



# Administration reconnected: Blockchain between technological promise and legal reality

## Impulses from North Rhine-Westphalia for smarter digitisation of municipalities

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Author: Heiko Pereira Wolf

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### 1. Introduction: Between vision and administrative practice

Blockchain technology is considered one of the most potentially disruptive digital innovations of our time. It promises a new paradigm for trust, transparency and decentralisation in data and transaction systems.

While its origins lie in the field of cryptocurrencies, applications beyond monetary transactions are increasingly coming to the fore, for example in the administration of public tasks. This opens up a field of action that is not only technically significant, but also politically and institutionally important, particularly for cities and municipalities: the use of blockchain for municipal services, processes and infrastructure.

Nevertheless, the picture in municipal practice is ambivalent. On the one hand, there are numerous pilot projects, model regions and real-world laboratories in which municipal actors are testing innovative applications – from digital vehicle registration to forgery-proof permits for street musicians or dog owners. On the other hand, many projects remain limited to symbolic beacons or technically isolated experiments. Integration into regulatory administration, the legally compliant implementation of cryptocurrency-based payment models and the sustainable scaling of corresponding infrastructures continue to pose considerable challenges.

At the same time, it is clear that the discussion about blockchain cannot be conducted purely in technological terms. It touches on fundamental questions of administrative law, state trust management and local self-government. If decentralised technologies are capable of taking over or supplementing classic administrative functions such as issuing notices, keeping registers or participation processes, then the question arises not only of their efficiency, but also of their legal legitimacy, governance and social acceptance.

The establishment of an independent Federal Ministry for Digitalisation and State Modernisation in 2025 underscores the growing importance of digital governance issues for all levels of administration – especially for local authorities. This article therefore classifies municipal blockchain projects not only as technical innovations, but also as building blocks of strategic administrative development in light of the federal policy framework.

Against this backdrop, this article is dedicated to a systematic analysis of blockchain use at the municipal level. It takes North Rhine-Westphalia as a case study, both because of the large number of documented projects and because of the state's strategic funding framework. The aim is to classify specific application examples, identify success factors and obstacles, and develop practical recommendations for municipal decision-makers. Particular attention is paid to the question of how technological innovation, municipal self-government and legal frameworks can be reconciled without falling into blind digitalisation activism.

The article is aimed at municipal administrators, those responsible for digitalisation and managers who are concerned with the question of how new technologies can be meaningfully and strategically transferred into the reality of administration. It is based on an interdisciplinary evaluation of current pilot projects, state policy initiatives and legal and organisational frameworks, and also reflects on the limits and potential of technology-driven administrative modernisation.

### 2. Blockchain in local government: definition, benefits, distinctions

The debate about blockchain in local government often suffers from a lack of clarity. While buzzwords such as 'Bitcoin' dominate, the technological core of blockchain is much broader: a decentralised, cryptographically secured register that stores data in an unalterable form. These characteristics – immutability, transparency and decentralisation – also open up interesting areas of application for public tasks (Federal Network Agency, n.d.).

Typical areas of application are those where authenticity and traceability are central – such as the issuance of certificates, the verification of identities or automated administrative acts via smart contracts. Unlike centrally operated databases, blockchain solutions enable multiple authorities to collaborate on an equal footing on a shared, audit-proof basis.

It is crucial that the added value does not result from the technology itself, but from its targeted use in clearly defined contexts. Blockchain is particularly suitable for situations where there is a lack of trust, complex federal coordination or special security requirements (regio IT, o.J. (a German IT company)).

It is also important to distinguish between blockchain as infrastructure and cryptocurrencies based on it. While the latter are primarily relevant in the financial sector, public administration prefers to use 'permissioned blockchains,' in which only authorised actors have access rights (Fraunhofer INT, n.d.). Such systems enable compliance with data protection and institutional requirements.

Blockchain is therefore not a panacea, but a complementary tool in the digital toolkit for administration – useful where traditional IT solutions reach their limits.

### 3. Project examples from North Rhine-Westphalia: an overview of realistic applications

North Rhine-Westphalia (a federal state in western Germany) is playing a pioneering role in Germany in testing blockchain applications at the municipal level. The spectrum ranges from large-scale infrastructure projects and pilot applications in individual cities to sector-specific real-world laboratories in the energy and environmental sectors. The following section presents selected projects that are representative of different areas of application and levels of implementation in the administration.

#### 3.1 GovChain.NRW: Pilot applications in Aachen and Gelsenkirchen

The GovChain.NRW project, funded by the state of North Rhine-Westphalia and carried out by regio IT GmbH (a company that provides IT services) from 2019 to 2021, represented a milestone for municipal blockchain use.

The aim was to establish a decentralised, municipal blockchain infrastructure operated by municipal data centres to make administrative procedures more secure and efficient (regio IT, n.d.). The city of Gelsenkirchen (a city in North Rhine-Westphalia, Germany) acted as the central pilot user. Among other things, digital certificates for confirmation of residence, keeping dangerous dogs and permission to play music on the streets were developed there.

This documentation was stored in the blockchain and could be verified by authorised bodies without the need for a central database (MWIKE NRW (Ministry of Innovation, Science and Research of North Rhine-Westphalia), n.d.). The applications targeted administrative areas with a comparatively high susceptibility to manipulation and recurring documentation requirements. Individual use cases were also tested in Aachen, for example for the validation of special use permits in public spaces.

The project results show that blockchain-based administrative services are technically feasible and can be integrated into everyday life, especially if they are limited to clear areas of application. At the same time, however, challenges arise with regard to standardisation, scalability and acceptance, particularly when transferring the technology to other local authorities with different administrative structures.

#### 3.2 Digital registration in Hamm: Blockchain meets vehicle registration

Another prominent example comes from the city of Hamm, where a digital vehicle registration system has been developed using blockchain technology.

The approach aims to record all vehicle data in a 'digital twin' and link it without any media discontinuity with the registration authority, insurance companies and vehicle owners. Decentralised storage is intended to enable audit-proof, data protection-compliant processing throughout the entire life cycle of a vehicle (KDN, n.d.).

Unlike in Gelsenkirchen (a city in the German state of North Rhine-Westphalia), the focus here is not on individual decisions, but on the creation of a permanently maintained technical register that can be used across institutions. The project is thus breaking new ground in the field of cross-administrative data coordination. However, its success depends largely on nationwide integration into register modernisation and digital identity management – a task that goes beyond municipal responsibilities.

#### 3.3 Monheim am Rhein: Municipal cryptocurrency as a citizen service

An innovative, albeit technically complex, approach is being pursued in the German city of Monheim am Rhein. As part of the 'Monheim Pass' project, a digital citizen account has been developed that not only serves as a means of access to municipal facilities, but also comes with a credit balance stored in a blockchain.

Citizens can use it to pay for municipal services such as public transport or admission to the swimming pool – tokenisation takes place at the municipal level, without any connection to traditional cryptocurrencies (MWIKE NRW, n.d.).

The Monheim case illustrates the potential of municipal token solutions that do not rely on global cryptocurrencies such as Bitcoin, but instead create purpose-built, locally designed units of use. The advantage lies in legal and budgetary certainty, as well as in the possibility of integrating control-relevant aspects such as social grading, time limits or regional restrictions directly into the token structure.

#### 3.4 Cologne: Environmental policy through blockchain

In Cologne, blockchain technology has been used in conjunction with geofencing to monitor the use of plug-in hybrid vehicles in environmental zones (restricted areas in cities where only certain types of vehicle are allowed to enter). The aim is to ensure that vehicles with combustion engines are actually powered by electricity when they are driven in sensitive urban areas.

The data is stored on a blockchain so that proof can be provided automatically and in a tamper-proof manner (MWIKE NRW, n.d.). The Cologne application shows that blockchain can also serve as a municipal control instrument in the environmental sector. This is particularly relevant in view of new requirements for digital proof in the context of emissions regulations or smart transport models. The challenge here lies less in the technology than in the design of data protection regulations and acceptance by citizens.

#### 3.5 Reallabor Rheinisches Revier (Rhine Basin Real-World Laboratory): Energy, Water, Logistics

In addition to the pilot municipalities, a blockchain real-world laboratory has been set up in the Rhine Basin (a region in western Germany), focusing primarily on applications in the energy sector. Among other things, intelligent billing systems for energy consumption, decentralised verification in water supply and logistics processes are being tested here. The project was funded by the state of North Rhine-Westphalia with 1.2 million euros and serves as an interdisciplinary platform between science, administration and industry (Fraunhofer INT, n.d.).

In contrast to purely municipal projects, the focus in the real-world laboratory is on cross-sector development. Municipalities are not the sole sponsors here, but important partners in the implementation of applications in public services. The results of the real-world laboratory could also be integrated into inter-municipal supply models in the medium term.

### 4. What can be learned from the projects?

The blockchain projects in North Rhine-Westphalia show that the technology can be used effectively in selected fields – provided that the framework conditions and areas of application are clearly defined. Projects with lean, formalised administrative processes have been particularly successful. Examples such as confirmation of residential registration and municipal bonus programmes benefit particularly from forgery protection and automation (regio IT, n.d.).

Interdisciplinary cooperation is also a key factor: collaboration between local authorities, higher education institutions, IT service providers and data centres not only ensures technical quality, but also facilitates integration into existing administrative structures (Fraunhofer INT, n.d.). Statewide networks such as govdigital offer additional infrastructure and strategic connectivity (IT.NRW, 2021).

However, legal uncertainty, for example regarding the use of cryptocurrencies, and a lack of standards for interfaces and identity management remain challenges. Many projects are currently isolated initiatives with no connectivity to supralocal registers. There is a risk of fragmentation if no overarching structures are created (European Commission, 2024).

Another obstacle is organisational inertia. Blockchain is changing responsibilities, control routines and accountability – and requires a new understanding of governance and error management. Without targeted awareness-raising, especially among managers, even technically viable innovation can come to nothing.

Interim conclusion: The technology offers potential – but only within the framework of a strategically coordinated, legally compliant and culturally compatible innovation policy.

### 5. Prospects for the use of cryptocurrencies

While blockchain technology is increasingly being piloted and tested in local government, the use of cryptocurrencies as a means of payment remains largely theoretical. The idea of paying municipal fees or services in Bitcoin or other digital currencies may seem visionary, but it poses considerable legal, budgetary and practical challenges. Nevertheless, from the perspective of municipal innovation policy, relevant lines of development are opening up that could gain importance in the medium term. From a legal perspective, cryptocurrency payments in the municipal context are currently in a legal grey area. Municipal tax sovereignty under Article 28(2) of the Basic Law (the constitution of Germany) gives municipalities the freedom to enact their own statutes and set their own fee schedules.

However, these are currently based on the euro as the legal tender. Accepting cryptocurrencies would therefore require an explicit amendment to the statutes, taking into account budgetary requirements, the principles of proper accounting and a comprehensible valuation of cryptocurrencies in euros at the time of payment (IT Planning Council (a German government body responsible for IT strategy), 2020).

It is also still unclear how reliable price valuation, conversion and posting in budget and accounting could be achieved. The high volatility of many cryptocurrencies contradicts the principles of accounting and risk-adequate use of funds. In addition, the double-entry accounting system used by municipalities (Doppik) sets clear standards for the balance sheet recognition of receivables, means of payment and income – standards that are not yet tailored to the specific characteristics of digital assets.

Against this backdrop, it is not surprising that there have been no real-world applications of cryptocurrency payments in German municipalities to date. Although there are isolated examples in the private sector – such as a café in Hiden, a club in Cologne and an online retailer in Lünen that accept Bitcoin – these are voluntary market transactions with no connection to public authorities (WDR, 2023). Initiatives such as Kryptostadt Mannheim (Mannheim Crypto City), where Bitcoin will be accepted at up to 30 locations in the future, have so far been limited to local retailers (SWR, 2024).

Nevertheless, these developments offer some opportunities for the future. International role models such as the Swiss cities of Zug and Lugano show that the systematic integration of cryptocurrencies into municipal tax and fee practices is possible – provided that the legal framework is adapted accordingly.

In both cities, public sector bills can be paid with Bitcoin or the stablecoin Tether. Transactions are automated via QR invoices, and conversion into the local currency is carried out in real time by specialised service providers such as Bitcoin Suisse. This avoids volatility and reduces the accounting burden (Swissinfo, 2023).

Another option is to develop municipal tokens, as has been done in Monheim am Rhein, for example. These are not cryptocurrencies in the strict sense, but rather digital credits that are used within a closed cycle of use. Such tokens can be used for control purposes, for example for social grading, citizen bonuses or targeted subsidies.

They offer the advantage of being able to be introduced without existing legal frameworks without affecting budgetary and monetary law (MWIKE NRW, n.d.). In the long term, the introduction of programmable money – based on a digital euro, for example – could bridge the gap between traditional budget management and digital payment infrastructure.

Pilot projects at national or regional level should be linked to municipal application scenarios at an early stage in order to build up experience and define interfaces. The prospects for cryptocurrencies in municipal administration are therefore to be found less in short-term implementation and more in strategic preparation for future options.

Municipalities that are already laying the legal and technical foundations today could be in a position to offer alternative payment models in the medium term – whether for specific services, types of fees or user groups. However, this requires an integrated approach that takes equal account of technological feasibility, legal legitimacy and fiscal sustainability.

### 6. From pilot project to sustainable innovation strategy

Blockchain technology does not offer a revolution for municipal administration, but rather a targeted evolution – especially at those interfaces where traditional processes reach their functional, legal or social limits. The pilot projects in North Rhine-Westphalia prove that if the scope of application is clearly defined, the legal framework is carefully examined and the technical implementation is carried out by qualified partners, decentralised solutions can be realised in a way that is close to the administration and compliant with the law.

Nevertheless, blockchain projects are not a sure-fire success. A lack of interoperability, legal uncertainties and cultural reservations within the administration make sustainable integration difficult. Without strategic control, there is a risk of technology-driven individual solutions that are neither scalable nor compatible – either within or between authorities.

That is why a change of perspective is needed: away from isolated technology experiments and towards a public-interest-oriented innovation policy. Pilot projects should be understood as structured learning spaces – with clear objectives, legal viability and a governance culture that takes participation, transparency and feedback seriously.

The Federal Ministry for Digitalisation and State Modernisation is providing a new political framework for municipal digitalisation. This opens up the opportunity to embed technological pilot projects such as blockchain into nationwide standards, data architectures and funding frameworks at an early stage. Those who test locally today can be systemically compatible tomorrow – and thus secure their ability to help shape the digital architecture of the federal state. Those who wait too long will have to adopt standards that do not meet their own needs.

Blockchain is not a panacea. But it is a strategic tool for administrations that are prepared to see technology policy as part of their basic services. The path to digital local government does not necessarily lead via blockchain – but it is becoming increasingly difficult to avoid it.

### tl;dr

Blockchain can be useful in municipal administration where traditional procedures reach their legal, technical or institutional limits – for example, in verification systems, tokenisation or secure data access. Pilot projects in North Rhine-Westphalia show that decentralised solutions are possible – provided the legal framework, clear objectives and governance are in place. This article analyses the opportunities, risks and strategic action required for municipalities that want to help shape digital sovereignty.

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