

Julian Walter Maurer

Concept and Sectoral Archetypes of Digital Public-Private Partnerships:

Comparative Insights from Health, Mobility,
Energy, and Identity Systems

CINOVUM · Reflections on Public Management and Innovation
Reflections and Working Paper Series

Vol. 1 (2025) | No. 1

Editor

Julian W. Maurer
c/o University of Applied Sciences Burgenland
Thomas-A.-Edison-Str. 2, 7000 Eisenstadt, Austria
E-Mail: julian.maurer@hochschule-burgenland.at
Webseite: <https://cinovum.info>

CINOVUM is published in *Zenodo*, the open-access repository created by the *European Organization for Nuclear Research (CERN)* in partnership with *OpenAIRE*, in accordance with the principles of Open Science and the long-term accessibility of academic knowledge. *Zenodo* is funded by *CERN*, *OpenAIRE*, and the *European Commission*.

ISSN

3061-1121

Responsible for content pursuant to § 18 MStV (Germany) resp. § 24 MedienG (Austria)

Julian W. Maurer

The Series

CINOVUM is an academic reflections and working paper series initiated in 2025. It is dedicated to in-depth engagement with contemporary challenges in *public management*, *digital transformation*, *administrative modernization*, and the *strategic and legal governance of public sector organizations*. The series brings together practice-oriented analyses, theoretical insights, and conceptual reflections. The name *CINOVUM* is derived from a fusion of *civitas* (Latin for *polity* or *community*) and *novum* (Latin for the *new*). It reflects the guiding vision of the series: to critically explore and help shape the renewal of public sector thinking and action in the face of complex societal transformations. Rather than treating innovation as a purely technological phenomenon, CINOVUM understands public sector innovation as a strategic, institutional, and normative process—a rethinking of governance, legality, participation, and organizational capability in the digital era. The series provides a platform for theoretically grounded, independently authored contributions that serve the early-stage academic discourse and are permanently citable. It aims to foster intellectual experimentation, policy-relevant reflection, and cross-disciplinary dialogue within and beyond the field of public sector studies.

License

© 2025 CINOVUM / Julian W. Maurer
Published *Open Access* under a *Creative Commons Attribution (CC BY) 4.0 International License*.

<https://creativecommons.org/licenses/by/4.0/>



How to Cite

Maurer, J. W. (2025). Concept and Sectoral Archetypes of Digital Public-Private Partnerships: Comparative Insights from Health, Mobility, Energy, and Identity Systems. *CINOVUM · Reflections on Public Management and Innovation*, Vol. 1, No. 1. DOI: 10.5281/zenodo.17109591.

First Publication

August 2025, Online

Concept and Sectoral Archetypes of Digital Public-Private Partnerships: Comparative Insights from Health, Mobility, Energy, and Identity Systems

Julian Walter Maurer ¹

¹University of Applied Sciences Burgenland, Thomas-A.-Edison-Str. 2, 7000 Eisenstadt, Austria
E-Mail: julian.maurer@hochschule-burgenland.at
ORCID: <https://orcid.org/0000-0001-7691-5352>

Abstract Digital technologies are changing not only business models, but also the institutional logic of public service delivery. While traditional public-private partnerships primarily pool infrastructure and capital, digital public-private partnerships (DPPPs) shift the focus to the shared use of digital resources such as data, algorithms and computing power. This paper develops an initial consistent definition proposal and shows how DPPPs can be understood as an independent cooperation format that goes beyond the mere transfer of resources and enables new interaction logics between the public and private sectors. Using the sectors of health, urban mobility, energy, and digital identity and trust infrastructures as examples, four archetypes are identified that illustrate the potential of these hybrid arrangements. In all cases, digital resources prove to be strategic factors of production whose joint institutionalisation opens up new forms of legitimacy, innovative strength, and social value creation. The comparative analysis reveals differences in regulatory density, innovation logic and governance models, but also points to cross-sectoral patterns. DPPPs thus appear to be a building block of a new institutional architecture that not only supports digital transformation, but can also actively shape it.

Keywords Digital Public-Private Partnerships · Innovation Governance · Sectoral Archetypes · Data and Algorithmic Resources · Hybrid Institutional Arrangements

1 Introduction

Digital technologies are increasingly changing the way public and corporate tasks are organised and performed (Baptista et al., 2020; Newman et al., 2022). While traditional public-private partnerships are primarily focused on financing, building and operating physical infrastructure, new forms of cooperation that focus on digital resources such as data, algorithms and computing power are becoming increasingly necessary and important (Batra, 2023; De Matteis et al., 2025; Wu, 2023). These so-called *Digital Public-Private Partnerships (DPPPs)* mark a qualitative step forward, as they not only mobilise material resources, but also transfer the foundations of digital value creation to shared responsibility.

However, scientific debate on DPPPs is still in its infancy. So far, there is no uniform definition or systematic approach for capturing sectoral patterns and archetypes of such partnerships. It is precisely this gap that makes a comprehensive conceptual clarification urgently necessary, as new institutional arrangements are emerging at the interfaces between public interest, technological dynamics and regulatory legitimacy, which need to be classified conceptually and phenomenologically. The aim of this working paper is therefore to propose an initial comprehensive definition and to illustrate the potential of DPPPs using selected fields as examples.

Regarding the methodological approach of this paper, it should be clarified that, in line with the nature of a working paper, the following remarks do not claim to fully reflect empirically verified findings from existing DPPP research. Rather, it is intended to serve as inspiration, supported by empirical evidence where possible, and to address aspects relevant to innovation policy that could be important in the understanding and creation of DPPPs. These would, of course, need to be examined in greater depth empirically in further steps. DPPP research is currently still in its early stages, which is why creative, innovation-centred conceptual work is particularly important today in order to create space for more in-depth scientific and practical debates.

The focus is on four sectors that are characterised by particular innovation dynamics and high social relevance. *Healthcare* illustrates how data-driven diagnostics, telemedicine and, for example, pandemic platforms can only

succeed through the interaction of public and private actors, while *urban mobility* offers scope for integrated platform solutions and sensor-based infrastructures that would be hardly conceivable without digital coordination. In the *energy sector*, too, smart grids and real-world laboratories are emerging, for example for decarbonisation, in which algorithmic control, regulatory flexibility and close cooperation between public and private actors play a central role. The same applies to *digital identity, finance and trust infrastructures*, where issues of data protection law, state sovereignty and legitimacy are particularly closely intertwined with technological innovations.

This paper is structured in such a way that the conceptual and theoretical foundations are first laid before the four sectors mentioned above are discussed as archetypes and brought together in a comparative synthesis. The selected sectors are by no means to be understood as exhaustive, but rather as exemplary fields of application in which DPPPs can unfold their particular potential. The paper finally concludes with a reflection on the significance of DPPPs for research and governance in the digital age.

2 Conceptualising Digital Public-Private Partnerships

An examination of traditional Public-Private Partnerships (PPPs) shows that, despite decades of use in a wide variety of contexts, no universally accepted definition has yet emerged (Ke et al., 2024). This is likely due to both the multitude of forms they take and the different normative and disciplinary perspectives involved. While international organisations such as the *World Bank* and the *OECD* focus strongly on risk transfer, management responsibility and performance orientation (Ke et al., 2024; OECD, 2008; Worldbank, 2021), the *European Commission* emphasises the importance of the breadth of possible fields of activity, from financing and construction to operation and maintenance to service provision (European Commission, 2003; Ke et al., 2024). National interpretations of the term, for example in Australia or China, further illustrate that institutional contexts also have a significant influence on whether PPPs are understood as classic procurement instruments or as a more comprehensive form of cooperation. In China, for example,

PPPs are primarily understood as long-term contractually framed collaborations between government institutions and societal capital in infrastructure and public services, from which it is sometimes concluded that in China the term “societal capital” is deliberately used instead of “private capital” because many supposedly ‘private’ projects in China are not carried out exclusively by private investors, but rather by state-owned enterprises (Ke et al., 2024; Tan & Zhao, 2019). In Australia, on the other hand, the focus of PPPs is more on private actors supporting government institutions in providing infrastructure and other services and support services in order to fulfil the further service responsibilities of government institutions in return for financial compensation. This is therefore more in line with a typical public procurement and contract relationship (Australian Government, 2008; Ke et al., 2024).

Apart from these definitional differences, there is broad consensus that PPPs are characterised by certain core elements. These include, as a rule, a long-term contractual relationship between the public sector and private partners, the joint bundling of several services across the entire life cycle of an infrastructure or service, a clear division of roles and responsibilities, and the appropriate distribution of risks according to the principle that these should be borne by the party best suited to do so (Ke et al., 2024). In addition, there is the involvement of private-sector expertise and resources, the expectation of efficiency gains, and cooperative, trust-based collaboration (Ke et al., 2024). Taken together, these characteristics form a common denominator, even if they are weighted differently depending on the type of project, legal system or sectoral characteristics.

Against this background, this paper is based on an understanding of PPPs as long-term, contractually regulated collaborations between public institutions and private actors in which significant investments, risks, management tasks and services are shared in order to provide infrastructure or services, taking into account both public added value and private sector interests.

From this, the following definition of PPPs can be derived (see **def. 1**):

We understand **Public-Private Partnerships (PPPs)** to be *long-term forms of cooperation between public institutions and private actors*, in which the private partner primarily provides *financial resources, construction capacities and operational services*, while the public sector acts as a *regulatory authority and client*.

Def. 1 Definition of Public-Private Partnerships

Traditional public-private partnerships can also be differentiated according to different models, each of which has specific mechanisms for distributing tasks, risks and ownership rights. One common model is the *operator model*, in which a private partner takes on the planning, construction, financing and operation of an infrastructure and receives payment for this from the public client (Krumm, 2016). In the *BOT (build-operate-transfer) model*, the private partner usually builds the facility, operates it for a contractually agreed period of time and then transfers it to the public sector (Krumm, 2016; see also Okudan et al., 2021; Yang et al., 2010). In contrast, the purchaser or owner model transfers ownership permanently to the private actor while leasing and rental models are also used when long-term use by the public sector is desired without a transfer of ownership (Krumm, 2016). The concession model allows the private partner to provide services to end users independently and to collect fees, while in the partnership model, public and private actors establish a joint operating company (Krumm, 2016). In addition, there are operational management and operational transfer models, in which the operation of an existing public facility or infrastructure is transferred to a private partner without affecting ownership rights. A detailed overview of various models can be found in *Krumm (2016)* from pp. 50, 52 onwards. This diversity also shows that traditional PPPs can take very different forms and require precise contractual arrangements depending on the context.

If we now want to examine the phenomenon or the ideal-typical design of digital public-private partnerships (DPPPs), which are not yet fully established and described, we find that DPPPs differ fundamentally from this. They, too, are primarily institutionalised cooperation arrangements between public and private actors, but their focus is no longer solely on capital and infrastructure services, but on the exchange and shared use of essential digital resources (Wu, 2023). Consider, for example, successful cooperation formats

from the coronavirus pandemic. Here, it became particularly clear that data, algorithmic processes and computing power in particular can be regarded as fundamental factors of production in the digital age (Wu, 2023). At the same time, public administrations often lack the necessary expertise to make productive use of these factors. Private actors, for example from the “big tech” sector, on the other hand, contribute not only money but also these productive factors and the necessary know-how as core competencies. The added value of DPPP's therefore lies not only in financial resources, but also in the private sector's ability to feed highly specialised technologies, expertise and innovation logic into public value creation.

At the same time, however, the logic of interaction between the state and the private sector is also shifting. While in classic PPP constructs, the state primarily acts as a framework provider for private actors, DPPP's can enable mutual empowerment as private companies support public actors, for example, in adapting regulatory processes to the pace of technological developments and setting new standards. Conversely, government institutions create spaces in which private actors can creatively and responsibly help shape public services and put digital innovations at the service of collective interests. The added value of cooperation thus lies in mutual enrichment and empowerment.

DPPP's can therefore be defined primarily as hybrid forms of cooperation, also and especially in regulated innovation environments, which are based on the shared flow and productive use of digital resources such as data, algorithms and computing capacities, while at the same time aiming to strike a balance between public benefit, private innovation and regulatory legitimacy.

They represent a new type of partnership in which not only risks and profits are shared, but also the foundations of digital value creation are jointly responsible.

The above descriptions can be used to derive the following definition of DPPP's (see **def. 2**):

Digital Public-Private Partnerships (DPPPs) are hybrid forms of cooperation that are not primarily based on capital and infrastructure services, but rather on the joint flow and productive use or utilisation of digital resources such as data, algorithms and computing capacity, thereby creating a mutual empowerment of the public and private sectors that balances public value creation, private innovation and regulatory legitimacy.

Def. 2 Definition of Digital Public-Private Partnerships

Or alternatively shortened (see **def. 3**):

Digital Public-Private Partnerships (DPPPs) are PPPs that, in the digital age, go beyond the provision of capital and infrastructure services and focus on the joint exchange and productive use or utilisation of essential digital resources such as data, algorithms and computing capacity, thereby enabling new forms of mutual empowerment between the public and private sectors.

Def. 3 Alternative Definition of Digital Public-Private Partnerships

3 Health and Life Sciences

The healthcare sector represents a particularly significant and promising field for future digital public-private partnerships. Even today, there are already a large number of collaborations, framed as classic PPPs or in other forms of cooperation, which could just as easily or even better be structured as DPPPs or can even already be considered DPPPs. Hardly any other area illustrates so clearly that digital transformation is not solely determined by technical feasibility, but also by interdependencies, including regulatory frameworks, social expectations and ethical obligations (Bak et al., 2025). Health is not just a market, but a public good with high social value (Anomaly, 2021; Heimburg et al., 2022), and it is precisely at this interface that DPPPs have the potential to unleash their innovative potential.

Digital diagnostics offer an impressive example of this, because the ability to make more accurate and earlier diagnoses, for example through algorithmic

analysis of imaging, genetic data or electronic health records, can particularly be achieved through close links between clinical infrastructure and private-sector innovation. Hospitals and research institutions have extensive data sets at their disposal, while technology companies can provide the tools to evaluate this information using AI and cloud systems. Among other things, DPPPs offer the opportunity to fundamentally accelerate diagnostic procedures and make personalised medicine a reality on a large scale.

The transformative potential is even more evident in telemedicine. Digital consultations, platform solutions for patient management and remote monitoring of chronic diseases could be combined to rethink comprehensive care (Cogiel et al., 2025; El-Rashidy et al., 2021; Oudbier et al., 2024). For public health systems facing demographic change, skills shortages and rising costs, DPPPs could provide a lever to address these challenges proactively rather than defensively. Private actors contribute the technological dynamism, while the public sector provides the integration and ensures that new models are embedded in existing care logic. The vision of medicine that is available regardless of location, in a timely manner and at the same time of high quality is thus within reach.

The COVID-19 pandemic has particularly highlighted the need for such partnerships (Wu, 2023). Pandemic platforms that bring together infection data, vaccine logistics and clinical trials could only be created through the interaction of government control, academic expertise and technological infrastructure. While the public sector contributed legitimacy, access to population groups and institutional stability, private partners proved crucial in providing scalable systems and data-based decision-making tools in the shortest possible time (Scognamiglio et al., 2023; Storeng & de Bengy Puyvallée, 2021). This experience gives an idea of how DPPPs can contribute to the resilience of public health systems in the future by not only responding to crises, but also creating structures that institutionalise flexibility and adaptability.

The archetype of the Health Innovation DPPP thus represents a new form of sectoral cooperation whose key feature is that the flow of central digital resources as data, algorithms and computing power, form the core of the partnership. In addition, there is a stronger ethical dimension, as issues of

data protection, informed consent and equitable access are central in almost no other field (Bak et al., 2025). Nevertheless, these partnerships open up the possibility of translating medical innovations into practice more quickly, setting new standards for quality and efficiency, and at the same time making healthcare systems more resilient to future stresses.

Health Innovation DPPPs should therefore be seen less as a continuation of traditional models and more as a laboratory for shaping the digital future of healthcare. They shift the focus from the mere provision of resources to shared responsibility for knowledge, technology and social value creation. By productively combining government protection interests and private-sector innovation logic, they demonstrate how the healthcare sector can be transformed in a data-driven world.

4 Urban Mobility and Smart Infrastructure

Urban spaces have always been seen as a testing ground for social and technological innovations. With increasing digitalisation, this opens up a wide field for new forms of cooperation that go far beyond traditional models of infrastructure development. In this context, DPPPs can become a key driver because they combine access to digital resources with the management of public tasks, thereby introducing a new dynamic into mobility and infrastructure policy.

The vision of integrated urban mobility, which intelligently links different modes of transport, is already beginning to take shape. This is perhaps the archetype most closely linked to traditional PPP approaches, as the infrastructure factor is likely to be a significant factor here, even beyond the digital realm. Mobility-as-a-service platforms, for example, have the potential to reduce private transport in the long term while at the same time making access to mobility more equitable (Cruz & Sarmiento, 2020; Lopes et al., 2023; Qiao & Yeh, 2023), although the range of services would first need to be expanded significantly to ensure equal access and to avoid a situation in which only digitally literate individuals can benefit (Lopes et al., 2023). In such arrangements, the private sector has the role of developing technological

systems, providing algorithms for route planning and implementing digital payment solutions, while public actors define the framework conditions, ensure the connection to existing transport systems and guarantee that public welfare objectives such as inclusion, sustainability and safety are taken into account. Digitally supported mobility that is multimodal, personalised and adaptive in real time could thus become the new normal.

The control of traffic flows by intelligent systems also points to the potential of such partnerships. Smart traffic solutions based on sensors, real-time data and algorithmic prediction make it possible to avoid congestion, reduce emissions and increase safety. However, these sensors and real-time data must also be put to effective use, and public authorities often lack the expertise and technical resources to do so. While companies contribute the necessary hardware, know-how and data-driven models, it is public institutions that embed these technologies in the “fabric” of (e.g. urban) infrastructure, maintaining a balance between efficiency gains and their legal mandate. Combining these two approaches thus creates the opportunity to transform transport policy from a reactive to a proactive task.

The role of sensor-based infrastructure deserves particular attention. Intelligent street lights, parking guidance systems and environmental monitoring stations can generate data streams that, when aggregated, provide a comprehensive picture of urban dynamics (Bittencourt et al., 2024). This gives local authorities the opportunity to make evidence-based policy decisions and, at the same time, tailor services more flexibly to the needs of the population. At the same time, the question arises as to how these data streams can be used responsibly without drifting into surveillance or monopolistic structures. It is precisely here that DPPP's prove to be a potentially suitable way of combining the technical innovative strength of private providers with the normative framework of public institutions and meeting the challenges of the digital transformation of the state and society.

Nevertheless, this area presents a particular challenge, as urban mobility is a highly fragmented field in which numerous actors, from municipal transport companies to global platform providers and specialised start-ups, operate with different interests. Governance and coordination problems are therefore almost inevitable. DPPP's can act as a bridge here by enabling a

form of coordination that goes beyond ad hoc cooperation or mere project-related arrangements through contractual arrangements, common standards and institutionalised exchange mechanisms.

The archetype of the Urban Mobility DPPP thus represents a partnership that not only provides infrastructure, but also understands data, algorithms and digital services as a shared resource. The aim in this sense is to design urban mobility systems in a way that is efficient, sustainable and inclusive.

By sharing responsibility, developing standards together and shortening innovation cycles, public and private actors can turn cities into platforms where mobility is promoted both as a public value and as a field of private-sector innovation.

5 Energy and Environmental Innovation

The transformation of energy systems is also one of the major, if not the most important, social and environmental challenges of the 21st century, alongside and in conjunction with the digital transformation of both the state and society. Digitalisation, decarbonisation and decentralisation are simultaneous drivers that are forcing the restructuring of traditional infrastructures while also opening up new opportunities for partnerships between the public and private sectors. On the one hand, these can certainly be traditional PPPs. In this case, however, the position is taken that DPPPs can play a truly key role in this context because they are able to combine access to data, algorithmic control and computing power with the design of regulatory frameworks.

Smart grids illustrate this potential particularly impressively. Intelligent grid control makes it possible to integrate volatile feed-in from renewable energies in real time, thus ensuring the resilience of the energy supply. While companies develop digital platforms, sensor technology and forecasting models, it is up to public actors to ensure interoperability, define market rules and incorporate social objectives such as security of supply, sustainability and fair pricing. DPPPs can act as accelerators here by shortening innovation cycles and treating the necessary infrastructure as a joint project.

Renewable platforms that intelligently link production, storage and consumption data are also becoming increasingly important. This opens up a field in which data streams themselves become a strategic resource. The exchange and sharing of such data in hybrid partnerships can enable more efficient integration of renewable energies, give rise to new business models in the area of flexibility markets and, at the same time, promote finer coordination between government climate targets and private-sector innovation.

The concept of data altruism is particularly innovative in this context as it aims to make data available not only for individual or business purposes, but also in the interest of collective concerns (Rachut & Maurer, 2024). Projects such as the Spanish *DATALOG* illustrate that voluntarily provided data can contribute to the design of sustainable energy systems (Rachut & Maurer, 2024). Even if these are not classic DPPPs in the strict sense, the structural parallels are unmistakable: shared use of data, institutionalised cooperation and a focus on clearly defined public benefits. Data altruism could therefore make a decisive contribution to the development of new models of cooperative governance that could be more closely aligned with the logic of DPPPs in the future.

With a view to future developments, it seems plausible that data altruism projects will increasingly be integrated into hybrid partnerships in order to combine regulatory legitimacy and private-sector innovation. Regulation and market liberalisation play a central role in this context. Without suitable framework conditions, there is a risk of monopolistic structures and a narrowing of innovation spaces. Conversely, overly rigid regulation can slow down technological dynamics (Rachut & Maurer, 2024).

DPPPs in the energy and environmental sector therefore operate in a field of tension between government control, market dynamics and technological disruption, but they also offer the opportunity to use this tension productively as government actors create reliable framework conditions, enable temporary flexibility and ensure that the common good is served, while private actors contribute technologies and investments that accelerate the transformation of energy systems.

The archetype of the Energy Transition DPPP thus represents a hybrid partnership that not only modernises infrastructure but also establishes new

forms of digitally supported coordination. Data, algorithms and computing capacities are becoming key production factors in the energy transition, and their shared use within the framework of DPPPs can become a decisive factor for success.

6 Identity, Finance, and Trust Infrastructures

Digital identity and trust infrastructures form the backbone of an increasingly networked economy. They determine whether citizens and businesses alike can reliably exercise their rights and fulfil their obligations in digital spaces. Unlike traditional PPPs, which primarily focus on infrastructure projects or physical networks, DPPPs in this area shift the focus to the design and shared use of infrastructures that guarantee trust, legal certainty and sovereignty. Digital identity systems such as the eID or similar variants show that without the expertise and innovative strength of private providers, no viable solutions can be developed that can be used on a mass scale (Lips et al., 2023). At the same time, the public sector is needed to ensure legitimacy, data protection and connectivity to existing administrative processes.

However, the possibilities extend far beyond identity verification. In the area of digital payments, ecosystems are emerging that rebalance interoperability, security and efficiency. Private payment service providers are continuously developing new processes, but integration into public systems such as tax administration, social benefits or subsidy programmes requires coordinated standards. DPPPs could act here as a link as they combine the flexibility of private innovation with the regulatory authority of the state. In such a constellation, new forms of financial inclusion can be developed, for example through low-cost digital transfers in the social sector or through secure interfaces between public financial management and private payment infrastructure.

The field of data trust and trust models also appears particularly visionary. Here, data flows are bundled, secured and controlled in the interests of the collective common good. DPPPs open up the possibility of placing these models on a broader institutional footing. While the public sector acts as a

guarantor of the rule of law and equal treatment, private actors contribute technology platforms, encryption methods and operational agility. This could create a hybrid space in which data is not only protected but can also be actively used as a resource for innovation, research and economic development without jeopardising public trust.

Data protection and state sovereignty are key reference points in this context, as one important challenge also is to balance power asymmetries between large technology companies and national institutions. DPPP could help to moderate these imbalances by highlighting mutual dependencies and providing institutionalised forms of cooperation. At the same time, they open up opportunities to put regulatory innovations such as dynamic consent mechanisms or cross-sector standards into practice more quickly. This would allow for the establishment of a regulatory framework that not only preserves European fundamental values but also strengthens competitiveness in the global innovation race.

The archetype of the Trust Infrastructure DPPP thus represents a new form of institutional architecture that integrates digital identity, financial flows and data usage into a comprehensive trust ecosystem. Its interface brings together technical expertise, regulatory control and social legitimacy. DPPPs in this area could become key factors for the ability of democratic states to act in the digital age, as they create the conditions for secure transactions, reliable identities and responsible data handling.

7 Comparative Synthesis

The four sectors examined show that DPPP are more likely to arise at the interface between technological innovation, regulatory design and social expectations. Nevertheless, there are clear differences in the nature, dynamics and logic of their design. The common thread is that digital resources as data, algorithms and computing power, are not treated as mere tools, but as primary factors of production. In all archetypes, DPPP take on the function of making these resources jointly usable and institutionally secure.

The healthcare sector is dominated by a highly regulated environment in which ethical issues such as data protection, informed consent and equitable access play a central role. The logic of innovation here is highly evidence-based and closely linked to scientific validation. Governance models in this field must be particularly focused on legitimacy and social acceptance, which is why Health Innovation DPPPs are likely to rely more heavily on transparency and participatory mechanisms than in other areas.

The urban mobility sector, on the other hand, is characterised by a fragmented field of actors and a dynamic culture of innovation. Regulatory density is comparatively low but at the same time its governance challenges are high as there are a large number of interfaces between private platform providers, municipal companies and citizens. Urban mobility DPPPs are therefore particularly dependent on institutionally anchoring coordination and standardisation, while at the same time responding to the speed and flexibility of private innovation cycles.

In the energy sector, DPPPs operate in an environment that mediates between government-mandated decarbonisation targets, market dynamics and technological disruption. The degree of regulation is high, but it is becoming increasingly flexible thanks to experimental clauses such as sandboxes. Innovation logic here is strongly oriented towards systemic integration and resilience. Energy transition DPPPs thus operate in a field of tension between market opening, collective sustainability agendas and protection against monopolisation. Data altruism, as seen in the above mentioned DATALOG project, also shows that new forms of resource sharing can emerge, which are taken up and perpetuated in hybrid partnerships.

Finally, the area of identity, financial flows and trust infrastructures is a particularly sensitive field that must simultaneously ensure technical interoperability, state sovereignty and social legitimacy. In regulatory terms, trust infrastructure DPPPs operate within highly dense legal frameworks such as the European Union's General Data Protection Regulation or financial supervision, while innovation logics lie in encryption technologies, platform architectures and data protection-friendly procedures. A characteristic feature is the institutional balance between the public mandate to provide guarantees

and private-sector technological expertise, which can coalesce into a comprehensive trust ecosystem.

Comparing the four archetypes, three dimensions can be identified along which differences and similarities become apparent. Firstly, the degree of regulation varies considerably: from particularly dense regulation in the health and identity sectors to more flexible structures in urban mobility. Secondly, the innovation logics differ: while health is strongly evidence-based and normatively embedded, mobility focuses on speed and user centricity, energy on systemic transformation, and identity on security and trust. Thirdly, the governance models take different forms: Health Innovation DPPP's emphasise legitimacy and ethical responsibility, Urban Mobility DPPP's focus on coordination, Energy Transition DPPP's on market opening under regulatory supervision, while Trust Infrastructure DPPP's pursue the establishment of long-term institutional sovereignty.

This differentiation can be summarised in a comparative matrix: high regulatory density, coupled with a high degree of innovation logic and strong governance embedding in the health sector; medium regulatory density with high innovation dynamics and complex coordination in urban mobility; similarly high regulation, but supplemented by experimental flexibilisation, in the energy sector. And finally, maximum regulatory density with an innovation logic focused on security and trust elements in the area of identity and financial infrastructures.

DPPP's can therefore not be understood as a monolithic concept, but rather as sectoral archetypes whose design is significantly influenced by the respective combination of degree of regulation, innovation logic and governance architecture. It is precisely this differentiation that gives them their innovative potential: they create cross-sector learning effects, open up space for regulatory innovation and show ways in which digital resources can be institutionalised for the common good.

8 Conclusions

The present considerations have shown that DPPPs represent a fundamentally promising and independent form of cooperation, which, despite its similarities, differs fundamentally from traditional PPPs in its structure. The focus is no longer on the mere provision of physical infrastructure and monetary resources, but on the shared use of digital and, in some cases, technically challenging resources that have become key production factors in the 21st century. Data, algorithms and computing power are becoming shared goods, the productive use of which enables new forms of public value creation. This reveals an institutional framework that not only allows innovation, but also seeks to structure it in the service of social interests.

The aim of this paper, which was to develop an initial consistent definition for DPPPs and illustrate their potential in exemplary sectors, has therefore been achieved. The sector analyses have shown that DPPPs are likely to become particularly relevant in areas where technological dynamics are accelerating, fragmenting or fundamentally transforming public tasks. Health, urban mobility, energy and trust infrastructures are particularly striking examples of this, but they are not alone. Similar structures can also be assumed to exist in areas such as education, security and culture, which have hardly been systematically recorded to date.

This also opens up new research questions that go beyond a conceptual approach. It remains unclear which governance mechanisms are suitable for stabilising DPPPs in the long term without curtailing their innovative power. The question also arises as to how national legal systems, (European) regulation and global standard-setting can be interlinked in such a way that institutional legitimacy and international competitiveness are equally guaranteed. Finally, there is also a need for in-depth discussion of the conditions under which trust in these hybrid structures can be established and secured in the long term.

DPPPs thus appear less as a temporary form of experimental cooperation and more as a building block of a new institutional architecture in the digital age. In future, therefore, further research should focus in particular on how these arrangements can be made permanent, legally enshrined and politically

balanced. If long-term models can be developed that consistently align innovation logics, public interests and regulatory frameworks, DPPPs may be able to realise their full potential and make a lasting contribution to the transformation of public governance.

References

- Anomaly, J. (2021). What is public health? public goods, publicized goods, and the conversion problem. *Public Choice*, *195*, 43–53. <https://doi.org/10.1007/s11127-021-00908-8>
- Australian Government. (2008). *National Public Private Partnership Guidelines. Overview*. Department of Infrastructure and Regional Development. <http://www.dpmc.gov.au/pmc/about-pmc/core-priorities/guidelines-and-procedures-other-agencies>
- Bak, M. A. R., Horbach, D., Buyx, A., & McLennan, S. (2025). A scoping review of ethical aspects of public-private partnerships in digital health. *Npj Digital Medicine*, *8*(1), 129. <https://doi.org/10.1038/s41746-025-01515-3>
- Baptista, J., Stein, M.-K., Klein, S., Watson-Manheim, M. B., & Lee, J. (2020). Digital work and organisational transformation: Emergent Digital/Human work configurations in modern organisations. *The Journal of Strategic Information Systems*, *29*(2), 101618. <https://doi.org/10.1016/j.jsis.2020.101618>
- Batra, R. (2023). Review of public–private partnerships across building sectors in nine European countries: Key adaptations for PPP in housing. *Engineering, Construction and Architectural Management*, *30*(7), 2904–2927. <https://doi.org/10.1108/ECAM-07-2021-0664>
- Bittencourt, J. C. N., Costa, D. G., Portugal, P., & Vasques, F. (2024). A Survey on Adaptive Smart Urban Systems. *IEEE Access*, *12*, 102826–102850. <https://doi.org/10.1109/ACCESS.2024.3433381>
- Cogiel, K., Sawina, A., Guzowska, A., Lau, K., & Kasperczyk, J. (2025). Managing chronic disease in the digital era: The role of telemedicine apps and platforms. *Przegląd Epidemiologiczny*. <https://doi.org/10.32394/pe/203948>
- Cruz, C. O., & Sarmiento, J. M. (2020). “Mobility as a Service” Platforms: A Critical Path towards Increasing the Sustainability of Transportation Systems. *Sustainability*, *12*(16), 6368. <https://doi.org/10.3390/su12166368>
- De Matteis, F., Borgonovi, E., Notaristefano, G., & Striani, F. (2025). The contribution of public-private partnership (PPP) to sustainability: governance and

- managerial implications from a literature review. In *Corporate Governance (Bingley)* (Vol. 25, Issue 1, pp. 144–159). Emerald Publishing. <https://doi.org/10.1108/CG-03-2023-0103>
- El-Rashidy, N., El-Sappagh, S., Islam, S., M. El-Bakry, H., & Abdelrazek, S. (2021). Mobile Health in Remote Patient Monitoring for Chronic Diseases: Principles, Trends, and Challenges. *Diagnostics*, *11*(4), 607. <https://doi.org/10.3390/diagnostics11040607>
- European Commission. (2003). *Guidelines for Successful Public-Private Partnerships*. Archives of the Czech Ministry of Finance. http://europa.eu.int/comm/regional_policy/sources/docgener/guides/PPPguide.htm
- Heimburg, D. von, Prilleltensky, I., Ness, O., & Ytterhus, B. (2022). From public health to public good: Toward universal wellbeing. *Scandinavian Journal of Public Health*, *50*(7), 1062–1070. <https://doi.org/10.1177/14034948221124670>
- Ke, Y., Cheng, Z., Zhang, J., & Liu, Y. (2024). Making sense of the definition of public-private partnerships. *Built Environment Project and Asset Management*, *14*(1), 4–21. <https://doi.org/10.1108/BEPAM-01-2023-0009>
- Krumm, T. (2016). *Staatlichkeit im Wandel. Öffentlich-private Partnerschaften im internationalen Vergleich*. Nomos. <https://doi.org/10.5771/9783845278339>
- Lips, S., Tsap, V., Bharosa, N., Krimmer, R., Tammet, T., & Draheim, D. (2023). Management of National eID Infrastructure as a State-Critical Asset and Public-private Partnership: Learning from the Case of Estonia. *Information Systems Frontiers*, *25*(6), 2439–2456. <https://doi.org/10.1007/s10796-022-10363-5>
- Lopes, A. S., Orozco-Fontalvo, M., Moura, F., & Vale, D. (2023). Mobility as a service and socio-territorial inequalities: A systematic literature review. *Journal of Transport and Land Use*, *16*(1), 215–240. <https://doi.org/10.5198/jtlu.2023.2273>
- Newman, J., Mintrom, M., & O’Neill, D. (2022). Digital technologies, artificial intelligence, and bureaucratic transformation. *Futures*, *136*, 102886. <https://doi.org/10.1016/j.futures.2021.102886>
- OECD. (2008). *Public-Private Partnerships. In Pursuit of Risk Sharing and Value for Money*. OECD. www.sourceoecd.org/finance/9789264042797
www.sourceoecd.org/governance/9789264042797
www.sourceoecd.org/9789264042797
- Okudan, O., Budayan, C., & Dikmen, I. (2021). Development of a conceptual life cycle performance measurement system for build–operate–transfer (BOT) projects. *Engineering, Construction and Architectural Management*, *28*(6), 1635–1656. <https://doi.org/10.1108/ECAM-01-2020-0071>
- Oudbier, S. J., Souget-Ruff, S. P., Chen, B. S. J., Ziesemer, K. A., Meij, H. J., & Smets, E. M. A. (2024). Implementation barriers and facilitators of remote

- monitoring, remote consultation and digital care platforms through the eyes of healthcare professionals: a review of reviews. *BMJ Open*, 14(6), e075833. <https://doi.org/10.1136/bmjopen-2023-075833>
- Qiao, S., & Yeh, A. G.-O. (2023). Mobility-on-demand public transport toward spatial justice: Shared mobility or Mobility as a Service. *Transportation Research Part D: Transport and Environment*, 123, 103916. <https://doi.org/10.1016/j.trd.2023.103916>
- Rachut, S., & Maurer, J. W. (2024). Altruismo de datos en el marco del Reglamento Europeo de Gobernanza de Datos, ¿un acierto o mejorable? *Revista de Derecho Comunitario Europeo*, 78, 183–213. <https://doi.org/10.18042/cepc/rdce.78.06>
- Scognamiglio, F., Sancino, A., Caló, F., Jacklin-Jarvis, C., & Rees, J. (2023). The public sector and co-creation in turbulent times: A systematic literature review on robust governance in the COVID-19 emergency. *Public Administration*, 101(1), 53–70. <https://doi.org/10.1111/padm.12875>
- Storeng, K. T., & de Bengy Puyvallée, A. (2021). The Smartphone Pandemic: How Big Tech and public health authorities partner in the digital response to Covid-19. *Global Public Health*, 16(8–9), 1482–1498. <https://doi.org/10.1080/17441692.2021.1882530>
- Tan, J., & Zhao, J. Z. (2019). The Rise of Public–Private Partnerships in China: An Effective Financing Approach for Infrastructure Investment? *Public Administration Review*, 79(4), 514–518. <https://doi.org/10.1111/puar.13046>
- Worldbank. (2021). *PPP Basics. What and Why*. PPP Reference Guide: Module 1. <https://ppp.worldbank.org/sites/default/files/2021-08/PPP%20Reference%20Guide%20Version%203%20-%20PPP%20Basics.pdf>
- Wu, S. (2023). *Innovative Digital Public-Private Partnerships from Pandemic Response to Resilient Recovery: Linking Emerging Frontier Technologies with Sustainable Development*. United Nations University. <https://sdgs.un.org/sites/default/files/2023-05/A21%20-%20Wu%20-%20Innovative%20Digital%20Public-Private%20Partnership%20from%20Pandemic%20Response%20to%20Resilient%20Recovery.pdf>
- Yang, J.-B., Yang, C.-C., & Kao, C.-K. (2010). Evaluating schedule delay causes for private participating public construction works under the Build-Operate-Transfer model. *International Journal of Project Management*, 28(6), 569–579. <https://doi.org/10.1016/j.ijproman.2009.10.005>