbourhoods have all collectively produced a 40% increase in public transport usage. Looking forward, 250 new trams are to be purchased. Soon, Bucharest will have intelligent traffic lights and radial roads connecting the ring highway. These improvements will enhance transport efficiency and sustainability (Mediafax, 2024).

In addition, new residential or business developments should be designed to be compact and walkable in big cities and rural areas and have all the above-mentioned facilities. A recent article by Forbes (2024) shows the 30 most walkable cities in the world. A positive fact is that the European Union countries dominated the list, with

seven cities in the top ten (Florence, Riga, Hamburg, Porto, Madrid, Tallinn, Stockholm), ranking very high in the hierarchy.

In 2016, Barcelona introduced the concept of superblock (Superilles), or car-free space, which improved pedestrian mobility by reducing the traffic in the respective urban areas. Superilles is a government-funded project aiming to increase accessibility for pedestrians by creating these superblocks of 400x400 m units that are bigger than a block but smaller than a neighbourhood (Figure 4.1.3).

Figure 4.1.3 **Barcelona superblocks**
Source: Global Magazin (2020).

The project aims to improve biodiversity by recovering community space and encouraging social cohesion (Postaria, 2021).

To limit the number of vehicles on the streets, municipalities should also encourage ridesharing and car-sharing of electric vehicles and provide incentives for using them.

SMASH is an integrated mobility service financed by the EU that offers a platform that allows all to share their vehicles. If one has a bike, car or other unused means of transportation, he or she could list it on SMASH, and users can rent it. SMASH is comprehensive and will enable users to commute more easily, rent the most convenient solution for their trip, and find the nearest charging station or parking spot using the same app (CORDIS, 2024).

Whim is an app in Finland that provides subscribers access to all available transport providers, including taxis. Users can plan multimodal trips and pay according to their preferences (Transdev, 2024).

Moreover, employers can incentivise employees to use ridesharing, bike, or public transportation. They can offer flexible work hours for their employees, so they avoid the rush hours. The solutions should also be available for tourists. Tourist destinations can provide eco-friendly shuttle services, encourage walking or biking, and ensure that tourist attractions are easily accessible by public transit.

4.1.4 Limitations and Challenges

Over centuries, transportation evolved slowly from horse riding to carriages and ships. After the Industrial Revolution, transportation modes evolved faster, adding trains, automobiles, planes and space shuttles. There has always been progress in this regard, and it will always be. Regarding sustainable transportation and its future, one should consider various fields involved in its progress, such as environmental science, technology, engineering, urban planning, and policymaking. Looking at these fields, we can think of several trends.

According to Bouton et al. (2017), new mobility services, built on top of technological advancements such as mobile communications, cashless payments, remote monitoring, data collection and analytics, energy storage, and artificial intelligence, have emerged to provide people living in municipalities with a broader array of transport choices than ever before. These can be roughly categorised into four groups (Figure 4.1.4).

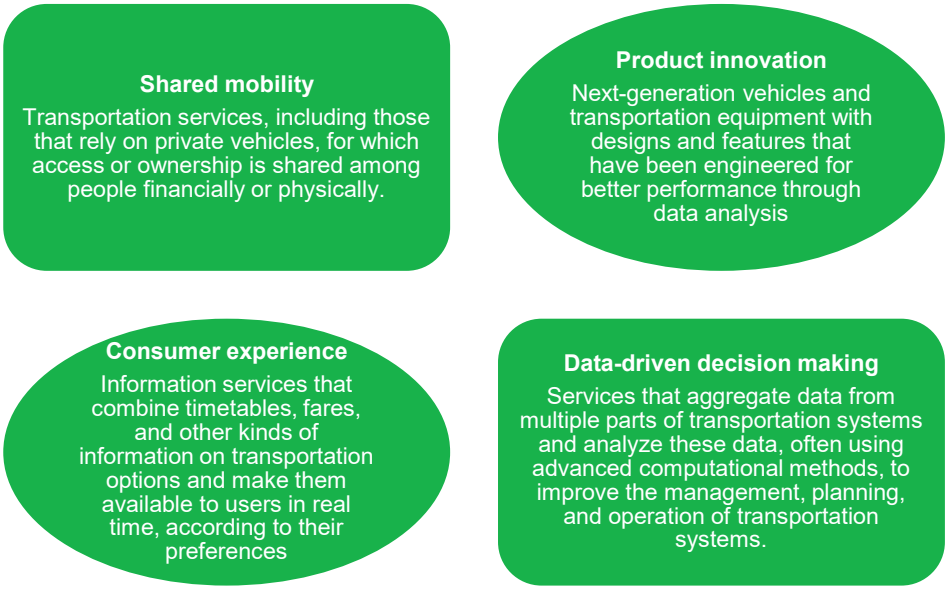

Figure 4.1.4 **New mobility services**
Source: Bouton et al. (2017).

Bouton et al. (2017) identified three new mobility applications that can help make public transportation more sustainable: dynamic trip planning and ticketing services (encourage citizens to take multimodal journeys), on-demand minibuses (fleet of electric minibuses hailed using a mobile app), and first – and last – mile ride sharing (which increase access to transportation for underserved city areas).

These trends require adaptation and partnerships between municipalities and private companies so that all stakeholders take advantage of the new mobility services and make transportation greener, accessible, affordable and efficient.

The electric vehicle technology will improve, particularly in hydrogen fuel cell vehicles. The projected fuel cell electric vehicle deployment worldwide will increase by 1360% between 2024 and 2028, from 233 thousand units to 3.4 million units, with Asian countries being the biggest market for this type of propulsion (Statista, 2024c). In 2022, there were insufficient hydrogen fuelling stations for road vehicles worldwide. The world leader was China, with 250, followed by Japan (161) and South Korea (141). From the EU, only Germany (93), France (21), the Netherlands (11), and Denmark (7) were in the world's top ten from this perspective (Statista, 2024d). Such stations should increase significantly to promote vehicles based on this propulsion and make fuel-cell electric cars more desirable. Municipalities should be aware of this trend and prepare accordingly.

The infrastructure supporting sustainable transportation will have to improve significantly (better public transportation networks, more electric vehicle charging stations, bike lanes, and modern pedestrian facilities to encourage walking). According to Statista (2024e), the number of charging stations for electric vehicles will increase by 51% between 2004 and 2008, from 2.2 million to 3.32 million.

Governments must enforce policies and regulations supporting sustainable transportation, such as incentives for buying green vehicles, stricter rules on combustion engine vehicles, urban planning policies promoting compact, walkable communities, and more. The number of electric and plug-in hybrid electric vehicles will also increase by 45% between 2024 and 2028, from 11.77 million vehicles to 17.07 million vehicles (Statista, 2024f). Therefore, municipalities should be at the forefront of this transition, ensuring the vehicle fleet adopts more and more green cars.

Based on Big Data, Artificial Intelligence will optimise routes and schedules for public transportation, improving traffic flow and reducing pollution with particulates. Consequently, autonomous vehicles will develop and enhance logistics by optimising routes and delivery times. They will also reduce the number of cars on the road and decrease traffic accidents. Statista (2024g) forecasts an increase of 172% in autonomous vehicles globally between 2024 and 2028, from approximately 26.56 thousand units to 72.28 thousand units.

Mobility as a service will be generalised (ridesharing, bike-sharing, scooter-sharing, car-sharing). According to the analysts of Mordor Intelligence, the global ridesharing market will grow from an estimated 47.62 billion USD in 2024 to 86.99 billion USD

by 2029, an increase of approximately 83% in the analysed timeframe (Mordor Intelligence, 2024).

People will own fewer means of transportation, preferring to use them as a service. Traffic and parking will be less congested.

The cumulative renewable capacity should increase significantly to ensure the energy required by green transportation. The IEA projections (2024) indicate that in the EU, the capacity will reach 1590 GW by 2030, while China's will peak at 3183 GW. Therefore, the EU members should develop more renewable energy capacities to remain among the countries with a competitive advantage.

The transition to sustainable transportation is a very complex and expensive process. This will involve heavy financial and material expenses in acquiring green vehicle fleets, charging or refuelling stations, and public, cyclist, or pedestrian transit infrastructure. The costs are burdensome for most municipalities. Still, the benefits are compensated by low operational expenses and many other advantages in the long run.

On a global scale, the shift to sustainable transport requires approximately 2 trillion dollars annually, which is close to the amount being spent on "business as usual" of 1.4 to 2.1 trillion dollars (UN, 2024).

The electric vehicles have a few shortcomings regarding charging time, range, and safety aspects. There are incidences reported of battery fires because of over-heating or high-impact force. Encouraging the use of electric vehicles requires incentives for buyers and implementing renewable energy sources for sustainable charging.

The transition to sustainable transportation requires a change in human behaviour, which can be achieved through education, incentivisation, which is also costly, and support policies. Changing people's habits is difficult, but the prize is a better and healthier environment for them. Moreover, green transport needs to be inclusive and equitable.

Municipalities must create walkable neighbourhoods and plan the coordinates of residential buildings, shops, and businesses accordingly.

The transition towards sustainable transportation can affect the labour force. Therefore, support for affected workers and communities alongside professional conversion programs will be required.

Green transportation is necessary, particularly in congested urban areas where pollution affects the health and well-being of the citizens due to greenhouse gas emissions, particulates, and noise.

Consequently, for this air pollution to decrease, the municipalities and cities must improve green mass transportation (trains, buses, trams) and individual means such as electric or hydrogen cars, bicycles, and scooters. In so doing, they decongest the traffic, improve the quality of the environment, and make their communities more desirable.

A green transportation ecosystem and infrastructure would also save time, an important asset.

An essential consideration in the green transportation equation is the source of energy. Municipalities and cities should empower these transportation means with electricity, hydrogen, or other green fuels produced from renewable sources.

References

BEGLEY-BLOOM, L. (2024). *Ranked: The 30 Most Walkable Cities in The World, According To A New Report.* Online. [20/06/2024]. Available at: <https://www.forbes.com/sites/laurabegleybloom/2024/06/30/ranked-the-30-most-walkable-cities-in-the-world-according-to-a-new-report/>.

BOUTON, S. et al. (2017). *Public–private collaborations for transforming urban mobility.* Online. [20/06/2024]. Available at: <https://www.mckinsey.com/capabilities/sustainability/our-insights/public-private-collaborations-for-transforming-urban-mobility#/>.

Cambridge Dictionary. (2024). Dictionaries. Online. [20/06/2024]. Available at: <https://dictionary.cambridge.org/dictionary/>.

CORDIS. (2024). Smart Sharing. Online. [20/06/2024]. Available at: <https://cordis.europa.eu/article/id/397840-bringing-smart-mobility-into-the-sharing-economy>.

European Commission. (2023). Mobility and Transport. Mobility Strategy. In *Strategy Studies*. Online. [20/06/2024]. Available at: <https://transport.ec.europa.eu/transport-themes/mobility-strategy_en>.

Global Magazin. (2020). Barcelona superblocks. Online. [20/06/2024]. Available at: <https://globalmagazin.com/wp-content/uploads/2020/11/barcelona-Kaspars-Upmanis-unsplash.jpg>.

IEA. (2024). Global cumulative renewable capacity in 2022, and capacity ambitions for 2030 by region. Online. [20/06/2024]. Available at: <https://www.iea.org/data-and-statistics/charts/global-cumulative-renewable-capacity-in-2022-and-capacity-ambitions-for-2030-by-region>.

JANIC, M. (2006). Sustainable transport in the European Union: A review of the past research and future ideas. In *Transport Reviews*, 26(1), 81-104. DOI: <https://doi.org/10.1080/01441640500178908>.

Mediafax. (2024). Nicușor Dan susține că utilizarea transportului public în București a crescut cu 40%. Pariez pe tramvai! Online. [20/06/2024]. Available at: <https://spotmedia.ro/stiri/social/nicusor-dan-sustine-ca-utilizarea-transportului-public-in-bucuresti-a-crescut-cu-40-pariez-pe-tramvai>.

Mordor Intelligence. (2024). Ridesharing Market Analysis. Online. [20/06/2024]. Available at: <https://www.mordorintelligence.com/industry-reports/ridesharing-market>.

POSTARIA, R. (2021). *Superblock (Superilla) Barcelona – a city redefined.* Available at: <https://www.citiesforum.org/news/superblock-superilla-barcelona-a-city-redefined/>.

SHEN, Y. et al. (2011). Sustainable road transport in the European Union: Changes in undesirable impacts. In *Transportation research record*, 2242(1), 37-44. DOI: <https://doi.org/10.3141/2242-05>.

Statista. (2024a). Distribution of greenhouse gas emissions worldwide in 2020, by sector. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/241756/proportion-of-energy-in-global-greenhouse-gas-emissions/>.

Statista. (2024b). Air Pollution Is The Greatest Human Health Risk. Online. [20/06/2024]. Available at: <https://www.statista.com/chart/16154/average-life-expectancy-lost-per-person-worldwide/>.

Statista. (2024c). Projected fuel cell electric vehicle deployment worldwide between 2020 and 2030. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/1272505/fuel-cell-electric-vehicle-global-deployment/>.

Statista. (2024d). Number of hydrogen fueling stations for road vehicles worldwide as of 2022, by country. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/1026719/number-of-hydrogen-fuel-stations-by-country/>.

Statista. (2024e). Charging stations. Online. [20/06/2024]. Available at: <https://www.statista.com/outlook/mmo/electric-vehicles/worldwide#unit-sales>.

Statista. (2024f). Vehicle sales. Online. [20/06/2024]. Available at: <https://www.statista.com/outlook/mmo/electric-vehicles/worldwide#unit-sales>.

Statista. (2024g). Number of autonomous vehicles globally in 2022, with a forecast through 2030. Online. [20/06/2024]. Available at: <https://www.statista.com/statistics/1230664/projected-number-autonomous-cars-worldwide/>.

Transdev. (2024). "Whim": one subscription for all your transport needs. Online. [20/06/2024]. Available at: <https://www.transdev.com/en/solutions/whim-maas/>.

UN. (2024). Fact Sheet- Financing sustainable transport. Online. [20/06/2024]. Available at: <https://www.un.org/sites/un2.un.org/files/media_gstc/FACT_SHEET_financing_sustainable_transport.pdf>.

4.2 Advocating Green Buildings in the Municipal Landscape

Author: Andreea-Emanuela Drăgoi

4.2.1 General Introduction

There are many valid approaches to defining a green building. Still, all emphasise a key element: such buildings have implemented the design and operation process to minimise or eliminate their environmental impact.

While the concept of green buildings may be traced back to the energy crisis in the 1960s, which spurred crucial research and activities to improve energy efficiency and decrease environmental pollution, presently, the focus is on energy-efficient and environmentally friendly building construction practices.

The concept of green building focuses on the design, construction, and operation of buildings to reduce their environmental impact and enhance occupant health and well-being. Green buildings incorporate energy efficiency, renewable energy, water conservation, sustainable materials, and waste reduction. The European Union (EU) aims to boost green buildings in the Member States through various initiatives and legal frameworks. The EU's Green Deal, aiming for climate neutrality by 2050, includes the Renovation Wave Strategy to improve building energy performance. The Energy Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED) are also key regulations, mandating nearly zero-energy buildings (NZEB) for new constructions and major renovations and setting energy performance standards. Moreover, other financial instruments like the European Regional Development Fund (ERDF) and the Horizon Europe Projects support green building development in the Member States. Against this background, one may say that the current legal framework has significantly impacted the evolution of green buildings in the EU by setting ambitious targets, providing financial support, and fostering innovation in sustainable construction practices, thus promoting a transition towards a more sustainable built environment across the continent.

Kubba (2016) shows that green building practices and their impact focus on occupant well-being, addressing aspects such as space use and air quality. Reddy & Jagadish (2003) point out a comprehensive view of green building's contributions to environmental preservation. The concept of green building is closer to sustainable building and construction. Apart from energy efficiency, it also includes aspects such as decreasing CO2 emissions.

While both sustainable and green buildings prioritise environmental benefits (Liu et al., 2021), sustainable buildings tend to take a broader approach that includes social and economic factors. In contrast, green buildings often emphasise environmentally friendly design and operation practices. Moreover, Liu et al. (2022) emphasise that green buildings concentrate on reducing the environmental impact of the building itself through

energy efficiency, water conservation, and improved indoor environmental quality, while sustainable buildings take a more holistic approach, incorporating not only the environmental aspects but also social and economic dimensions. In practice, that entails the objective of long-term viability by balancing environmental performance with social equity and economic feasibility (for sustainable buildings).

Sustainable buildings focus on minimising their overall environmental impact throughout their entire life cycle, from design and construction to operation and eventual demolition. Sustainability goals may encompass energy efficiency, water conservation, the use of renewable materials, waste reduction, and indoor environmental quality.

Some analyses (Eichner & Ivanova, 2019) state that bioclimatic design is mandatory for a green building. The bioclimatic design principles include shading from the summer sun and collecting the winter sun with a thoughtful orientation of the building and placement of the windows and skylights, indoor lighting designed to ensure a safe, productive, and warm environment with a minimum amount of energy use and designs that provide natural daylight enters the building while minimising the energy consumption.

At the EU level, the primary regulation in the field is the Communication on Resource Efficiency Opportunities in the Building Sector, adopted in 2014. Currently, in the EU, there are several green building rating systems, many of which rate the materials used for construction to reduce energy consumption while gradually achieving minimum energy consumption for buildings.

The EU's policies in the field of energy savings for buildings have shown the expected results in recent years. According to EU Building Stock Observatory 6 data (BSO, 2024), European buildings' energy consumption has significantly declined.

The latest data (available only for 2021) show that final energy consumption in residential buildings in EU-27 has decreased in the last decade, while direct emissions due to fossil fuel use have also diminished.

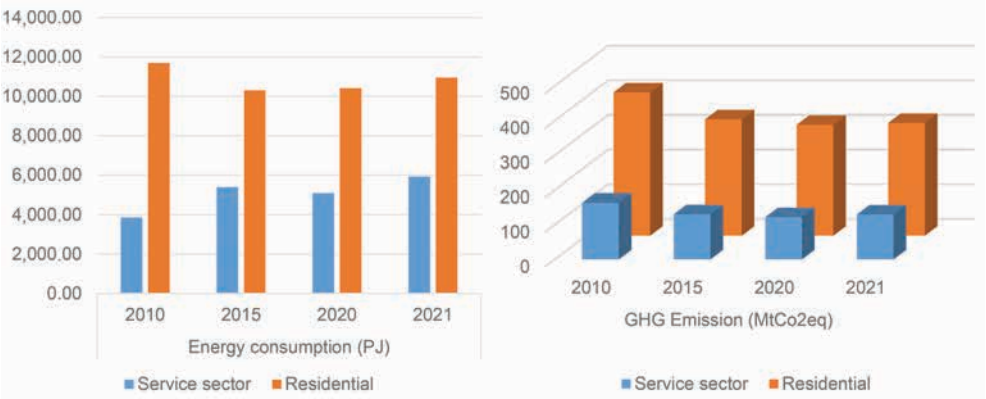

Figure 4.2.1 **Toward more sustainable buildings across EU-27**

Source: Author based on European Commission (2024).

Note: PJ stands for Petajoule, a unit of energy used to express the energy contents of fuels and other energy sources. 1 PJ = 1,000 TJ. MtCO2eq is the abbreviation of Million Tons of carbon dioxide equivalent.

Figure 4.2.1 shows that the most significant decrease in both energy consumption and GHG emission of the buildings from EU's residential area occurred during the first year of the COVID-19 pandemic, while a minor increase may be noticed for both indicators in the following year (due to partial rebound as economic activities resumed and behavioural patterns shifted once again toward pre-pandemic level). The most significant decrease in energy consumption and greenhouse gas (GHG) emissions from EU residential buildings occurred during the first year of the COVID-19 pandemic due to widespread lockdown measures that reduced energy demand in buildings due to decreased occupancy, altered working patterns (such as remote work), and changes in heating and cooling requirements.

Moreover, according to the European Environment Agency (2023) data, greenhouse gas emissions from EU buildings decreased by 31% between 2005 and 2021 (Figure 4.2.2). This trend was driven by higher energy efficiency standards for new buildings, improvements in existing buildings, decarburisation of the electricity and heating sectors, and warmer temperatures.

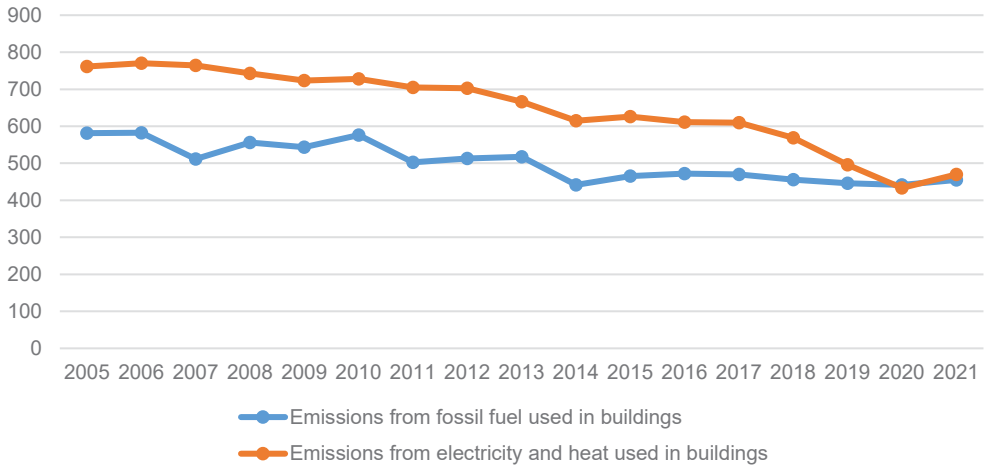

Figure 4.2.2 **GHG emissions from energy use in buildings in EU-27**
Source: Author based on European Environment Agency (2024).

4.2.2 Importance and Benefits

Green heating systems in the EU use four guiding principles, whether for residential or institutional use: efficiency, utility, durability, and comfort. These principles are ensured by using recycled materials, reducing waste from heating process construction, reducing pollution to minimise carbon emissions, and managing and maximising water and energy consumption to reduce operating costs.

A green building reduces its impact on the environment throughout its lifetime. Sustainability also has a positive economic effect, reducing costs using green methods – one of the most effective methods of reducing costs is energy performance.

A green building lessens or eliminates negative environmental impact and may even positively influence our natural setting, from design to construction and commissioning. Green buildings conserve precious natural resources and improve our quality of life.

A green building contributes to improving its occupants' lifestyle and comfort and caring for the environment. In a green building, renewable energy sources are used economically considering the environment. They are located nearby, either on the building or the land owned by the building. Therefore, the consumption will be covered mainly by renewable energy sources produced right on the spot.

Green buildings typically refer to structures that incorporate environmentally friendly design (see Box 4.2.1), construction, and operation practices to reduce environmental impact. These practices may include energy-efficient systems, using sustainable materials, incorporating renewable energy sources, water-efficient fixtures, and waste-reduction strategies.

Box 4.2.1 **Environmentally friendly design is usually incorporated into green buildings**

Type	Benefits	Overview of the literature
Green roofs	Being partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane, green roofs help reduce urban heat island effect, improve air quality, manage storm water, and provide insulation to reduce energy usage.	Berardi (2016) highlights how green roofs contribute to improving the outdoor microclimate by mitigating the urban heat island effect and enhancing air quality. Additionally, green roofs offer significant energy savings by providing natural insulation, which reduces the need for heating and cooling inside buildings.
Solar panels	Solar panels harness solar energy for electricity, reducing reliance on non-renewable energy sources.	Zhai et al. (2007) present an integrated system of heating, air-conditioning, natural ventilation and hot water supply based on solar energy, which was designed for the green building of Shanghai institute of architecture science.

Continuation of Box 4.2.1

Type	Benefits	Overview of the literature
Rainwater Harvesting Systems	This system is eco-friendly through the practice of collecting and storing rainwater for non-potable uses such as irrigation, flushing toilets, and cooling towers. In doing so it helps reducing the demand on municipal water supplies.	Campisano et al., 2017 are showing that while Rainwater Harvesting (RWH) is probably the most ancient practice in use in the world to cope with water supply needs, recently, as a result of new technological possibilities, many countries are supporting updated implementation of such practice to address the increase in water demand pressures and environmental challenges.
Energy-Efficient Lighting	The design that proposes the use of LED lighting and smart lighting systems that adjust based on occupancy and natural light availability, help reducing energy consumption.	Dubois and Blomsterberg (2011) review the potential energy savings from implementing energy-efficient lighting in office buildings and they show that there is a significant reduction in energy use and operational costs that can be achieved through advanced lighting technologies, contributing to overall building sustainability.
High-Performance Insulation	Using advanced insulation materials may improve thermal efficiency, thereby reducing the need for heating and cooling.	Zinzi and Agnoli (2012) compare the benefits of cool roofs and green roofs, highlighting high-performance insulation as a key factor in passive cooling strategies. The research demonstrates how effective insulation can enhance indoor comfort and significantly lower energy consumption in residential buildings.
Low-Emissivity Windows	Installing windows that have a special coating to minimize the amount of infrared and ultraviolet light that comes through the glass without compromising the amount of visible light transmitted.	Rissman & Kennan (2013) are showing that lowemissivity windows (“low-e”) use a transparent coating that blocks infrared radiation, keeping heat out side the building on hot days and keeping it inside the building on cold days. Relative to an ordinary, single-pane window, the best lowe windows can reduce heat loss by 85%.

Source: Authors based on the references.

Green buildings often focus on reducing resource consumption and minimising pollution during construction and occupancy. According to some studies (Alsulaili et al., 2020; Ding et al., 2018), green buildings are environmentally friendly and have great endurance. Ding et al. (2018) show that the life cycle of a green building extends beyond these initial phases, with its full benefits becoming more apparent during the operational stages of the building. Alsulaili (2020) shows that the concept of green buildings encompasses using eco-friendly materials (see Box 4.2.2) in residential houses to develop more sustainable and high-performance buildings.

Box 4.2.2 **Type of eco-friendly material typically used in the construction of green buildings**

Type	Benefits	Overview of the literature
Recycled Materials	Recycled steel, reclaimed wood, recycled glass, and recycled plastic reduce the demand for virgin resources, decrease energy consumption during production, and divert waste from landfills.	Pacheco-Torgal (2014) provides an in-depth analysis of the life cycle assessment of various construction materials, emphasizing the benefits of using recycled materials to enhance sustainability in the construction industry.
Bamboo	Bamboo grows rapidly and can be harvested sustainably without replanting. It has a high strength-to-weight ratio, making it a durable alternative to traditional hardwoods.	van der Lugt, van den Dobbelsteen & Janssen, (2006) are evaluating bamboo‘s potential as a sustainable building material, focusing on its rapid growth, renewability, and structural properties.
Low-VOC (Volatile Organic Compounds) Paints and Finishes	Low-VOC paints release fewer harmful chemicals into the air, improving indoor air quality and reducing health risks for occupants.	US EPA. (2016) is essentially a guide published by the US Environmental Protection Agency and explains the importance of low-VOC paints and finishes in improving indoor air quality and reducing health risks.
Hempcrete	Hempcrete, or “hemp-lime”, is a medium density natural insulation material produced by wet-mixing hemp shiv with a lime binder, which has extraordinary thermal properties and “deep-green” sustainability credentials.	Walker et al. (2014) underline the properties and benefits of hempcrete, highlighting its insulating capabilities, breathability, and carbon sequestration properties.

Continuation of Box 4.2.2

Type	Benefits	Overview of the literature
Cross-Laminated Timber (CLT)	CLT is made from layers of wood glued together at right angles, creating a strong and sustainable building material. CLT is unique in that it has a strength-to-weight ratio that's comparable to concrete, despite being five-times lighter.	Brandner (2013) discusses the production processes, structural properties, and environmental benefits of CLT, emphasizing its role in sustainable construction.
Cork	Cork in green building maintains its structural integrity and performance consistency over time, contributing to the solidity and reliability of structures. With an optimal insulating capacity, characterized by a lambda value of 0.039, cork is indispensable for thermal insulation in buildings.	Gil (2015) discusses the properties and applications of cork composites, highlighting their environmental benefits and suitability for sustainable construction.

Source: Authors based on the references.

As shown in Box 4.2.1 and Box 4.2.2, the used materials and eco-friendly design of green buildings are key elements that bring important benefits for sustainability and the well-being of the occupants. Moreover, using eco-friendly materials, also known as sustainable or green building materials, allows the creation of buildings that are not only sustainable but also high-performing in terms of energy use, indoor air quality, and overall environmental footprint.

4.2.3 Practical Applications

As mentioned, green buildings may be developed for business and housing projects. Such a business project was the construction of the Penny Market Otopeni, which received BREEAM certification. The Penny Market Otopeni has a grassy roof and is partially covered with photovoltaic panels and 55 tubes that bring natural light inside the store. Rainwater from the roof is collected and reused for toilets. The walls on the south side are also clad with photovoltaic panels, and the east side supports climbing plants. The grass roof and the rest of the green areas contain acclimatised plants that do not need irrigation. In the parking lot, there are two places for electric cars, with the corresponding chargers and a platform for car sharing, and near the entrance, there are racks for bicycles. The site has been carefully analysed to ensure safe pedestrian routes

(sidewalks, pedestrian crossings and markings to regulate pedestrian priority). Innovation is represented by the markings for people with visual disabilities, led from the site's entrance to the store, from where the staff is trained to help them make their purchases. The equipment is energy efficient, and their use is optimised to consume as little electricity as possible.

Romania's financial institutions support the development of green buildings as greenhouses through the national scheme of Green Mortgage. The scheme enables the development of green buildings in residential areas near big cities, allowing residential investors and developers to facilitate a rapid and profitable transformation of the construction and real estate industry toward a low-carbon and green economy.

For housing projects, a best practice example is the green residential area that was constructed in the Lake District in Iași County, Romania. This project is located in the Miroslava community near Iasi. It has begun construction with plans for over 600 row houses, with the first tranche certified in the RoGBC Green Homes program. The project uses innovative structurally insulated panels to achieve superior energy performance, seismic resistance and construction quality while maintaining affordability. The Lake District project's homes include passive solar design and optimised natural ventilation, Forest Stewardship Council (FSC)-certified wood and water efficient sanitary items and landscaping. The project's construction management diverts over 50% of construction waste from landfills (with 25% being standard industry practice).

Another successful project is West Side Park, developed by Studium Green in Cluj-Napoca. West Side Park is a residential project comprising 244 apartments. The project stands out through the generous high-performance windows and large balconies in each apartment; the ventilated facade includes photocatalytic ceramics treated with titanium dioxide, which protects against pollution and constantly produces active oxygen. The project also hosts the most extensive green suspended terrace in Transylvania, with an area of 2500 sqm (about the area of a large mansion), along with other green spaces on the premises that are freely accessible to tenants. The West Side Park residential project was completed in 2019 and has received the class "A" for energy performance.

4.2.4 Limitations and Challenges

There are many challenges related to green building construction. While green buildings are designed to be durable to minimise repairs, their construction principles demand better planning efforts and "integrated design" of the different disciplines to ensure optimal results, maximise the use of space, avoid costly construction mistakes, and minimise waste (Ghaffarian Hoseini et al., 2013). Some of the challenges of green buildings are related to fire safety, as Meachan et al. (2013) pointed out. Also, the common idea is that high technology means high price and that green buildings equal high-cost buildings (Kats, 2003). Some researchers (Furchtgott-Roth, 2012) argue that

certified green buildings cannot save money or energy, while others show that green buildings can contribute significantly to energy and money savings and provide environmentally friendly construction (Hwang & Tan, 2012). However, as demonstrated by the projects constructed in Romania, many green building projects may incur additional costs because the green design often includes efficient mechanical systems, which are pretty expensive and complex.

In conclusion, our main finding is that the concept of green buildings has evolved, focusing on minimising or eliminating their environmental impact through design and operational processes. While various definitions exist, they all underscore the importance of ecological stewardship and occupant well-being. The European Union aligns the concept of green buildings closely with sustainability and sustainable construction, emphasising energy efficiency and factors such as CO2 emissions reduction and eco-friendly materials.

Our second finding indicates that green buildings offer enduring benefits, extending beyond initial construction phases to provide long-term environmental and economic advantages. Bioclimatic design principles and renewable energy sources are integral to green building practices. At the EU level, regulations and green building rating systems promote resource efficiency and energy performance in building construction and operation.

Our last finding is that despite their benefits, challenges still need to be addressed in green building construction, including the need for integrated design approaches, fire safety considerations, and perceptions of higher costs associated with green technology. However, evidence suggests that green buildings can save energy and cost while promoting environmentally friendly construction practices.

References

ALSULAILI, A. D. et al. (2020). Environmental and economic benefits of applying green building concepts in Kuwait. In *Environment, Development and Sustainability*, 22, 3371-3387. DOI: <https://doi.org/10.1007/s10668-019-00352-1>.

AVRAM, A. et al. (2023). *DiGreen Handbook of GREEN good Practice: Solutions for cities and municipalities.* Online. [27/06/2024]. Available at: <https://bia.unibz.it/esploro/outputs/991006685597001241?institution=39UBZ_INST&skipUsageReporting=true&recordUsage=false#file-0>.

BERARDI, U. (2016). The outdoor microclimate benefits and energy saving resulting from green roofs retrofits. In *Energy and Buildings*, 121(1 June 2016), 217-229. DOI: <https://doi.org/10.1016/j.enbuild.2016.03.021>.

BRANDNER, R. (2013). Production and technology of cross-laminated timber (CLT): A state-of-the-art report. In *European Journal of Wood and Wood Products,* 71(3), 373-392. DOI: https://doi.org/10.1007/s00107-013-0721-5

BSO. (2024). BSO factsheets. Online. [20/06/2024]. Available at: <https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/eu-building-stock-observatory_en>.

CAMPISANO, A. et al. (2017). Urban rainwater harvesting systems: Research, implementation and future perspectives. In *Water research,* 115(15 May 2017), 195-209. DOI: <https://doi.org/10.1016/j.watres.2017.02.056>.

CREŢU, R. F., CIOBOTAR, G. N. (2015). Researches Regarding the Green Buildings Assessement in Romania. In *Natural Gas,* 100(217), 117.

DING, Z. et al. (2018). Green building evaluation system implementation. In *Building and Environment*, 133(April 2018), 32-40. DOI: <https://doi.org/10.1016/j.buildenv.2018.02.012>.

DUBOIS, M. C., BLOMSTERBERG, Å. (2011). Energy saving potential and strategies for electric lighting in future North European, low energy office buildings: A literature review. In *Energy and Buildings,* 43(10), 2572-2582. DOI: <https://doi.org/10.1016/j.enbuild.2011.07.001>.

EICHNER, M., IVANOVA, Z. (2019). Bioclimatic architecture as the main part of green building. In *E3S Web of Conferences 91, article ID 05015.* DOI: <https://doi.org/10.1051/e3sconf/20199105015>.

European Commission. (2024). BSO-EU Building Stock Observatory – Factsheets. Online. [20/06/2024]. Available at: <https://building-stock-observatory.energy.ec.europa.eu/factsheets/>.

European Environment Agency. (2024). Greenhouse gas emissions from energy use in buildings in Europe. Online. [20/06/2024]. Available at: <https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-energy>.

FURCHTGOTT-ROTH, D. (2012). The elusive and expensive green job. In *Energy economics*, 34 (November 2012), S43-S52. DOI: <https://doi.org/10.1016/j.eneco.2012.08.034>.

GHAFFARIAN HOSEINI, A. et al. (2013). Sustainable energy performances of green buildings: A review of current theories, implementations and challenges. In *Renewable and sustainable energy reviews*, 25(September 2013), 1-17. DOI: <https://doi.org/10.1016/j.rser.2013.01.010>.

GIL, L. (2015). Cork composites: A review. In *Materials,* 8(9), 625-644. DOI: <https://doi.org/10.3390/ma8096256>.

HWANG, B. G., TAN, J. S. (2012). Green building project management: obstacles and solutions for sustainable development. In *Sustainable development,* 20(5), 335-349. DOI: <https://doi.org/10.1002/sd.492>.

KATS, G. (2003*). Green building costs and financial benefits.* Boston : Massachusetts technology collaborative.

KUBBA, S. (2016). *LEED v4 practices, certification, and accreditation handbook.* Waltham : Butterworth-Heinemann.

LIU, W. et al. (2022). Comparative analysis Chinese green buildings' of input–output effect based on data envelope analysis. In *Buildings,* 12(5), 659. DOI: <https://doi.org/10.3390/buildings12050659>.

MEACHAM, B. et al. (2013). Fire safety challenges of green buildings. In *Springer Science & Business Media.* New York : Springer New York. DOI: <https://doi.org/10.1007/978-1-4614-8142-3>.

PACHECO-TORGAL, F. (2014). *Eco-efficient construction and building materials: Life cycle assessment (LCA), eco-labeling, and case studies.* Philadelphia : Woodhead Publishing.

REDDY, B. V., JAGADISH, K. S. (2003). Embodied energy of common and alternative building materials and technologies. In *Energy and Buildings,* 35(2), 129-137. DOI: <https://doi.org/10.1016/S0378-7788(01)00141-4>.

RISSMAN, J., KENNAN, H. (2013). *Low-emissivity Windows. American Energy Innovation Council.* Online. [20/06/2024]. Available at: <https://americanenergyinnovation.org/wp-content/uploads/2013/03/Case-Low-e-Windows.pdf>.

US EPA. (2016). The Inside Story: A Guide to Indoor Air Quality. Environmental Protection Agency. Online. [20/06/2024]. Available at: <https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality>.

VAN DER LUGT, P. et al. (2006). An environmental, economic, and practical assessment of bamboo as a building material for supporting structures. In *Construction and Building Materials,* 20(9), 648-656. DOI: <https://doi.org/10.1016/j.conbuildmat.2005.02.023>.

WALKER, R. et al. (2014). Mechanical properties and durability of hemp-lime concretes. In *Construction and Building Materials,* 61(30 June 2014), 340-348. DOI: <https://doi.org/10.1016/j.conbuildmat.2014.02.065>.

ZHAI, X. Q. et al. (2007). Solar integrated energy system for a green building. In *Energy and buildings,* 39(8), 985-993. DOI: <https://doi.org/10.1016/j.enbuild.2006.11.010>.

ZINZI, M., AGNOLI, S. (2012). Cool and green roofs. An energy and comfort comparison between passive cooling and mitigation urban heat island techniques for residential buildings in the Mediterranean region. In *Energy and Buildings,* 55(December 2012), 66-76. DOI: <https://doi.org/10.1016/j.enbuild.2011.09.024>.

4.3 Renewable Energies Powering Municipalities and Cities

Authors: Andreea-Emanuela Drăgoi and Simona Moagăr-Poladian

4.3.1 General Introduction

Renewable energy (RE) is sustainable and environmentally friendly and comes from natural processes that are continuously replenished. Renewable energy is a subset of sustainable energy[1] that, unlike finite fossil fuels, is derived from abundant and sustainable sources over the long term. RE plays a crucial role in reducing greenhouse gas emissions and mitigating climate change. The EU's legal framework, including the Renewable Energy Directive, the Fit for 55 package, and the European Green Deal, highlights the pivotal role of RE in achieving sustainability goals. These documents emphasise renewable energy's role in improving energy efficiency while reducing greenhouse gas emissions to ensure a sustainable future.

Renewable energy (RE) has been analysed in several studies in recent years (Ehrlich et al., 2022; Olabi & Abdelkareem, 2022; Twidell, 2021; Panwar et al., 2011; Dincer, 2000). According to a widely accepted definition in specialised literature (Ang et al., 2022), the types of renewable energy are solar, wind, biomass, hydraulic, geothermal and hydrogen energy, and these types of energy are produced without affecting the environment the same extent as the production of fossil fuels. At the EU level, there has been a constant concern for boosting the development of RE and increasing their share in the EU energy mix, given that these types of energy can generate zero or close to zero CO2 emissions while increasing their use in energy consumption may facilitate the acceleration towards the "green" transition in all Member States.

4.3.2 Importance and Benefits

The use of RE in the energy mix of the Member States represents a trend widely supported at the EU level through a series of strategies and legislative acts such as the European Green Deal, Fitfor55 and REPowerEU.

[1] One must underline that sustainable energy is not a perfect synonym for renewable energy. Sustainable energy is a broader term that encompasses all forms of energy that meet the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable energy includes: renewable energy that are replenished naturally and are considered inexhaustible on a human timescale, low-carbon energy that encompasses renewable energy sources and nuclear power, which, while not renewable, produces very low greenhouse gas emissions once operational and also clean energy which refers to both renewable energy and low-carbon energy sources that have minimal impact on the environment.

The European Green Deal[2] proposes a comprehensive plan to make the European Union (EU) climate-neutral by 2050. Green Deal aims to increase the share of renewable energy in the EU's energy mix to at least 32% by 2030 while promoting offshore wind farms and other renewable sources.

The Fitfor55 Package[3] encompasses a comprehensive set of proposals presented by the European Commission to help the EU achieve its climate goals, mainly the target of reducing greenhouse gas emissions by 55% by 2030 compared to 1990 levels. This package includes several targets and measures related to renewable energy. The Fitfor55 proposes to increase the overall share of renewable energy in the EU's energy mix to 42.5% by 2030. It also proposes to encourage the development of renewable energy in specific sectors. For instance, in the transport sector, the target is to achieve a 13% reduction in the greenhouse gas intensity of fuels by 2030 while encouraging the use of advanced biofuels and renewable fuels of non-biological origin (e.g., green hydrogen). In the heating and cooling sector, the Member States should achieve an annual increase of 1.1 percentage points in renewable energy use. Also, Fitfor55 encourage district heating and cooling systems to achieve a renewable energy share of at least 49% by 2030. The Member States should also promote energy efficiency measures across all sectors to reduce energy consumption. For this goal, Fitfor55 plans to support the electrification of sectors such as transport, heating, and industry to increase the use of renewable electricity.

REPowerEU[4] is an initiative to reduce the European Union's dependence on Russian fossil fuels while accelerating the transition to renewable energy. The plan includes several key targets and measures related to renewable energy. The main objective of REPowerEU in the field of renewable energy is to raise the share of this type of energy in the EU's energy mix to 45% by 2030. Also, REPowerEU has established more specific targets for various kinds of RE. In the field of solar energy, it proposes to install over 320 GW of solar photovoltaic (PV) capacity by 2025 (doubling the current levels) while achieving 600 GW of installed solar PV capacity by 2030. Also, REPowerEU aims to encourage the Member States to produce 10 million tons of domestic renewable hydrogen within the EU by 2030 while supporting hydrogen infrastructure development, including pipelines and storage facilities.

---

2 Adopted through the Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions the European Green Deal COM/2019/640 final. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52019DC0640>.

3 Adopted through Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality, COM/2021/550 final. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0550>.

4 Adopted through Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions REPowerEU Plan COM/2022/230 final. Available at: <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52022DC0230>.

Presently, the EU is committed to stimulating the use of RE as much as possible for energy consumption, transport, electricity, heating, and cooling.

A recently published report on the situation of the community energy sector (European Commission, 2023) shows that by promoting RE, the community authorities managed to find an answer to the energy crisis of recent years and also encourage the "green" transition and climate neutrality.

The mentioned report also states that the EU authorities managed to find effective solutions to reduce the effects of the energy bans imposed on the Russian Federation in response to its military aggression in Ukraine, but also to increase its energy security while also accelerating the transition to clean energy, diversification of energy supply and energy conservation. The increased use of RE has contributed to avoiding interruptions in energy supply and limiting the increase in energy prices. At the same time, the structural reform of the EU energy system has been continued.

If we look at the evolution of the use of RE in total energy consumption at the EU level in recent years, important progress is visible. However, the EU is still far below the proposed objective for the year 2030, namely reaching a threshold of 42.5% of the use of RE in energy consumption, since in 2021 (the year of the most recent data) the share of RE in total energy consumption is only 21.7%. Regarding the share of RE in the EU's energy mix, according to the data from the mentioned report, published in October 2023, the increase in their share has been modest in the last ten years, standing at 19% of the total in 2021, compared to 12% of the total in 2010, still far below the cumulative share of all fossil fuels. When we look at the share of RE use in the energy consumption of the Member States, we may see that Romania managed to occupy a favourable position in the EU ranking, exceeding, in 2021, the EU average of the share of RE in energy consumption, with a value of 23.5% of the total (Graph 4.3.1).

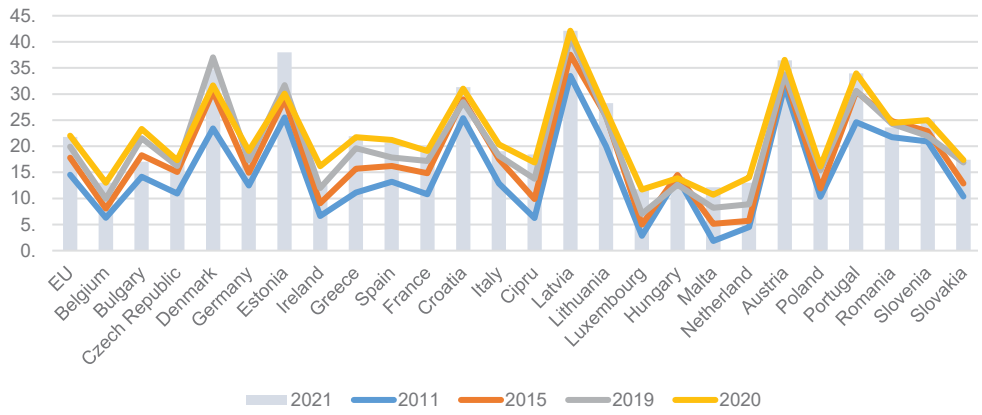

Figure 4.3.1 **Share of RE use in energy consumption in Member States in the period 2011-2021 (% of total)**

Source: Authors based on Eurostat data.

The graph shows that in recent years, Latvia, Austria, Estonia and Denmark have performed best regarding using RE in energy consumption, constantly recording performances above the EU average.

If we look at the situation of the Member States at the level of 2021, relatively few countries underperform below the EU average.

Several examples of best practices regarding the use of RE in the Member States in recent years are provided (see Box 4.3.1).

Box 4.3.1 **Best practices in the field of RE in various Member States**

Use of RE in consumption

While 23% of energy consumed in the EU (according to Eurostat estimations for 2022) was generated from renewable sources, some Member States performed better than others.

For instance, in 2022, Sweden, Finland, and Latvia led the EU Member States in the share of RE in their energy mix. These countries benefit significantly from their robust hydropower industries and extensive use of solid biofuels.

When examining growth over time, Sweden, Denmark, and Estonia have shown the most significant increases in RE shares, each experiencing an increase of more than 20 percentage points since 2005.

In many Member States, using renewable energy (RE) in consumption was encouraged through simplified notification procedures. For example, in small-scale photovoltaic (PV) installations, recent reports from the European Commission (EC) on technical support for RE policies highlighted successful implementation in the Czech Republic and Bulgaria.

In the Czech Republic, the thresholds for power generation licenses and building permits for small-scale solar PV installations were raised from 10 and 20 kW installed capacity to 50 kW in January 2023. Similarly, in Bulgaria, self-consumption of renewable energy sources without exporting to the grid for installations of up to 20 kW located in urban areas (such as rooftop or building-integrated photovoltaics or on plots adjacent to existing buildings) benefited from a simplified notification procedure starting in early 2023. Owners must notify the grid operator and local municipality about the installation's technical specifications but are no longer required to obtain a building permit.

In Romania, a significant legislative change now allows for the development of renewable energy projects directly on extra-muros lands with fertility classes III, IV, and V, marking a significant shift in policy. Meanwhile, Portugal has undertaken preparatory work to identify areas for future acceleration of renewable energy projects, aiming to cover approximately 12% of the country's territory. Spain has also made substantial progress by establishing acceleration areas for onshore wind and solar photovoltaic (PV) projects. The Spanish Government initiated this process by conducting environmental sensitivity mapping for both technologies in 2022, providing developers with a publicly available digital tool to identify suitable areas for renewable energy development nationwide. Developers have been utilizing this map since February 2022 to expedite the expansion of renewables. To delineate "no-go areas," Spain has set up exclusion and weighting indicators for various areas. The more sensitive the area (such

Continuation of Box 4.3.1

as urban areas, water bodies and flood zones, certain regions for species conservation, Natura 2000 sites), the more challenging it becomes to obtain a permit.

Use of RE in transport

Based on preliminary data from the European Environment Agency (EEA), the share of renewable energy used in transport in the EU rose from less than 2% in 2005 to 8.7% in 2022. However, this is still 5.3 percentage points short of the 2030 target for renewable energy use in transport. Progress among EU Member States varies widely, with renewable energy shares in transport ranging from 4.4% in Greece and Ireland to 30.8% in Sweden.

Sweden and Finland have already reached their 2030 renewable energy targets for transport. Preliminary estimates for 2022 indicate that only five countries have achieved a 10% share of renewable energy in transport, with two additional countries nearing this mark.

Sweden, which boasts the highest share of renewable energy in transport, has set ambitious targets for this sector and employs energy and carbon taxes to meet them. Since 1991, Sweden has had a carbon tax on fuels, with exemptions and reductions for sustainable biofuels.

Finland has led the way in implementing biofuel distribution obligations, which require blending renewable fuels to a specific energy content. This policy has significantly reduced road transport emissions due to a substantial increase in biodiesel consumption. However, in 2021, renewable electricity made up only 4% of Finland's total renewable energy used in transport, with the remainder coming from biofuels.

Use of RE for heating and cooling

Some countries, such as Sweden, Denmark, and Bulgaria, are highly suitable for multiple renewable energy strategies, including electrification, district heating, and direct use of renewable energy sources (RES). Latvia and Lithuania are well-suited for all strategies due to their high wind and solar energy potential. Many countries also show suitability for electrification in heating and cooling, supported by strong policies promoting the use of heat pumps for space heating.

District heating is important in many countries for utilizing renewable energy for heating and cooling. It complements electrification by reaching low heat density areas and supplying District heating, which allows for the exploitation of additional RES resources that are inaccessible to decentralized heating systems.

Northern countries like Sweden, Denmark, Estonia, Finland, Latvia, and Lithuania have significant potential for district heating due to their renewable energy resources and settlement structures. These countries also have well-developed district heating markets and infrastructure. Germany also shows excellent potential for district heating as a central strategy due to its strong RES potentials, suitable settlement structures, and well-developed markets and infrastructure.

Use of RE for electricity

According to REPowerEU recommendations, renewable power purchase agreements (PPAs) – direct contracts between corporate companies and electricity suppliers – are expected

Continuation of Box 4.3.1

to drive market-based renewable energy deployment significantly in the coming years. The European PPA Market Outlook for 2024 reports that in 2023, the PPA market saw a substantial 16.2 GW of disclosed contracted volumes, marking an increase of over 40% compared to 2022. The deals peaked at 272 PPAs, a notable 65% increase from 2022. Spain and Germany accounted for half of the 2023 volumes, with 8.4GW concentrated in these Member States, representing 51% of the total 16.2GW.

The report highlights that Spain remained the leader in volume and deal count for the fifth consecutive year, with a total of 4.67 GW. Of this, an impressive 4.3 GW across 37 deals came from the solar sector, while only 260MW were attributed to onshore wind. In the previous year, Spain's top position (3.9GW) was mainly due to Alcoa's two onshore wind PPAs totaling 1.8GW with Greenalia and Endesa, which significantly boosted the country's wind energy capacity.

Germany ranked second in contracted volumes for 2023, totaling 3.73GW. Both solar PV (1.77GW across 18 deals) and offshore wind (1.73GW across 14 deals) contributed equally to this achievement, revitalizing interest in Germany's solar sector.

Source: Authors based on Eurostat data[5].

Regarding the share of the use of RE in electricity consumption, an upward trend can be noted in recent years. Since adopting the European Green Deal, the EU average was between 34% and 37%. Among the states that perform better than the EU average for using RE in electricity consumption are Denmark, Latvia, the Netherlands and Portugal, with values almost double the European average. Romania was also above the EU average in 2021, with a value of 42.4%. Malta was last in the EU hierarchy, with only 9% in 2021.

Regarding the use of RE in heating or cooling, the EU average was 22.8% in 2021, a visible progress compared to the beginning of the analysis period (2011), when it stood at 17.4%. The EU average is exceeded by most of the Member States in both 2020 and 2021, which demonstrates a sustained commitment to the objectives of the European Green Deal; the only states with very low performances were Belgium, Ireland and Luxembourg, while Romania recorded an upward performance with the share of RE use for heating/cooling increasing from 31.1% in 2011 to 42.4% in 2021. When we look at the evolution of the share of the use of RE in transport in the Member States, it can be observed that the best evolution was recorded in 2020, the year in which most countries performed above the EU average. In 2021, there is a slight regression for many, as is the case of Romania, registering a value (7.6%) below the community average (8.8%) (Figure 4.3.2).

[5] See the: European Environment Agency Data (https://www.eea.europa.eu/en/analysis), EC (2023) – Technical support for RES policy development and implementation – Simplification of permission and administrative procedures for RES installations.

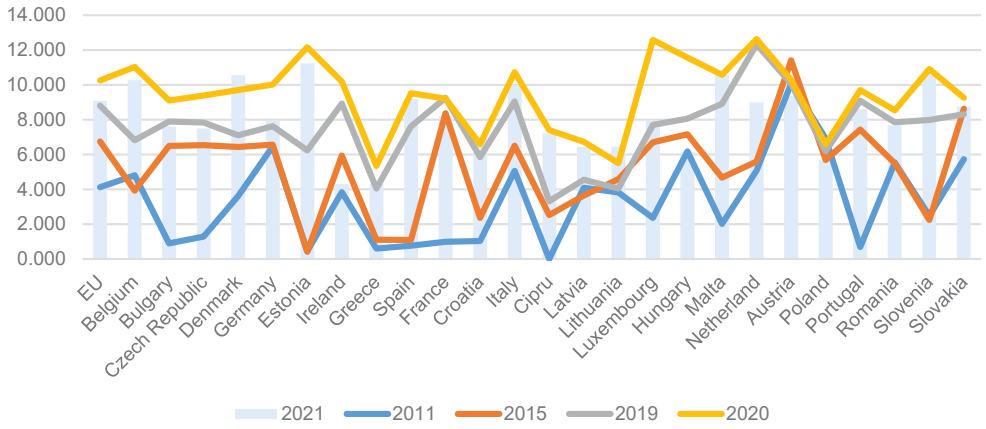

Figure 4.3.2 **Share of the use of RE in transport in the Member States in the period 2011-2021 (% of the total)**

Source: Authors based on Eurostat data.

4.3.3 Practical Application

Various practical applications of RE show the diverse ways in which renewable energy sources can be harnessed to meet energy needs, reduce greenhouse gas emissions, and promote sustainability (see Box 4.3.2).

Box 4.3.2 **Harnessing Renewable Energy: Applications from Key Sources**

Source of energy	Practical application	Studied literature
Solar	**Residential Solar Panels**: Homeowners install photovoltaic (PV) panels on rooftops to generate electricity, reducing reliance on grid power and lowering utility bills. **Solar Water Heaters**: Systems that use solar energy to heat water for domestic use, reducing the need for conventional water heating methods.	Asrami, R. F., Sohani, A., Saedpanah, E., & Sayyaadi, H. (2021). Towards achieving the best solution to utilize photovoltaic solar panels for residential buildings in urban areas. *Sustainable Cities and Society*, *71*, 102968. Vengadesan, E., & Senthil, R. (2020). A review on recent development of thermal performance enhancement methods of flat plate solar water heater. *Solar Energy*, *206*, 935-961.

Continuation of Box 4.3.2

Source of energy	Practical application	Studied literature
Wind	**Onshore Wind Farms**: Wind turbines installed on land that convert wind energy into electricity. These are commonly found in rural or open areas with consistent wind patterns. **Offshore Wind Farms**: Wind turbines located in bodies of water, typically on continental shelves, where wind speeds are higher and more consistent, providing a substantial amount of renewable energy. **Small Wind Turbines**: Used by individual properties or small communities for local electricity generation, often supplementing grid power.	Haces-Fernandez, F., Cruz-Mendoza, M., & Li, H. (2022). Onshore wind farm development: Technologies and layouts. *Energies*, *15*(7), 2381. Díaz, H., & Soares, C. G. (2020). Review of the current status, technology and future trends of offshore wind farms. *Ocean Engineering*, *209*, 107381. Chagas, C. C. M., Pereira, M. G., Rosa, L. P., da Silva, N. F., Freitas, M. A. V., & Hunt, J. D. (2020). From megawatts to kilowatts: A review of small wind turbine applications, lessons from the US to Brazil. *Sustainability*, *12*(7), 2760.
Hydro-electric	**Large Hydropower Plants**: Dams and reservoirs that use flowing water to turn turbines and generate electricity on a large scale, providing a significant portion of renewable energy in many countries. **Small-Scale Hydropower**: Micro-hydro systems that provide power to remote communities or individual properties, often in off-grid locations. **Pumped Storage Hydropower**: Systems that store energy by pumping water to a higher elevation during low demand periods and releasing it to generate electricity during peak demand periods.	Catolico, A. C. C., Maestrini, M., Strauch, J. C. M., Giusti, F., & Hunt, J. (2021). Socioeconomic impacts of large hydroelectric power plants in Brazil: A synthetic control assessment of Estreito hydropower plant. *Renewable and Sustainable Energy Reviews*, *151*, 111508. Azimov, U., & Avezova, N. (2022). Sustainable small-scale hydropower solutions in Central Asian countries for local and cross-border energy/water supply. *Renewable and Sustainable Energy Reviews*, *167*, 112726. Zhao, J. F., Oh, U. J., Park, J. C., Park, E. S., Im, H. B., Lee, K. Y., & Choi, J. S. (2022). A review of world-wide advanced pumped storage hydropower technologies. *IFAC-PapersOnLine*, *55*(9), 170-174.

Continuation of Box 4.3.2

Source of energy	Practical application	Studied literature
Biomass	**Biomass Power Plants**: Facilities that burn organic materials such as wood, agricultural residues, and dedicated energy crops to produce electricity and heat. **Biofuels**: Renewable fuels like ethanol and biodiesel, produced from plant materials that can replace or supplement gasoline and diesel in vehicles. **Biogas Systems**: Anaerobic digesters that convert organic waste (e.g., food waste, animal manure) into biogas, which can be used for heating, electricity generation, or as a vehicle fuel.	Milovanović, Z., & Milovanović, V. J. (2023). Biomass power plants. *ОДРЖИВИ РАЗВОЈ И УПРАВЉАЊЕ ПРИРОДНИМ РЕСУРСИМА РЕПУБЛИКЕ СРПСКЕ*, *6*(6). Liu, Y., Cruz-Morales, P., Zargar, A., Belcher, M. S., Pang, B., Englund, E., ... & Keasling, J. D. (2021). Biofuels for a sustainable future. *Cell*, *184*(6), 1636-1647. Marks, S., Dach, J., Fernandez Morales, F. J., Mazurkiewicz, J., Pochwatka, P., & Gierz, Ł. (2020). New trends in substrates and biogas systems in Poland. *Journal of Ecological Engineering*, *21*(4).
Geothermal	Geothermal Power Plants: Facilities that harness heat from the Earth's crust to generate electricity. These plants are typically located in regions with high geothermal activity, such as Iceland and the western United States.	Hackstein, F. V., & Madlener, R. (2021). Sustainable operation of geothermal power plants: why economics matters. *Geothermal Energy*, *9*, 1-30.
Tidal and wave energy	Tidal Power Plants: Facilities that use the movement of tides to turn turbines and generate electricity. These plants are often located in coastal areas with significant tidal ranges.	Mirzadeh, M., Simab, M., & Ghaedi, A. (2020). Reliability evaluation of power systems containing tidal power plant. *Journal of Energy Management and Technology*, *4*(2), 28-38.

Source: Authors based on the references.

4.3.4 Limitations and Challenges

Multiple challenges exist regarding the RE sector in the EU. Although there is a favourable legislative framework and many Member States have implemented a series of national plans to boost the development of RE, better-targeted national subsidies are still needed, given that this field, which depends on advanced technological investments, is frequently subject to market failures.

An important challenge for the EU Member States will be granting adequate support measures for RE production, including state aid, without prejudicing free competition on the internal market. A possible solution to this challenge could be granting horizontal state aid (especially for research-development-innovation), which could also increase the EU's technological competitiveness in the field.

Although the adoption of RE sources for power generation is increasing, most energy production in the EU is still achieved using fossil fuels due to RE's intermittent nature and high initial production cost. For example, the photovoltaic system can only work during the day, the wind turbine can only work when there is sufficient airflow, and the hydro turbine depends on water flow.

The widespread use of RE in the Member States is undoubtedly an extremely ambitious goal, but it is not without risks. Given that RE has no complete stability and predictability, phasing out fossil fuels is impossible without disrupting industrial production and consumer comfort. Despite all these challenges, the current geopolitical climate highlighted how dangerous it is for the EU's energy security to depend on energy imports from such an unpredictable partner in the international arena as the Russian Federation; hence, faced with this reality, the EU should increase, in the long term, the share of RE in the European energy mix to preserve energy security.

In conclusion, our main finding is that while there is a robust body of literature on renewable energies, most studies emphasise the environmental benefits of renewable energy and its economic and social implications. The extensive literature underscores stakeholders, including governments, businesses, and civil society, are increasingly engaged in research and policy discussions to advance renewable energy technologies and their adoption.

Our second finding indicates how the current legal framework and geopolitical turmoil, particularly heightened by the war in Ukraine, drive renewable energy initiatives in the EU. However, despite these impetuses, significant challenges persist. Against this background, the high costs associated with renewable energy technologies and the complex task of the EU's stakeholders to boost the green transition without harming free competition may threaten RE progress.

Our last finding shows that the fluctuating nature of renewable energy sources necessitates robust energy storage solutions and grid integration strategies to ensure reliability and stability. Moreover, public perception is crucial in shaping policy decisions and project approvals. Hence, addressing public concerns about costs, land use, and

perceived reliability of renewable energy technologies is essential for fostering greater public acceptance and support.

References

AMENTA, C., STAGNARO, C. (2022). The failures of the entrepreneurial state: Subsidies to renewable energies in Europe. In WENNBERG, K., SANDSTRÖM, C. (eds.) *Questioning the Entrepreneurial State. International Studies in Entrepreneurship,* vol. 53. Cham: Springer, p. 233-250. DOI: <https://doi.org/10.1007/978-3-030-94273-1_13>.

ANG, T. Z. et al. (2022). A comprehensive study of renewable energy sources: Classifications, challenges and suggestions. In *Energy Strategy Reviews,* 43(September 2022), article ID 100939. DOI: <https://doi.org/10.1016/j.esr.2022.100939>.

ASRAMI, R. F. et al. (2021). Towards achieving the best solution to utilize photovoltaic solar panels for residential buildings in urban areas. In *Sustainable Cities and Society,* 71(August 2021), article ID 102968. DOI: <https://doi.org/10.1016/j.scs.2021.102968>.

AVRAM, A. et al. (2023). *DiGreen Handbook of GREEN good Practice: Solutions for cities and municipalities.* Online. [27/06/2024]. Available at: <https://bia.unibz.it/esploro/outputs/9910066855970012 41?institution=39UBZ_INST&skipUsageReporting=true&recordUsage=false#file-0>.

AZIMOV, U., AVEZOVA, N. (2022). Sustainable small-scale hydropower solutions in Central Asian countries for local and cross-border energy/water supply. In *Renewable and Sustainable Energy Reviews,* 167(October 2022), article ID 112726. DOI: <https://doi.org/10.1016/j.rser.2022.112726>.

CATOLICO, A. C. C. et al. (2021). Socioeconomic impacts of large hydroelectric power plants in Brazil: A synthetic control assessment of Estreito hydropower plant. In *Renewable and Sustainable Energy Reviews,* 151(November 2021), article ID 111508. DOI: <https://doi.org/10.1016/j.rser.2021.111508>.

CHAGAS, C. C. M. et al. (2020). From megawatts to kilowatts: A review of small wind turbine applications, lessons from the US to Brazil. In *Sustainability,* 12(7), article ID 2760. DOI: <https://doi.org/10.3390/su12072760>.

DÍAZ, H., SOARES, C. G. (2020). Review of the current status, technology and future trends of offshore wind farms. In *Ocean Engineering,* 209(1 August 2020), article ID 107381. DOI: <https://doi.org/10.1016/j.oceaneng.2020.107381>.

DINCER, I. (2000). Renewable energy and sustainable development: a crucial review. In *Renewable and sustainable energy reviews,* 4(2), 157-175. DOI: <https://doi.org/10.1016/S1364-0321(99)00011-8>.

EHRLICH, R. et al. (2022). *Renewable energy: a first course.* Boca Raton : CRC press.

European Commission (2023). State of the Energy Union 2023: EU responds effectively to crisis, looks to the future, and accelerates the green transition. Online. [20/06/2024]. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/ip_23_5188>.

European Commission. (2019). European Green Deal. Online. [20/06/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en>.

European Commission. (2022). RePowerEU. Online. [20/06/2024]. Available at: <https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_ro>.

European Council. (2022). Fit for 55. Online. [20/06/2024]. Available at: <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>.

GATZERT, N., KOSUB, T. (2017). Determinants of policy risks of renewable energy investments. In *International journal of energy sector management,* 11(1), 28-45. DOI: <https://doi.org/10.1108/IJESM-11-2015-0001>.

HACES-FERNANDEZ, F. et al. (2022). Onshore wind farm development: Technologies and layouts. In *Energies,* 15(7), Article ID 2381. DOI: <https://doi.org/10.3390/en15072381>.

KOZLOVA, M., OVERLAND, I. (2022). Combining capacity mechanisms and renewable energy support: A review of the international experience. In *Renewable and Sustainable Energy Reviews,* 155(March 2022), article ID 111878. DOI: <https://doi.org/10.1016/j.rser.2021.111878>.

KUZEMKO, C. et al. (2022). Russia's war on Ukraine, European energy policy responses & implications for sustainable transformations. In *Energy Research & Social Science,* 93(November 2022), article ID 102842. DOI: <https://doi.org/10.1016/j.erss.2022.102842>.

LIU, Y. (2021). Biofuels for a sustainable future. In *Cell,* 184(6), 1636-1647. DOI: <https://doi.org/10.1016/j.cell.2021.01.052>.

MARKS, S. et al. (2020). New trends in substrates and biogas systems in Poland. In *Journal of Ecological Engineering,* 21(4), 19-25. DOI: <https://doi.org/10.12911/22998993/119528>.

MILOVANOVIĆ, Z., MILOVANOVIĆ, V. J. (2023). Biomass power plants. In *Sustainable development and management of natural resources of the Republic of Srpska,* 6(6), 581-702. DOI: <https://doi.org/10.7251/EORU2306581M>.

MIRZADEH, M. et al. (2020). Reliability evaluation of power systems containing tidal power plant. In *Journal of Energy Management and Technology,* 4(2), 28-38. DOI: <https://doi.org/10.22109/JEMT.2020.176501.1167>.

OLABI, A. G., ABDELKAREEM, M. A. (2022). Renewable energy and climate change. In *Renewable and Sustainable Energy Reviews,* 158 (April 2022), article ID 112111. DOI: <https://doi.org/10.1016/j.rser.2022.112111>.

PANWAR, N. L. et al. (2011). Role of renewable energy sources in environmental protection: A review. In *Renewable and sustainable energy reviews,* 15(3), 1513-1524. DOI: <https://doi.org/10.1016/j.rser.2010.11.037>.

SENDSTAD, L. H. et al. (2022). The impact of subsidy retraction on European renewable energy investments. In *Energy Policy,* 160 (January 2022), article ID 112675. DOI: <https://doi.org/10.1016/j.enpol.2021.112675>.

STEFFEN, B., PATT, A. (2022). A historical turning point? Early evidence on how the Russia-Ukraine war changes public support for clean energy policies. In *Energy Research & Social Science,* 91 (September 2022), article ID 102758. DOI: <https://doi.org/10.1016/j.erss.2022.102758>.

STERN, N. (2022). Towards a carbon neutral economy: How government should respond to market failures and market absence. In *Journal of Government and Economics,* 6 (Summer 2022), article ID 100036. DOI: <https://doi.org/10.1016/j.jge.2022.100036>.

TWIDELL, J. (2021). *Renewable energy resources.* New York : Routledge.

VENGADESAN, E., SENTHIL, R. (2020). A review on recent development of thermal performance enhancement methods of flat plate solar water heater. In *Solar Energy,* 206 (December 2020), 935-961. DOI: <https://doi.org/10.1016/j.rser.2020.110315>.

ZHAO, J. F. et al. (2022). A review of world-wide advanced pumped storage hydropower technologies. *In IFAC-PapersOnLine,* 55(9), 170-174. DOI: <https://doi.org/10.1016/j.ifacol.2022.07.030>.

4.4 Local Communities Benefiting from Circular Economy

Author: Dominik Prüller

4.4.1 General Introduction

Humanity uses more resources than the earth can replace due to population growth and economic expansion. Since 1950, the global population has nearly tripled, while waste production has increased significantly, too. The depletion of scarce resources such as rare earth elements and metals drives their prices. Consequently, businesses have had to rethink their operations (Buchberger et al., 2019). The problem with limited resources, which is a result of high consumption rates and a growing population, can be seen in things like climate change, agricultural degradation and the loss of biodiversity. Therefore, there's been an urgent call for worldwide efforts towards changing from "produce-use-dispose" linear production systems into circular ones that reduce disposal amounts and maximise utilisation levels of materials (prioritise waste prevention). This transition has serious ecological, economic, and social implications. (Wilts and von Gries, 2017)

We need to change our economic system due to the effects of climate change. Normally, we use raw materials, but this leads to a lot of resources being used up when the demand is high. Besides the fact that this destroys the environment, it is also not reversible. Our ecosystems suffer greatly from this action, and it causes global problems such as heating up because gases that cause the greenhouse effect are released into the atmosphere. Europe is an example where some countries have minimal natural resources, yet they depend largely on resource-intensive industries, mainly through imports. To make such nations more resilient, they should rethink their resource consumption by encouraging the utilisation of secondary resources. The move will not only make them less dependent on worldwide markets but also enable companies dealing with processing these materials to plan ahead effectively. Additionally, extensive recycling of all resources is very important. It requires industries, politics and society to cooperate, still aiming at economic development without losing the focus on environmental conservation. (Kranert, 2018)

The circular economy is an approach that aims to establish an economy based on natural systems in which there is no such thing as waste. It is meant to replace the traditional linear model of "take, make, dispose" by creating closed-loop systems. This means that resources are taken, goods are produced, and materials are used, reused or recycled so they can keep their value and thus reduce waste (Münger, 2021).

The basic idea behind the circular economy is for products and materials to be designed in such a way that they can be used over a longer period of time and for many life cycles, thereby eliminating waste production. When products and materials are kept

longer in use, the need for resource extraction and new production decreases. Products should not be disposed of after their useful lives; rather there should be a system for their retrieval, repairing and returning back into the economy to minimise environmental impacts. To achieve this goal, items need to be created with more emphasis on their sturdiness, ease of mending and ability to serve again multiple times. Another key point is avoiding toxic substances wherever feasible since employment of non-nontoxic elements streamlines recycling methods, making them more effective within circular economies (Münger, 2021).

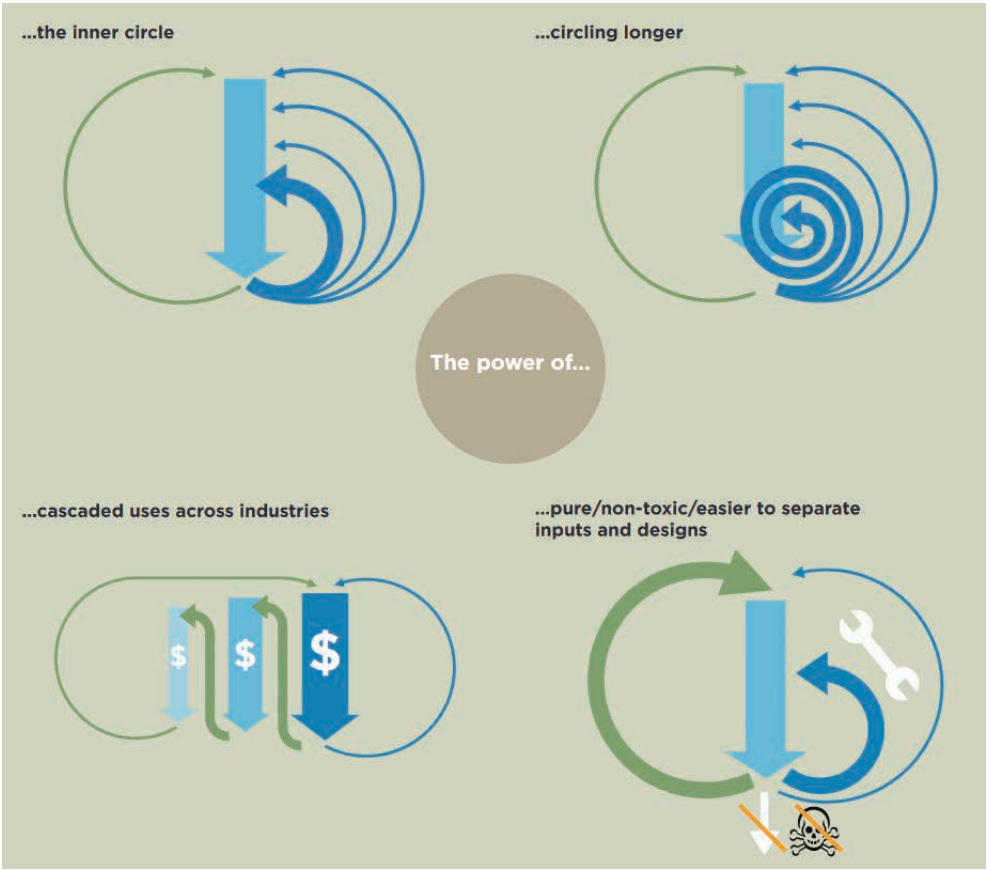

Figure 4.4.1 **Circles of Circular Economy**
Source: Ellen Macarthur Foundation (2014).

Therefore, the first part of the Circular Economy, known as the "inner cycle", is about reducing the use of materials and waste during production by creating products that can easily be repaired or refurbished for use several times. In the end, this will help to save resources and minimise environmental pollution. Then there is what is referred to as the "extended circle", which seeks to keep items in use as long as possible

through repairs, refurbishments and reconditioning. The more products last, the less materials, energy and other resources are used up. The "cross-industry circle" comes after this, whereby goods and substances are reused among different sectors so that they may serve their purpose for extended periods of time before being thrown away. Lastly, we have what is called the "pure circle", where safe or non-hazardous materials are employed, thus simplifying recycling while at the same time enhancing material productivity (Münger, 2021).

In 2020, the European Commission adopted a new strategy for the implementation of circular economy in Europe. The European Commission has put forward legislation on sustainable products as part of its broader circular economy agenda. It aims at making all goods sold within the EU last longer with ease of repair, reuse and recycling being key features alongside greater use of recycled materials. Disposable items should be limited, built-in obsolescence should be addressed, and the destruction of unsold durable consumer goods should be banned. Consumers must be given access to reliable information about repair options for a product before purchase, as well as its expected lifetime; they should also be empowered through such knowledge to choose only those goods that have the least impact on natural resources when being disposed of. Additionally, a "right-to-repair" principle must be established, allowing individuals or third-party service providers to fix appliances without invalidating warranties (European Commission, 2020).

Resource-intensive industries with high potential, such as electronics, batteries, packaging plastics, textiles construction, and the food industry, need to be targeted by specific actions. The intention behind these measures is to prolong the life span of products, improve their collection and treatment systems while reducing over-packaging, increase the use of recycled materials, and promote reusables. It will also pay attention to preventing waste generation, converting it into high-quality secondary raw materials that can be traded in well-functioning markets. Furthermore, models for waste collection should be harmonised at the EU level, along with labels attached to products to restrict any outward waste transportation from the Member States. In contrast, shipments containing trash must not be allowed to enter in illegally either (European Commission, 2020).

Circular economy is often visualized by a number of so-called Rs – various aspects of circular economy beginning with the letter R.

Waste reduction is highly significant for environmental protection and sustainable development. The most important aspects of waste reduction are changes in production and consumption patterns and encouraging the use of technologies that consume fewer natural resources. Waste reduction can help stimulate market demand for efficient services and lead to reduced risks to human health and the environment. Waste reduction includes strategies such as avoiding dangerous substances, reducing material usage in production and distribution, reusing products for their original intended purpose, and reusing products for other uses. (Reisinger and Krammer, 2006)

Smarter product use and manufacture	**R0 Refuse**	Make product redundant by abandoning its function or by offering the same function with a radically different product.
	R1 Rethink	Make product use more intensive (e.g., through sharing products, or by putting multi-functional products on the market).
	R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials.
Extend lifespan of product and its parts	**R3 Re-use**	Re-use by another consumer of discarded product which is still in good condition and fulfills its original function.
	R4 Repair	Repair and maintenance of defective product so it can be used with its original function.
	R5 Refurbish	Restore an old product and bring it up to date.
	R6 Remanufacture	Use parts of discarded product in a new product with the same function.
	R7 Repurpose	Use discarded product or its parts in a new product with a different function.
Useful application of materials	**R8 Recycle**	Process materials to obtain the same (high grade) or lower (low grade) quality.
	R9 Recover	Incineration of materials with energy recovery.

Figure 4.4.2 **The Rs of Circular Economy**
Source: Potting et al. (2017).

There are distinctions between quantitative and qualitative waste prevention, as well as product-related and facility-related waste prevention. Quantitative waste prevention involves reducing or eliminating substances or processes that lead to waste, while qualitative waste prevention focuses on substituting environmentally hazardous substances with safer alternatives. (Reisinger and Krammer, 2006)

Product-related waste prevention includes measures that enable product reuse, extend product lifespans, or reduce production waste. Facility-related waste prevention involves modifying production processes or equipment to minimise waste generation, such as internally recycling production materials. (Reisinger and Krammer, 2006)

Up to now, efforts to decouple waste generation from economic growth have not been entirely successful. Transitioning to qualitative economic growth can reduce waste generation by focusing on services and high-tech products with minimal material usage. Moreover, regulations and market-driven behaviours play vital roles in waste prevention. (Reisinger and Krammer, 2006)

However, there are limits to waste reduction, as some regulations that lead to a reduction of waste may shift responsible economic activities to other countries. To increase

public support for these measures, it is also necessary to make waste reduction regulations as easy and understandable as possible. (Reisinger and Krammer, 2006)

Reuse of products has a high potential for significant resource savings. Reuse involves users utilising used products that others no longer need after they have been inspected, cleaned, repaired, and repurposed for their original function. This practice extends the lifespan of products, conserving resources that would otherwise be used in producing replacement items while preserving existing consumption functions. (Wilts and von Gries, 2017)

The focus on extending product lifespans is particularly relevant to electronic devices like smartphones, as they contain valuable materials like precious metals and rare earth elements. However, the continuous innovation and modification of electronic devices result in increased production and sales numbers and shorter product lifespans due to consumer preferences for constantly updated models. Consequently, electronic waste generation in Europe is growing by 3 to 5% annually. (Wilts and von Gries, 2017)

The full potential of reuse has not yet been realised, and locals play a crucial role in promoting repair and reuse activities. Achieving high reuse rates requires adjustments to established practices and coordination among various stakeholders. This involves making products repair-friendly and ensuring the availability of spare parts, tools, and repair instructions. Collecting unwanted products requires consumer participation, accessible return options, and tailored collection, transportation, and unloading processes that do not damage the items. For effective high-volume reuse, access to products must be regulated, involving cooperation between collection actors (municipalities, retailers, manufacturers) and reuse initiatives. (Wilts and von Gries, 2017)

Furthermore, the successful sale of used goods depends on consumer responsibility and willingness to consider buying used items, even in the face of manufacturer-driven trends and marketing strategies. Reuse initiatives must compete with new products by offering high-quality reused items, guaranteeing the trust of consumers through measures like warranties. (Wilts and von Gries, 2017)

Recycling is a term derived from Latin and Greek roots, meaning “again” or “back” and “kýklos” (circle or cycle). It involves bringing objects back into a circular system. In practical terms, it refers to the process of repurposing items classified as waste by adapting the resources used for another purpose. Recycling is the third step in the waste hierarchy, following waste reduction and reuse or repair. (Innsbrucker Kommunalbetriebe, 2023)

Recycling involves individuals disposing of recyclable waste at collection points provided by municipalities. These materials are then sent to companies responsible for proper processing. This system transforms a significant amount of waste into reusable resources, contributing to resource conservation. (Innsbrucker Kommunalbetriebe, 2023)

The purpose of recycling is to minimise environmental impact and conserve resources. It is a critical alternative to the previously prevalent practice of depositing all unwanted and broken items in landfills. This method caused severe environmental harm, and

a shift towards recycling began in the 1970s. Future strategies involve minimising the production of non-recyclable items and creating a sustainable cycle of resources, which further reduces the need for new materials. (Innsbrucker Kommunalbetriebe, 2023)

Recycling encompasses material and resource recycling, involving waste processing into products, materials, or substances. Other forms of waste utilisation, on the other hand, include energy recovery. Material recycling involves reshaping materials to create new products without any chemical change (molecules remain intact). It typically requires high material purity. On the other hand, resource recycling utilises the basic components of materials at the molecular level by chemically altering the forms and breaking down macromolecules into smaller ones. These substances are then used either energetically or chemically. The waste used for recycling can come from various sources, including production and processing, separately collected waste from households and other areas, and facilities that process mixed waste from households and other sectors. (Kranert, 2018)

Upcycling is a process for enhancing and repurposing old or discarded items, such as clothing, furniture, or appliances, rather than simply recycling them. Therefore, it can give new purpose to items that are no longer needed or usable. Upcycling can contribute to resource conservation. (Verbraucherzentrale, 2022)

Figure 4.4.3 **Upcycled bags in Tallinn**
Source: Authors.

Instead of recycling, where products are broken down into their basic materials, upcycling is about creatively repurposing items for different uses. Examples of upcycling include crafting a tea light holder from an old glass jar, making a wallet from an old pair of jeans, or creating a bag from an old T-shirt or pillowcase. (Verbraucherzentrale, 2022)

The advantages of upcycling include resource conservation, reduced waste generation, promotion of sustainable consumption, creation of unique and personalised products, and fostering creativity. However, some drawbacks include the potential use of harmful materials, the possibility that buying additional products for upcycling may not be more sustainable than purchasing new items, and the necessity for the upcycled product to be useful. (Verbraucherzentrale, 2022)

4.4.2 Importance and Benefits

The move toward a circular economy has many advantages for the environment and the economy. Models of this type can lead to sustainable development by breaking the link between economic growth and resource use, which causes harm to our planet. This is supported by research findings in four main areas – use of resources, environmental effects, economic growth and social well-being (Wilts, 2016).

Primarily, it helps conserve primary materials through their conversion into higher quality products and recycling of wastes into secondary material resources. The result is a lower demand for virgin feedstock, thus reducing imports by industries. Such industries would not be greatly affected when prices fluctuate due to scarcity or geopolitics-related disturbances since they would have lessened their reliance on outside sources. At the moment, technological know-how permits saving between 6-12% of total material consumption, including fossil fuels, through recycling; however, there exists potential to increase this figure up to 17% without any new inventions being made (Wilts, 2016).

Moreover, it brings about several ecological benefits because of reduced environmental impact. Its main aim is to uncouple resource and energy consumption as well as their associated environmental effects from economic growth and social welfare. Strategies employed under this principle lay more emphasis on avoiding waste generation rather than managing it after being produced once more. In line with waste targets set at the European Union level, if all landfills were closed while recycling rates went up, then approximately 440 million tons of CO2 emissions could have been 2014-2030. On top of that, two-four per cent of annual greenhouse gas emissions are already mitigated through such practices as eco-designing and reusing materials (Wilts, 2016).

Moreover, circular economy has several opportunities for economic growth and innovation. Transitioning from the linear production and consumption model offers substantial economic opportunities. The circular economy brings cost savings across industries. For example, it can save up to $630 billion in material costs alone in the EU by improving cycles in producing consumer goods. Moreover, the circular economy encourages technological innovation, business models, and approaches to extract

economic value from limited resources. This enhances Europe's economic resilience and global competitiveness. (Wilts, 2016)

Last but not least, implementing a circular economy can also benefit society by promoting sustainable consumer behaviour and creating employment opportunities. Social innovations in waste prevention, recycling, eco-design, and sharing economies encourage sustainable choices and contribute to human well-being and safety. Transitioning to a circular economy has the potential to create over 180,000 new jobs in Europe by 2030, according to the European Commission's impact assessment. (Wilts, 2016)

4.4.3 Practical Applications

Municipalities and regions are a key factor in the transition to a circular economy. Their unique position as hubs of resource and energy consumption makes them essential players. With well-established structures and close proximity to citizens and businesses, they serve as coordinators, communicators, instigators, and role models. Municipalities act as the first point of contact for citizens and companies seeking guidance in circular economy. They facilitate collaboration, fostering connections and mobilising collective efforts. By highlighting local circular economy initiatives, municipalities raise awareness and cultivate a culture of sustainability, benefiting both society and businesses. Moreover, by making use of their substantial public influence, municipalities can drive demand for circular products and services. They can, therefore, change the market towards a higher demand for products of the circular economy. Apart from that, municipalities can also lead by example and implement appropriate policies, influencing private sector resource practices. (Ressourcen Forum Austria, 2023)

In these endeavours, municipalities can collaborate with citizen-led initiatives, local businesses, research institutions, and government bodies. Key action areas include resource management, water conservation, circular procurement, sustainable construction, urban development, livelihood support, mobility, knowledge dissemination, and circular energy. Strategies such as reducing consumption, extending product lifecycles, and promoting recycling are essential. (Ressourcen Forum Austria, 2023)

For example, the Austrian municipality of Kremsmünster aims to implement a so-called "Kostnix-Laden" (Kremsmünster, 2020). "Kostnix-Laden" can be translated as "Costs-nothing-Shop". At a "Kostnix-Laden", people can "shop" without spending money. Everybody is welcome to drop by and take things they need without any obligation, while voluntary donations are appreciated to help cover the shop's ongoing expenses. People can also bring items they have at home and no longer need. Effectively, the "Kostnix-Laden" serves as a storage space for items that are donated and freely redistributed. The shop's offer includes everyday items such as books, clothing, shoes, records, movies, small electronic devices, kitchenware, and various household items, among many other things. (Kostnix-Laden, 2022)

Another example is the Austrian "Öli" project. Used cooking oils and fats can be disposed of using the reusable collection container called "Öli." By collecting cooking oil and fat with Öli, people can contribute to relieving the pressure on sewage systems and wastewater treatment plants. Additionally, this helps in recycling used cooking fats as a valuable resource, which is processed into eco-friendly fuels like biodiesel. (Marktgemeinde Frastanz, 2023)

4.4.4 Limitations and Challenges

One example of challenges in implementing circular economy can be found in Germany. The German waste industry appears to be stuck in a technological lock-in, where both industry and consumers have little incentive to reduce waste as long as the waste management system offers affordable alternatives. Waste management in Germany has overcapacity in waste incineration due to the construction of expensive waste incineration plants with long lifespans, creating a barrier to waste reduction efforts. Private and public investors want to use existing infrastructure for as long as possible to maximise investment returns. This hinders efforts to reduce waste, as they continue to use the old waste plants. (Wilts, 2016)

Low prices for waste incineration have even led to insolvencies in the medium-sized recycling industry. It has become cheaper to burn waste than to recover materials, making recycling less economically viable. This situation poses a serious challenge for innovations aimed at achieving a circular economy. (Wilts, 2016)

The idea behind the circular economy is transitioning from a linear economy to a circular one, emphasizing reuse and recycling. Circular economy principles focus on eliminating waste by designing durable, repairable, and reusable products, conserving resources, and reducing environmental impact. Therefore, it should help mitigate the effects of population growth and economic expansion, lack of resources, waste generation, and other environmental problems.

Waste reduction involves changes in production, consumption patterns, and technology adoption. Reuse extends product lifespans, conserving resources and reducing electronic waste. Recycling, an essential circular economy step, transforms waste into reusable resources, contributing to resource conservation. Upcycling creatively repurposes items, contributing to resource conservation and reducing waste.

Circular economy offers ecological, economic, and social benefits, including efficient resource utilisation, environmental impact reduction, economic growth, and job creation. Challenges include overcoming the waste industry's technological lock-in and low waste deposit prices.

References

BUCHBERGER, S. et al. (2019). Das Konzept der Circular Economy als Maxime für Beschaffung und Vertrieb in der Industrie. In *Arbeitsberichte – Working Papers* 46, 1-37.

Ellen Macarthur Foundation. (2014). Towards the Circular Economy. Online. [20/06/2024]. Available at: <https://emf.thirdlight.com/file/24/cDm30tVcyxPQsxcD10AcOo2GK/Towards%20the%20circular%20economy%20Vol%203%3A%20Accelerating%20the%20scale-up%20across%20global%20supply%20chains.pdf>.

European Commission. (2020). Änderung unserer Produktions und Verbrauchsmuster: neuer Aktionsplan für Kreislaufwirtschaft ebnet Weg zu klimaneutraler und wettbewerbsfähiger Wirtschaft mit mündigen Verbrauchern, Online. [20/06/2024]. Available at: <https://ec.europa.eu/commission/presscorner/detail/de/ip_20_420>.

Innsbrucker Kommunalbetriebe. (2023). Was ist Recycling und warum ist es so wichtig? Online. [20/06/2024]. Available at: <https://www.ikb.at/themenwelten/recycling>.

Kostnix-Laden. (2022). Über uns. Online. [20/06/2024]. Available at: <https://www.kostnixladen.at/ueber-uns/>.

KRANERT, M. (2018*). Einführung in die Kreislaufwirtschaft: Planung – Recht – Verfahren.* Wiesbaden : Springer Vieweg.

Kremsmünster. (2020). Zukunftsprofil 2020. Online. [20/06/2024]. Available at: <https://www.kremsmuenster.at/Gemeinde_Service/Gemeindepolitik/Zukunftsprofil_2020>.

Marktgemeinde Frastanz. (2023). Öli. Online. [20/06/2024]. Available at: <https://frastanz.at/buergerservice/service/dienstleistungen-a-z/oeli.html>.

MÜNGER, A. (2021). Kreislaufwirtschaft als Strategie der Zukunft: Nachhaltige Geschäftsmodelle entwickeln und umsetzen. Freiburg: Haufe-Lexware. DOI: <https://doi.org/10.34157/9783648156230>.

POTTING, J. (2017). Circular Economy: Measuring Innovation in the Product Chain. Online. [20/06/2024]. Available at: <https://www.pbl.nl/sites/default/files/downloads/pbl-2016-circular-economy-measuring-innovation-in-product-chains-2544.pdf>.

REISINGER, H., KRAMMER, H. J. (2006): Abfallvermeidung undverwertung in Österreich. In *Materialenband zum Bundes Abfallwirtschaftsplan.* 2006.

Ressourcen Forum Austria (2023). Kreislaufwirtschaft & Ressourceneffizienz in Gemeinden und Regionen. Online. [20/06/2024]. Available at: <https://www.ressourcenforum.at/thema/gemeinde/>.

Verbraucherzentrale (2022). Was ist Upcycling? Und wann ist es sinnvoll? Online. [20/06/2024]. Available at: <https://www.verbraucherzentrale.de/wissen/umwelt-haushalt/nachhaltigkeit/was-ist-upcycling-und-wann-ist-es-sinnvoll-68377>.

WILTS, H. (2016). Deutschland auf dem Weg in die Kreislaufwirtschaft? WISO Diskurs 06/2016. Online. [20/06/2024]. Available at: <https://library.fes.de/pdf-files/wiso/12651.pdf>.

WILTS, H., VON GRIES, N. (2017). Der schwere Weg zur Kreislaufwirtschaft. In *Gesellschaft, Wirtschaft, Politik,* 66(1), 23-28. DOI: <https://doi.org/10.3224/gwp.v66i1.02>.

4.5 Local Significance of Food Waste Management

Author: Peter Decarli

4.5.1 General Introduction

Over the past decade, the issue of food waste prevention has become increasingly prominent on the political agenda. This is due to the staggering amount of food waste produced globally each year, estimated at 1.3 billion tonnes, which equates to roughly one-third of all food produced (Treutwein & Langen, 2021). This significant issue has drawn the attention of policymakers, businesses, civil society, and researchers (Lipinski et al., 2017; European Court of Auditors, 2016; FAO, 2011).

In 2020, around 130 kilogrammes of food per inhabitant were wasted in the EU. Austria, Italy and Germany are close to this mark, while Slovakia wastes less food than the EU average:

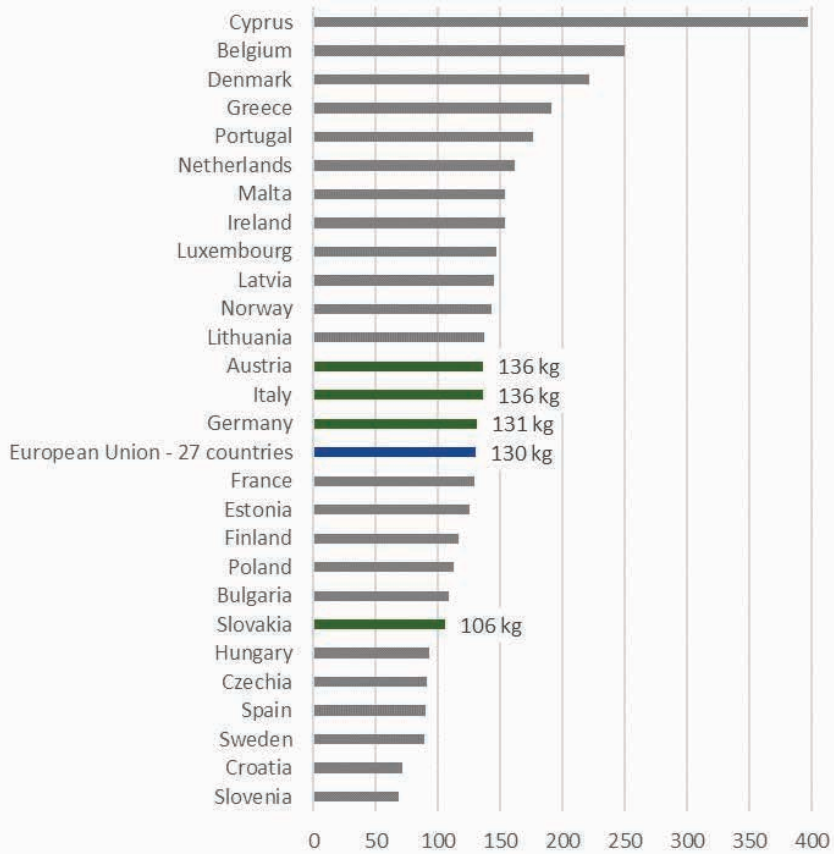

Figure 4.5.1 **Food waste in the EU – Kilograms per capita**
Source: Eurostat (2023).

Food waste undermines efforts to address hunger and malnutrition by losing valuable nutrients that could help feed the growing global population (UN, 2021). This also contributes to economic losses for producers and consumers alike. The environmental impact is equally concerning; food waste contributes 8-10% of global greenhouse gas emissions, exacerbating climate change. Moreover, the resources used in producing the wasted food, such as water and energy, are also squandered, placing unnecessary pressure on already strained natural resources (United Nations Environment Programme, 2021).

The concept of food waste encompasses the entire food supply chain, from primary production to the level of consumption (BMEL, 2019; EC, 2019). As defined in the EU project FUSIONS, food waste includes "any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed of (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)" (Östergren et al., 2014). Local or municipal food waste prevention policies refer to the actions, practices, or by-laws implemented or adopted by local governments that aim to reduce or prevent food waste (Treutwein & Langen, 2021; Schwartz, 2016).

In line with the waste hierarchy (Papargyropoulou et al., 2014), the focus should be on preventing food waste rather than managing it or finding better ways to valorise it, as illustrated in Figure 4.5.2. This distinction is crucial in setting the objective for a long-term transition towards sustainability (Mourad, 2016).

Figure 4.5.2 **The food waste hierarchy**
Source: Authors based on Papargyropoulou et al. (2014).

The United Nations incorporated food waste into its Sustainable Development Goals (SDGs). Specifically, Target 12.3 aims to cut global food waste per capita in half at the retail and consumer levels and to decrease food losses throughout the production and supply chains, including post-harvest losses, by 2030 (UN DESA, 2018).

In addition to international, national, and regional strategies, cities must also actively contribute to achieving this objective (Treutwein & Langen, 2021). In a 2017 resolution on reducing food waste and improving food safety, the European Parliament emphasised the crucial role of municipalities and local stakeholders in "implement food waste reduction and prevention programmes", "reduce food waste in public establishments" and "providing information and assistance to citizens on how best to keep and/or use food in order to prevent and reduce foodwaste" (European Parliament, 2017).

4.5.2 Importance and Benefits

While decision-makers in various municipalities worldwide have acknowledged the local significance of preventing food waste, placed the issue on the local agenda, and taken appropriate action (Magarini et al., 2018; WBA & C40, 2018), the topic isn't a priority in most local communities (Treutwein & Langen, 2021). In fact, a German study has shown that the main policy processes affecting food waste are not rooted at the municipal level but at the state, federal, and European levels. As much as 80% of waste-related policies that impact municipal activities are established at the European level (AWM, 2017).

Unfortunately, food waste prevention is not always a high priority on the busy agenda of local authorities. It represents a new and optional task for municipalities, competing for attention, personnel, and financial resources with a broad range of other issues. Local policymakers may not even realise there is room for municipal action to address this problem. Research on waste prevention in Bavaria revealed that up to half of the municipalities consulted viewed their potential to prevent food waste as low or even very low (Hutner et al., 2017).

As a result, it's important to understand how food waste and its prevention are perceived as a "public" problem that needs local authorities' attention (Treutwein & Langen, 2021; Wu et al., 2012).

4.5.3 Practical Applications

Since causes of food waste span both public and private realms, the options of food waste prevention policies for local authorities can be structured according to public actors' role vis-a-vis private actors. In the framework which Kern et al. (2005) and Bulkeley and Kern (2006) developed regarding local climate change policy, municipalities can take four different, albeit sometimes overlapping, roles:

Given that the causes of food waste extend across both the public and private sectors, the strategies for food waste prevention policies available to local authorities can be organised based on public entities' roles in relation to private entities (Treutwein & Langen, 2021). According to the framework developed by Kern et al. (2005) and Bulkeley and

Kern (2006) concerning local climate change policy, municipalities can assume four distinct, though occasionally intersecting, roles (Treutwein & Langen, 2021):

- as consumers and role models,
- as enablers and facilitators,
- as service providers and
- as regulators and planners.

Municipalities as consumers and role models

The first role involves municipalities better managing their activities. Local authorities (indirectly) consume food, for example, in administrative office canteens and through their catering concessions in public establishments such as schools, hospitals, and kindergartens (Treutwein & Langen, 2021). One straightforward method of reducing food waste is incorporating food waste considerations into municipal actions (Treutwein & Langen, 2021).

Municipalities as enablers and facilitators

The second role involves municipalities "facilitating, co-ordinating and encouraging action through partnership with private- and voluntary-sector agencies, and […] various forms of community engagement" (Bulkeley & Kern, 2006). A report by the city-network Eurocities discovered that this municipal role is the most prevalent form of food waste-related practices in the 38 European cities evaluated (Magarini et al., 2018).

Municipalities as service providers

The third role involves influencing behaviour and actions by providing basic services. For example, organic waste collection can serve as an opportunity to engage citizens in food waste prevention (Quested, 2013). Local public waste authorities are on the forefront of this role and should act as a household contact point (Treutwein & Langen, 2021).

Municipalities as regulators and planners

The fourth role involves traditional forms of regulatory policies, which are somewhat limited in the field of food waste prevention on the municipal level (Treutwein & Langen, 2021). In many cases, the federal and state levels are responsible for waste prevention legislation and regulations that could lead to food waste (Treutwein & Langen, 2021). Food safety or agricultural policies are determined at the federal and European levels (Sante, 2018).

In conclusion, strategies to prevent food waste can be incorporated into various sectors at the municipal level. For example, as direct policies for food and waste prevention in an educational context and climate or local sustainability policies (Treutwein & Langen, 2021).

As a starting point, Table 4.5.1 gives an overview of policy options for food waste prevention in municipalities based on recent studies (Treutwein & Langen, 2021; Magarini et al., 2018; Jepsen et al., 2016; City of Milan, 2015; Galda, 2014; Priefer et al., 2013; Kranert et al., 2012; Marthinsen et al., 2012).

Table 4.5.1 **Selected options for local food waste prevention policies**

Role of Municipality	Consumer and Role Model	Enabler and Facilitator	Service Provider	Regulator and Planner
Food Waste Prevention Policy Options	• Integration in public procurement • Capacity building for public employees • Campaigns in public institutions • Canteen reorganisation • Food waste sensitive catering during public events	• Educational and awareness raising campaigns • Support of citizen and business initiatives and innovation • Support of food redistribution organisations • Funding for research • Enabling collaboration across food supply chain	• Household campaign • Adjustment of cost for organic waste disposal	• Integration in Food System Planning • Tax incentives for food donation
Overarching	Integration in local food, waste prevention, education, climate, and sustainability policies			

Source: Treutwein & Langen (2021).

4.5.4 Limitations and Challenges

When tackling food waste management on the municipal level, there are some enabling as well as hindering factors that need to be taken into consideration (Treutwein & Langen, 2021):

Enabling factors for municipal food waste management:

- The topic needs **champions** inside the local authorities
  - Policy entrepreneurs have an important role in enabling food waste management to be on the local agenda (Treutwein & Langen, 2021). This role should be filled by persons within the municipal administration, as their position gives them a direct line to policymakers. They themselves must be convinced by the need for food waste prevention and advocate for the issue while having

the professional credentials and network to bestow upon them a certain level of expertise concerning the suggested actions (Treutwein & Langen, 2021).

- Policymaking dynamics on **other governmental levels** need to be considered
  - Policymaking dynamics on other governmental levels influence local agenda-setting (Treutwein & Langen, 2021). To succeed and be sustainable, local actions need to align with existing state or federal policies (Liu et al., 2010).
  - Connections to state-level actors and initiatives significantly facilitated the emergence of food waste management on municipal agendas. Proposals from policy innovators with ties to higher governmental networks have a higher chance of being accepted and implemented (Treutwein & Langen, 2021).
- The **framing** of the topic is important
  - The framing of a topic plays a significant role in defining "what the problem is about, why it occurred, who is to blame and what can be done about it" (Knaggård, 2016).
  - Studies found that a positive, food-centred framing proved more effective than one centred on waste (HLPE, 2014). Framing food waste as a waste evokes rather negative associations (Treutwein & Langen, 2021; Evans et al., 2012). Focusing on education, awareness, value, quality, nutrition, appreciation, knowledge, and skills leads to a positive food-focused viewpoint (Treutwein & Langen, 2021). From this angle, the positive implications of the proposed measures are readily apparent. Crucially, these perspectives meshed well with a broader agenda to transform the local food system (Treutwein & Langen, 2021).

Hindering factors for municipal food waste management:

- **Facing the competition for available resources**
  - A primary limitation is the dual challenge of problem overload and budget constraints in local public authorities. Studies show municipalities' strained ability to address a broad range of issues, especially within the administration and among policymakers, due to a varying focus on either factor (Treutwein & Langen, 2021). Consequently, a relatively new and so far voluntary issue like food waste management tends to be overshadowed when more critical, crisis-like problems demand attention (Treutwein & Langen, 2021).
- **Lacking pressure for local policy change**
  - In the political sphere, the lack of pressure from interest groups significantly hinders major agenda shifts towards preventing food waste (Treutwein & Langen, 2021). Even if cities have robust initiatives focused on private and educational actions to alter individual behaviour and conserve surplus food in place, these initiatives do not necessarily lead to policy change (Treutwein & Langen, 2021). The constrained resources of the municipal administration result in a rivalry among issues to be addressed. Consequently, food waste

management is often overshadowed by other topics like the supply of regional or organic food (Treutwein & Langen, 2021).

- **Spatial mismatch between problem and solution**
  - A third constraint to municipal food waste management is the (apparent) geographical discrepancy between the issue of food waste, its more significant solutions, and local political jurisdiction (Treutwein & Langen, 2021). Local actors often perceive the need for regulatory actions to be implemented at the national level: Quantitative reduction targets, the elimination of detrimental policies, or a general economic transition towards adequacy are facets of food waste prevention that surpass the scope of merely local authority (Treutwein & Langen, 2021).
- **Challenges of implementing food waste policies**
  - The voluntary nature of food waste management and prevention has impeded the development of policy agendas from the beginning (Treutwein & Langen, 2021). Better integrating food waste management across city departments encounters the dual obstacles of budgetary constraints and technical viability (Treutwein & Langen, 2021). For example, bids incorporating food waste prevention stipulations in public procurement represent a new responsibility and thus require additional, knowledgeable personnel. The combined restriction of financial implications and potential lack of public approval particularly impacts measures aimed at school catering. The obligation to provide cost-effective school meals is significant, resulting in several objectives, including food and packaging waste prevention, quality, local sourcing, or an enhanced offering, being deprioritised (Treutwein & Langen, 2021).

References

AWM, 2017. Abfallwirtschaftskonzept 2017 – 2026: Landeshauptstadt München. München: Abfallwirtschaftsbetrieb München.

BMEL, 2019. Nationale Strategie zur Reduzierung der Lebensmittelverschwendung. Berlin. Online. [20/06/2024]. Available at: <https://www.bmel.de/DE/themen/ernaehrung/lebensmittelverschwendung/strategie-lebensmittelverschwendung.html>.

BULKELEY, H., KERN, K., 2006. Local government and the governing of climate change in Germany and the UK. In *Urban Studies,* 43(12), 2237-2259. DOI: <https://doi.org/10.1080/004209806009364>.

City of Milan, 2015. Food Waste Recycling in a Densely Populated European City: The Case Study of Milan. Milan. Online. [20/06/2024]. Available at: <http://www.arsambiente.it/files/leaflet%20MRC_v7_ing_HR.PDF>.

European Commission, 2019. Commission Delegated Decision of 3.5.2019: C (2019) 3211 Final. Brussels. Online. [20/06/2024]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=pi_com%3AC%282019%293211>.

European Court of Auditors, 2016. Combating Food Waste: an Opportunity for the EU to Improve the Resource-Efficiency of the Food Supply Chain, Special Report. European Union, Luxembourg. Online. [20/06/2024]. Available at: <https://www.eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_EN.pdf>.

European Parliament. (2017). European Parliament Resolution of 16 May 2017 on Initiative on Resource Efficiency: Reducing Food Waste. Improving food safety, 2016/2223(INI). Strasbourg Online. [20/06/2024]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52017IP0207>.

Eurostat. (2023). Food waste and food waste prevention by NACE Rev. 2 activity – tonnes of fresh mass. env_wasfw. DOI: <https://doi.org/10.2908/ENV_WASFW>.

FAO, 2011. Global Food Losses and Food Waste e Extent, Causes and Prevention. Rome. Online. [20/06/2024]. Available at: <https://www.fao.org/4/mb060e/mb060e00.pdf>.

GALDA, A. (2014). Ernährungssystemplanung in Deutschland, ISR Impulse Online. Berlin : Universitätsverlag der TU Berlin.

HLPE. (2014). Food Losses and Waste in the Context of Sustainable Food Systems: A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome, Italy. Online. [20/06/2024]. Available at: <https://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_S_and_R/HLPE_2014_Food_Losses_and_Waste_Summary_EN.pdf>.

HUTNER, P. et al. (2017). Waste prevention in communities: A comprehensive survey analyzing status quo, potentials, barriers and measures. In *Journal of Cleaner Production,* 141 (10 January 2017), 837-851. DOI: <https://doi.org/10.1016/j.jclepro.2016.09.156>.

JEPSEN, D. et al. (2016). *Entwicklung von Instrumenten zur Vermeidung von Lebensmittelabfällen: Endbericht, Texte. Dessau-Roßlau: Umweltbundesamtes.*

KERN, K. et al. (2005). *Kommunaler Klimaschutz in Deutschland – handlungsoptionen, Entwicklung und Perspektiven*. Discussion Paper SPS. Berlin : Wissenschaftszentrum Berlin für Sozialforschung.

KNAGGÅRD, Å. (2016). Chapter seven e framing the problem: knowledge-Brokers in the multiple-streams framework. In ZOHLNHÖFER, R., RÜB, F. W. (eds.) *Decision-Making under Ambiguity and Time Constraints, ECPR - Studies in European Political Science.* Colchester : ECPR Press, 109-124.

KRANERT, M. (2012). *Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland.* Stuttgart : Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz.

LIPINSKI, B. et al. (2017). *SDG Target 12.3 on Food Loss and Waste: 2017 Progress Report: An Annual Update on Behalf of Champions 12.3. Campions 12.3.* Online. [20/06/2024]. Available at: <https://champions123.org/sites/default/files/2020-09/champions-12-3-2017-progress-report.pdf>.

LIU, X. et al. (2010). Understanding local policymaking: policy Elites' perceptions of local agenda setting and alternative policy selection. In *Policy Studies Journal,* 38(1), 69-91. DOI: <https://doi.org/10.1111/j.1541-0072.2009.00345.x>.

MAGARINI, A. et al. (2018). *Food Losses and Waste in European Cities: Working Document.* Milan : Milan Food Policy Office.

MARTHINSEN, J. et al. (2012). *Prevention of Food Waste in Restaurants, Hotels, Canteens and Catering.* Copenhagen : Nordic Council of Ministers.

MOURAD, M. (2016). Recycling, recovering and preventing "food waste": competing solutions for food systems sustainability in the United States and France. In *Journal of Cleaner Production,* 126 (10 July 2016), 461-477. DOI: <https://doi.org/10.1016/j.jclepro.2016.03.084>.

ÖSTERGREN, K. et al. (2014). *FUSIONS Definitional Framework for Food Waste: Full Report.* Göteborg : The Swedish Institute for Food and Biotechnology.

PAPARGYROPOULOU, E. et al. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. In *Journal of Cleaner Production,* 76 (1 August 2014), 106-115. DOI: <https://doi.org/10.1016/j.jclepro.2014.04.020>.

PRIEFER, C. et al. (2013). *Technology Options for Feeding 10 Billion People – Options for Cutting Food Waste.* Brussels : European Union.

QUESTED, T. (2013). Effect of Food Waste Collections on Arisings: Recent Evidence, Resources, Conservation and Recycling, 79 (October 2013), 43-51. DOI: <https://doi.org/10.1016/j.resconrec.2013.04.011>.

SANTE, D. G. (2018). Summary Report: EU platform on food losses & food waste. DG Health and Food Safety (SANTE). 4th meeting. In *The Framework of the International Exhibition for Agriculture and Food Industry e AgroBalt 2018.* European Commission.

SCHWARTZ, E. (2016). *Local Solutions to a Global Problem? Canadian Municipal Policy Responses to Climate Change.* Vancouver : University of British Columbia. DOI: <https://doi.org/10.14288/1.0300060>.

TREUTWEIN, R., LANGEN, N. (2021). Setting the agenda for food waste prevention – A perspective on local government policymaking. In *Journal of Cleaner Production,* 286 (1 March 2021), 125337. DOI: <https://doi.org/10.1016/j.jclepro.2020.125337>.

UN DESA. (2018). Sustainable Development Knowledge Platform: Sustainable Development Goal 12. UN. <https://sdgs.un.org/goals/goal12>.

UN. (2021). Food waste: a global problem that undermines healthy diets. UN News. Online. [20/06/2024]. Available at: <https://news.un.org/en/story/2021/09/1101532>.

United Nations Environment Programme. (2021). Food Waste Index Report 2021. Nairobi.

WBA, C.40. (2018). Global Food Waste Management: an Implementation Guide for Cities. World Biogas Association and C40 Cities.

WU, X. et al. (eds.), 2012. The Public Policy Primer. Routledge. <https://doi.org/10.4324/9780203845943>.

Concluding Remarks

The DiGreen Knowledge Base can be used as a resource for digitalisation and climate neutrality in municipalities and cities. The project aims to close skills gaps and promote collaborations between different stakeholders interested in sustainable development by providing extensive and accessible knowledge about it.

The wide range of subjects covered, including digital transformation, sustainable mobility, data management or renewable energies, considers the fact that digitalisation and sustainability are key challenges faced by public administrations today. Each section of this knowledge base has been designed to give useful insights, practical strategies and examples of best practices.

This knowledge base also deals with the need of public administrations to be resilient. New ways of communicating and open data are covered as well, as they are important for promoting transparency and trust between governments and citizens, and therefore making public services more effective. Moreover, introducing new technologies, like the Internet of Things (IoT) and artificial intelligence, creates new opportunities for innovations in public administration.

This project result also tackles key sustainability issues. It covers green buildings, renewable energy, circular economy and food waste reduction. These areas play a crucial role in reducing environmental damage and building a sustainable future.

The DiGreen Knowledge Base should serve as a helpful tool for students, professionals, and staff in municipalities. We hope that this resource will inspire and guide municipalities in their efforts in digitalisation and climate neutrality.

About the Project

PROJECT DETAILS
Programme: Erasmus+
Action Type: KA220-HED - Cooperation partnerships in higher education
Call: 2021
Round: Round 1
Field: Higher Education
Project Title: Digital government for green municipalities and cities
Project Acronym: DiGreen
Project number: 2021-1-SK01-KA220-HED-000023505
Duration: 01. 11. 2021 – 01. 11. 2024
Total Budget: 324 810 Euro
National Agency: Slovenská akademická asociácia pre medzinárodnú spoluprácu (Slovak Academic Association for International Cooperation)

Project Coordinator
Univerzita Pavla Jozefa Šafárika v Košiciach, Fakulta verejnej správy (Pavol Jozef Šafárik University in Košice, Faculty of Public Administration, Slovakia)

Project partner organisations
Accademia Europea di Bolzano (Eurac Research, Italy)
Institutul de Economie Mondiala (The Institute for World Economy, Romania)
FH OÖ Studienbetriebs GmbH (University of Applied Sciences Upper Austria, Austria)

Project Scope
DiGreen aims to provide professionals working in the municipality/city self-government public bodies and young citizens (students) with a framework to exchange knowledge and digital and green good practices. DiGreen will provide a crosscutting teaching and education DiGreen concept together with a multidimensional curriculum.
DiGreen will facilitate the exchange among an international network of municipalities and cities, municipalities' employees, universities, research institutions and communal practitioners on learning about green digital skills and other environmental and digital issues.
The general objective of the DiGreen project is to establish a transnational collaboration between partners involved and apply innovative approaches for addressing their target groups.

Project results
Project result 1.: Handbook of DIGITAL good practice – cities and municipalities as the source for viable solutions

The "digital" handbook is a source of good practice in providing digital services at the municipality/city level. Partner municipalities and cities cooperating with the consortium are the primary sources of good examples,
Project result activities 01.12.2021 – 28.02.2023.

Project result 2.: Handbook of GREEN good practice – cities and municipalities as the source for viable solutions.
The "green" handbook is a source of good practice for municipalities and cities' employees as key drivers for a green and sustainable environment. Partner municipalities and cities cooperating with the consortium are the primary sources of good examples,
Project result activities 01.01.2022 – 31.03.2023.

Project result 3.: Crosscutting teaching and education DiGreen concept
The teaching and education concept is an interdisciplinary educational and life-long learning knowledge base that encompasses content for developing knowledge in the field of digitalisation and climate neutrality,
Project result activities 01.02.2023 – 30.06.2024.

Project result 4.: Multidimensional DiGreen Curriculum
The curriculum is usable in its entirety or at the level of particular specific modules for higher education covering digitalisation and climate neutrality topics,
Project result activities 01.08.2023 – 31.08.2024.

https://bit.ly/digreen-project

Contributors

Alina Cerasela Avram

Alina Cerasela Avram, senior researcher at the Institute for World Economy with experience coordinating studies in the digital and green transition fields, is a Bucharest Academy of Economic Studies graduate and has experience coordinating studies in the digital and green transition field. Alina is editor-in-chief and founder of the Junior Scientific Researcher online research journal. The publication was founded in 2015 after she won the Start-Up Smart funding project for young entrepreneurs. She also has vast experience in organising academic conferences, being part of the organising team of the "Romanian Conference for Education and Research", an annual event organised by the Information company.

Josef Bernhart

Josef Bernhart is a senior researcher and vice head of the Eurac Research Institute for Public Management in Bolzano (Italy) and external lecturer at the University of Innsbruck, the Berlin School of Economics and Law, and the Carinthia University of Applied Sciences. His research focuses on international public management reforms, quality management in public sector organizations, social management, brand management, and sustainability management. Furthermore, he is a committed volunteer in the social and cultural area, especially as a member of the committee and leadership of the Catholic Labourers Association (KVW) and as a representative of the local social associations in the council of the AFI Institute South Tyrol (Institute for the Promotion of Employment).

Franziska Cecon

Since 2007 Franziska Cecon is professor for Public Management at the Upper Austria University of Applied Sciences, in the Department of Healthcare, Social, and Public Management, which covers a part-time bachelor's and a master's programme. Her fields of interest are public management reforms and innovations at all governance levels but especially at the local level. Digital transformation, sustainability, and reorganisation schemes are only some of the current topics she is dealing with. Also, governance aspects like transparency, participation or outcome orientation are part of her profile. Regional management issues like inter-municipal cooperation, strategic development, resilience of regions or brownfield development are research topics she is recently involved in.

Peter Decarli

Peter Decarli is a researcher at the Institute for Public Management of Eurac Research in Bolzano, Italy, and an external lecturer at the University of Innsbruck, Austria. His research focuses primarily on Government Analytics, Public sector innovation and municipal management. Exploring data-driven advancements and innovations in the public sector as well as the possibility for international collaboration and knowledge exchange, are his aspirations for DiGreen and other projects.

Andreea-Emanuela Drăgoi

Andreea-Emanuela Drăgoi, senior researcher at the Institute for World Economy, has a strong background in sustainable rural development policies and renewable energies. Mrs Drăgoi participated as an expert in numerous national and international research projects. Between 2013 and 2014, she participated as an expert in the Dialogue and experience exchange project regarding renewable energy policies, identifying opportunities for cooperation between China and Romania. Between 2014 and 2015, she worked as an editing expert and coordinated the volumes edited within the European Programme "Doctorial and post-doctoral programs for research support" – Impact of Socioeconomic and Technological Transformations at a National, European and World Level. Currently, she is a member of the Center for Writing European Projects research team in Climate Change under the Institute for World Economy coordination starting in July 2020.

George Cornel Dumitrescu

George Cornel Dumitrescu, senior researcher and coordinator of the Department of Structural Changes in the World Economy of IWE, has a strong background in macroeconomics. Mr Dumitrescu has attended a significant number of scientific conferences at the national and international levels and published numerous scientific papers in various fields, including but not limited to the transition toward the circular economy and ICT. He is also a research expert at the Centre for Writing European Projects. Mr Dumitrescu has coordinated studies regarding the digital and green transition. He is responsible for managing and coordinating all project activities on the Romanian side.

Miroslav Fečko

Miroslav Fečko is an assistant professor at the Pavol Jozef Šafárik University in Košice, Faculty of Public Administration (Slovakia). In his research and teaching, he focuses on particular aspects of public administration, public policy, e-government, smart cities, municipalities and cities, communal management, disinformation, EU single market. The research orientation is evident in his engagement in national and international projects in recent years, focusing on Capacity building for an output-oriented management in small and medium-sized municipalities; Functional city regions as an innovative approach for an integrated territorial development; Public administration education

quality enhancement; Driving change and capacity building towards innovative, Entrepreneurial Universities; Strengthening the Resilience of Public Administration after COVID-19 with the Common Assessment Framework. He also acquired experience as the supervisor of mayors and employees of the self-government units regarding the implementation of the Municipality Data Centre, which introduced e-government at the municipality level.

Belinda Hanner

Belinda Hanner did her bachelor's degree and master's degree at the University of Applied Sciences Upper Austria at the Campus for Medical Engineering & Applied Social Sciences in Linz. Currently, she is working as a research associate at the University mentioned above and assists Professor Franziska Cecon.

Davide Maffei

Davide Maffei is a researcher at the Institute for Public Management of Eurac Research in Bolzano, South Tyrol, and a PhD student in Management at the University of Innsbruck, Tyrol. His research focuses primarily on the public administration and on public expenditure. He is originally from Trentino but completed his bachelor's studies in Political Science and Management and Economics as well as the master's program in Management, Communication & IT in Innsbruck. It is no wonder that he is often defined as a "child of the Euregio".

Ondrej Mitaľ

Ondrej Mitaľ currently works as an assistant professor at the Pavol Jozef Šafárik University in Košice. As a member of the Department of Public Policy and Theory of Public Administration concentrates his research activities on the impacts of new digital forms of communication on municipalities and cities, the use of social media by public institutions, and policymaking. Within his research, he also deals with the importance of trust in public institutions, public integrity, as well as transparency and openness of public institutions. His research and educational orientation are indicated by his involvement in national and international projects over recent years, particularly Future of public administration (FoPA), European Inclusive education for digital society, social innovation and global citizenship (EURIDICE), Shared public services towards integrated self-government, Strengthening the resilience of public administration after COVID-19 with the CAF.

Simona Moagăr-Poladian

Simona Moagăr-Poladian, senior researcher and managing director of the Institute for World Economy from Bucharest, has experience in structural changes in the world economy, economic integration, and economic effects of climate change. Since 2020 she has been professor habil at the Romanian Academy of Doctoral Studies.

Moagăr-Poladian is also a member of the Management Board of the Romanian European Institute from Bucharest.

Between 2014 and 2015, she was the project manager for a National Project for Doctoral and Postdoctoral Studies under European Social Fund and coordinated PhD and postdoctoral students in Fundamental and Applied Scientific Research. Since April 2020, she is also the project manager of the Centre for Writing European Projects in the field of Climate Change, submitted to the Institute for World Economy and funded by the Competitiveness Operational Program.

Dominik Prüller

Dominik Prüller has joined the DiGreen project team in March 2022 as researcher. He has a bachelor's degree in social economics. Besides his work for the DiGreen project, he mainly works with children and teenagers in the primary and secondary educational sector, focusing on non-formal education and socially disadvantaged young people.

Silvia Ručinská

Silvia Ručinská is a professor at the Pavol Jozef Šafárik University in Košice, Faculty of Public Administration (Slovakia). In her research and teaching activities, she focuses on the topics of public policy, public administration, governance, e-government, smart cities, disinformation, strategic management, leadership, and territorial development. As a lead research and researcher, she contributed in several projects, for example Driving change and capacity building towards innovative, Entrepreneurial Universities (Inno-Change, EIT digital Project); Capacity building for an output oriented management in small and medium-sized municipalities (KoWist, Erasmus+ Project); Functional city region as an innovative approach for an integrated territorial development in the Slovak Republic conditions. She worked on several expertise and consultancies for concrete cities in the Slovak Republic. She is part of an international consortium that focuses on analysing disinformation in public policy (Counterfake). In the recent months, she also contributed to a study and analysis for OECD within the project Strengthening the Resilience of Public Administration after COVID-19 with the Common Assessment Framework (CAF).

Exploring Digital and Green Concepts
Knowledge Base for Cities and Municipalities

Alina Cerasela Avram – Franziska Cecon – Peter Decarli – Andreea-Emanuela Drăgoi – George Cornel Dumitrescu – Miroslav Fečko – Belinda Hanner – Davide Maffei – Ondrej Mitaľ – Simona Moagăr-Poladian – Dominik Prüller – Silvia Ručinská

Editorial office Wolters Kluwer SR s. r. o.
Mlynské nivy 48, 821 09 Bratislava
Typography by Forma, s. r. o.
Cover design by Ing. Tatiana Bareán Žolnová
Published by Wolters Kluwer ČR, a. s.
U Nákladového nádraží 3265/10, 130 00 Prague 3, Czech Republic,
in 2024 as its 5269th publication.
First edition
208 pages. Format: B5. Impresion: 100 copies. Copyright sheets: 10.4
www.wkcr.cz, e-mail: knihy@wkcr.cz
tel.: + 420 246 040 405, + 420 246 040 444

ISBN 978-80-286-0048-8 (paperback)
ISBN 978-80-286-0049-5 (pdf)