Genealogy of a data ecosystem: The digitalisation of planning development and control in Ireland, 2000-2024

Rob Kitchin[1], Juliette Davret[2], Carla Maria Kayanan[3] and Samuel Mutter[4]

Maynooth University Social Sciences Institute, Iontas Building, North Campus, Maynooth University, County Kildare, Ireland

1. Rob.Kitchin@mu.ie, ORCID: 0000-0003-4458-7299
2. Juliette.Davret@mu.ie, ORCID: 0009-0005-7778-6595
3. Carla.Kayanan@mu.ie, ORCID: 0000-0002-4359-3534
4. Samuel.Mutter@mu.ie, ORCID: 0000-0002-9246-7147

Data Stories Working Paper 5
12 December 2024
datastories.maynoothuniversity.ie

The Data Stories project is funded by the European Research Council, grant no. 101052998.

Abstract

In this paper, we address two significant empirical and theoretical gaps in two literatures. The first is documenting how a data ecosystem emerges and evolves as a socio-technical assemblage over a substantive period of time. To date, studies of data ecosystems have examined their organization and operation at a particular point in time, but have not empirically detailed how they are constructed, maintained and change over time. The second is charting the digitalization of a planning data ecosystem as it transfers from a paper-based endeavour to one that is digitally mediated. While a number of studies have examined the adoption and use of specific digital technologies in planning, there has been no detailed examination of the suite of digital technologies that have been assembled for undertaking the day-to-day work of planning development and control (the management of the planning and construction pipeline from planning application, to appeals process, to building control). We resolve these two lacunae through a genealogical analysis of the digitalisation of the development and control function of planning and its associated data ecosystem in Ireland over a 25 year period. Our analysis reveals the contingent and relational nature of (planning) data ecosystems and the social, political and technical work that continually reconfigures their relations and practices.

Key words: digitalisation, genealogy, data ecosystem, planning, Ireland

Introduction

Since the turn of the millennium, processes of mass digitalisation and datafication have been underway across public and private sectors as networked technologies are employed to digitally mediate all kinds of tasks (e.g., bureaucracy, service delivery, manufacturing), replacing analogue modes of operation or introducing new systems and practices (Dunleavy et al., 2006; van Dijck, 2014; Kitchin, 2022). Within and across different domains 'technical infrastructures' (Engels 2020) have been put in place composed of various interlinked IT systems that together form data ecosystems – an amalgam of interacting systems that exchange, produce and consume data around a common endeavour (Oliveira and Loscio, 2018; Scassa, 2019; Gelhaar et al., 2021). Planning has been a part of this digital transformation, with all aspects of planning practice experiencing digitalisation and datafication to some degree (though some analogue practices still remain in use), and extensive planning data ecosystems have been created.

In this paper, we provide an in-depth examination of a planning data ecosystem, which has enabled us to address two significant empirical and theoretical gaps in the Critical Data Studies and Planning literatures. Within Critical Data Studies, there has been a relatively small number of attempts to detail the nature of data ecosystems and to chart their organization and operation at a particular point in time (e.g., Dawes et al., 2016 and van Schalkwyk et al., 2016) but, as yet, how they are constructed, maintained and change over time has not been examined in detail. We address this lacuna by examining how a planning data ecosystem emerges and evolves as a socio-technical assemblage over a 25 year period. In so doing, we address a second lacuna by providing a genealogical analysis of the digitalisation of a planning data ecosystem as it transfers from a paper-based endeavour to one that is digitally mediated. While there has been critical reflection on the digital turn within planning (see Daniel and Pettit (2021), Boland et al. (2022), Potts and Webb (2023) and Kuppler and Fricke (2024)), longitudinal analyses of digitalisation and datafication processes and effects are lacking (though see Datta and Muthama (2024) for an analysis of the digitalisation of land ownership records).

Our case study is a genealogy of the digitalisation of planning development and control (the management of the development and construction pipeline from pre-planning, planning application, appeals process, to building control) and the formation of its associated data ecosystem in Ireland from 2000 to 2024. A genealogical analysis seeks to trace out the contingent, relational unfolding of a planning system, recognising its multiple origin points, emergent pathways, and choices not taken, rather than producing a teleological historiography (Crowley 2009). A genealogy is 'employed to untangle and make sense historically of the multiple, complex and sometimes contradictory or paradoxical iterations of how a phenomenon came to be – the evolving and situated unfolding of ideas, decisions, constraints, actions and actors that shape their development, along with dead-ends and apparent failures' (Foucault 1977; Kitchin 2022: 134). Such an approach recognises that planning is composed of a complex institutional landscape involving multiple actors, it takes place in a multi-scalar policy and legislative context, and the adoption, adaptation and use of technologies do not follow a unified, historical trajectory. Rather, as we detail below, a data ecosystem can be constructed in a piecemeal fashion by actors following aligned and partially intersecting paths.

We used a complimentary set of methods to construct our genealogy of the data ecosystem used to manage the development and control functions of planning in Ireland (the interlinked data systems that are designed to aid the management of planning applications and track compliance through the construction process with granted planning conditions and building control measures). Initially, our intention was to chart in detail the data ecosystem at a particular point in time, August 2023. To that end, interviews were conducted with 29 public sector officials within the planning system at local, regional and national levels between June and August 2023. A number of these were walk-through interviews, wherein the interviewee undertook their usual data work, demonstrating and explaining how they used a data system and its various functionalities. In addition, we undertook a close reading of the user manuals for data systems and performed a full data audit for five systems to reconstruct their data dictionaries: three planning application management systems (iPlan, APAS and Odyssey) used by Local Authorities (LAs), the Building Control Management System (BCMS), and planning.localgov.ie (an online application system). Further, we documented the data variables available in a number of downstream open data sites and planning/housing data tracking tools (e.g., Dublin Housing Observatory, Housing Delivery Tracker, Housing for All dashboard). This suite of methods enabled an understanding of the data architecture of each system, as well as how they interconnect to form a wider data ecosystem. Following on from this initial mapping we used documentary evidence and follow-up conversations to map out and verify the historical unfolding of the data ecosystem from 2000 until August 2024. Prior to charting the digitalisation of planning development and control in Ireland, we first examine the nature of data ecosystems.

The emergent, socio-technical nature of data ecosystems

At a technical level, a data ecosystem can be understood as a form of technical infrastructure: the conjunction of a set of inter-related data systems that are functionally interlinked and share data to some degree, and collectively enable all the tasks that make-up a domain of work to be undertaken (in our case, the assessment and tracking of the entire development pipeline from planning application, to appeals process, to the construction phase, to the provision of open data). The use of the term 'ecosystem' highlights that this technical conjunction involves collaboration between actors and not just an exchange of data between data systems. Oliveira and Loscio (2018: 4) thus define a data ecosystem as:

> 'a set of networks composed by autonomous actors that directly or indirectly consume, produce or provide data and other related resources (e.g., software, services and infrastructure). Each actor performs one or more roles and is connected to other actors through relationships, in such a way that actors['] collaboration and competition promotes data ecosystem self-regulation.'

There are some parallels to the biological roots of ecosystems in such a definition, but in the main the term is used metaphorically. Others, such as van Schalkwyk et al. (2016), make a more direct analogy with the language and ideas of ecosystems theory to argue that data ecosystems involve co-determinate and symbiotic relationships between mutually interacting organisms (firms, institutions, customers, etc.), including 'keystone species' such as data intermediaries (e.g., research and training consultancies) that create the conditions for successful data systems within organisms and collaboration between them. Relationships between organisms are seen as cyclical and reinforcing, with interdependencies existing between organisms, their data systems, and resources, enabling adaptation and resilience (van Schalkwyk et al., 2016).

In the Critical Data Studies literature, a data ecosystem is understood in socio-technical terms, with an emphasis on the social aspect, rather than in an analogous biological sense. Here, there is a conceptual move beyond a descriptive acknowledgement of the inter-relationship between actors to highlight the social, political and governance/legal arrangements and interdependencies that have been established between actors and systems that is constitutive of the nature of a data ecosystem and how it operates (Scassa, 2019). For Kitchin (2022), a data ecosystem is thus best understood through assemblage thinking. Here, each data system is cast as a data assemblage; a complex socio-technical arrangement composed of many apparatus (e.g., network, hardware, database, software, interface), actors (e.g., those that variously contributed to its construction and operation) and conditions (e.g., systems of thought, forms of knowledge, finance, legal and regulatory context, political economy) which collectively shape the design and on-going use of a data system. As such, each data system is not simply a commonsensical socio-technical arrangement, but is the product of data politics and data power (Kennedy et al., 2015; Ruppert et al., 2017), and they reinscribe and reproduce these relations. A data ecosystem from this perspective is an 'assemblage of assemblages' (DeLanda, 2016); data systems are assembled together to form a data ecosystem, bound by shared goals and legislative mandates and supported by institutional (e.g., strategic partnerships, licensing, memoranda of understanding) and technical (e.g., protocols, data standards) arrangements, and guided by regulations, values and norms.

As a socio-technical assemblage of data assemblages, a data ecosystem is understood to be emergent, constantly in a state of becoming. Data ecosystems are never bounded, fixed and stable, but contingently unfold in relation to an ever-shifting context. This contingency is present with respect to a data ecosystem's day-to-day form and operation – evident in their ever-shifting, though repetitive and citational, rhythms, tempo, and timings – but also their longer term development and the on-going reconfiguration across years (Coutard 2024). As Kitchin and Lauriault (2018: 9) note, data assemblages (and thus data ecosystems) are constantly evolving 'as new ideas and knowledges emerge, technologies are invented, organizations change, business models are created, the political economy changes, regulations and laws are introduced and repealed, skill sets develop, debates take place, and markets grow or shrink'. They are 'never entirely coherent, and [are] always being re-made' (Allen and Vollmer, 2018: 23).

A number of recent studies have examined the temporalities of technical infrastructures (such as a data ecosystem), noting their emergent nature, and how they develop, grow and change over time. As Smith (2016: 173) notes, '[i]nfrastructure systems are not brought into the world fully formed nor are they put into place all at once … [I]nfrastructure is always in a state of becoming, designed to do something, but … never 'finished'.' Initial studies of infrastructure development tended to chart sequential and linear histories, detailing phases of creation and progression (Engels, 2020; Monstadt, 2022). For example, Hughes (1987) and Offner (1993) charted how infrastructures passed through phases of planning, procurement, construction, growth, maturity, decline and demise, though they also note that these phases can overlap and backtrack (Carse and Kneas 2019; Coutard 2024). Within such accounts, initial ideas, investments and conditions set a direction of infrastructural development, and as technologies, work practices, and systems of management and governance become embedded, a path dependency develops that produces a self-reinforcing trajectory of future design iterations and innovation (Rast, 2012).

This transition and path dependency progression model has been challenged. For example, Carse and Kneas (2019) note that infrastructures rarely follow an anticipated, linear trajectory, experiencing blockages, delays, realignments and obsolescence that add dead-ends, retreats and knots to the path experienced. Likewise, Moss (2021: 1) contends that transition accounts do not 'capture the complex dynamics, non-linear developments, alternative pathways and hybrid configurations' of infrastructure development. Similarly, Engels (2020) and Monstadt (2022) draw on Koselleck's (2000/2018) notion of the layering of time, in which it is recognized that the components of an infrastructure are added at different times, to note how infrastructure components become bound together so that 'multiple historical times [are] present at the same moment, layer upon layer pressed together, some still volatile, others already hardened' (Koselleck, 2018: viii). Engels (2020) thus argues that infrastructure histories should be understood not as sequences, but as palimpsests, with new socio-technical elements fused onto older ones. Moreover, aspects of development can be divergent, with several related components unfolding over time in variable ways, even though they are part of the same infrastructure. For example, different organisations in the same data ecosystem might rollout, configure and deploy the same data system in varying ways, or employ different data systems to perform the same tasks (both of which occur in the data ecosystem we detail).

How an infrastructure develops then is not predetermined and teleological but is subject to emergence, multiple trajectories of adoption and adaptation, and is open to critical junctures (radical breaks such as abandonment and replacement) (Grzymala-Busse, 2011). At any one point of development there are alternative paths that can be taken; indeed, meetings to discuss IT implementation often set out and debate different scenarios and their merits prior to selection, and delays and external factors (e.g., a cut in funding or a new piece of legislation or policy) can shift or derail implementation. That said, while infrastructure development over time is contingent and not locked on a path dependency, it is also not an open-ended horizon. Rather it is conditioned by enduring and resilient existing socio-technical arrangements (Tutton, 2017). In this sense, those responsible for innovating a data ecosystem 'are heirs before they are choosers' (Rose, 1990: 263).

How an infrastructure is constructed and unfolds in practice occurs, in our view, through the processes of visioning, articulation, scaffolding, and overwriting. Visioning is a process of identifying an issue to be solved and devising a general approach for how to solve it. For example, identifying the need to construct a data ecosystem to support the development and control functions of a planning system, or the need to digitalise an analogue function or introduce an entirely novel data system to perform a new function. The visioning might be quite modest and limited to a relatively short time horizon, and not designed to anticipate how a data ecosystem might be constituted in 20 years. Articulation refers to the process of turning this vision into a plan of action: identifying, scheduling, coordinating and monitoring of all necessary tasks – and the steps within these tasks – to complete a job (Kaltenbrunner, 2015; Tanweer et al., 2016). In essence, articulation involves planning the workflow and resources needed, and aligning relevant actors, to undertake tasks and to construct and maintain systems and processes (Nadim, 2016). Each stage might be separately articulated, with the stages then meshed together.

Scaffolding involves assembling the resources needed – data, technologies, finance, governance, and personal and institutional relationships – and to construct the bureaucratic structures and procedures and technical systems to fulfil these articulations (Halfmann, 2020). Scaffolding helps realise articulation work by providing the means to achieve its ambition. Once the various components are scaffolded into place and are fully operational, the scaffold can be removed (e.g., discontinuing working groups established to realise the articulation) (Halfmann, 2020). Over time, new components might be articulated and scaffolded into the data ecosystem. In some cases, these might overwrite existing components, either upgrading them or replacing them, thus creating a palimpsest layering of the infrastructure (Engels 2020). For example, the process of digitalisation has meant that paper-based components of a data ecosystem become over-written by digital data systems, or spreadsheets might be over-written by relational databases.

In the remainder of the paper, we map out a genealogy of the formation and long-term emergence and evolution over a 25 year period of a nationwide data ecosystem that spans 31 LAs and a handful of government agencies and departments, focusing in particular on how the data ecosystem has been scaffolded into place, including successive rounds of overwriting.

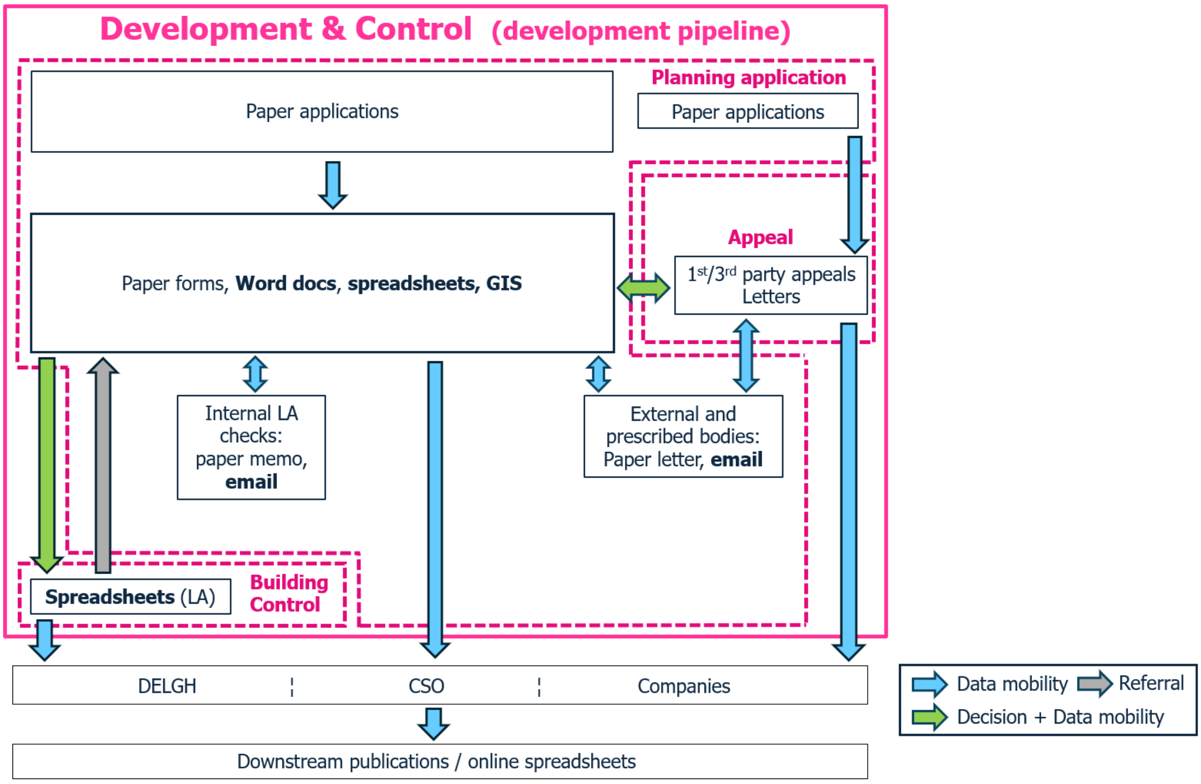
A genealogy of the Irish development and control data ecosystem

Pre-2000

Prior to the 1960s, planning in Ireland was laissez-faire and sectoral. The Local Government (Planning and Development) Act 1963 aimed to introduce a more orderly planning system through a managerial approach administered by LAs (the lowest scale of administrative government) (Bartley 2007). LAs were tasked with producing and implementing plans for future development (strategic planning), assessing planning applications and tracking construction (development and control), and ensuring that new development complied with planning and building control conditions (enforcement and compliance). The aim was to rationalise development and limit undesirable change, and to manage potential conflicts through accountable procedures that would take account of public opinion (Bartley 2007). Each LA established a bureaucratic procedure for managing planning processes, which was entirely paper-based. Here, a good deal of visioning and data articulation work was undertaken to envisage and construct an initial system of application and assessment, and to scaffold this into place as an operational system. This process of making up planning – establishing planning departments (initially linked to engineering departments; Bannon and Bradley 2007) and devising systems of assessment and decision making – created an initial template with a lasting legacy, with its impression still visible in present-day planning (Kayanan et al., 2024). That is, subsequent bureaucracy has iterated on initial processes, rather than there being a critical juncture and a shift to an entirely new set of procedures and modes of assessment.

This is not to say that planning ideology, practice and its institutional organisation has lacked innovation. During the late 1980s, there was a move to adopt the ethos of entrepreneurial planning, with additional, site-specific planning authorities set-up with special powers to fast-track development in strategic development zones, a reduction in 'red-tape', and the adoption of a pro-development stance (Kitchin et al., 2012; MacLaran and Kelly, 2014). In the 1990s, GIS systems were enrolled into strategic planning and the production of county and local area development plans. By the early 2000s, a multi-tiered planning system had been put in place with the development of regional planning and the adoption of a National Spatial Strategy (Bartley 2007). At the same time, there was a move to adopt planning application management systems for processing planning permission applications. Prior to this, the development and control function had been paper-based, with applications submitted as printed forms, site layouts, and architectural drawings. Requests for feedback on whether applications complied with development plans, laws and regulations, and national and local policy, were mailed to internal units (e.g., transportation, environment, and archaeology and heritage departments) and external parties (e.g., what were then named the Department of Environment and Local Government; Department of Tourism, Transport and Communications; Health Service Executive), and returned letters were noted in ledgers and filed in folders and filing cabinets. Copies of the applications were lodged in a public office that citizens could visit in order to view them, with support or objections lodged via the mail system. In the 1990s, this paper-based process was complemented by the use of word processing for the writing of reports and memos, spreadsheets and GIS for recording information and tracking applications, and the use of email to request internal and external feedback, but paper remained the key media for the planning system (see Figure 1).

Figure 1: The development and control data ecosystem pre-2000



Bolded text = Planning data system or digitally mediated means of capturing, processing or storing planning data.

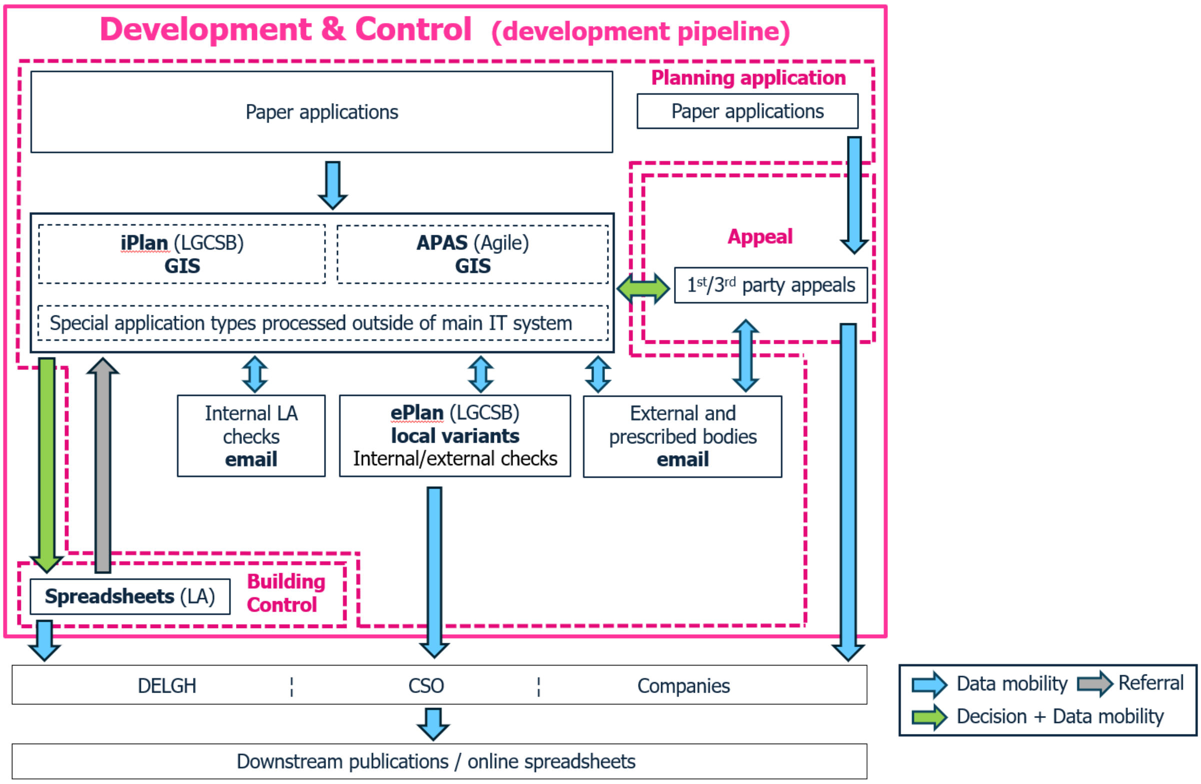
2000-2010

Digitalisation of the planning development and control function of Irish planning started in earnest in 2000. In that year, Dublin City Council adopted APAS, a proprietary system developed by a UK company (Agile Applications), as their management system for processing and tracking planning applications. The same system was also adopted by the other three Dublin LAs. In 2002, iPlan, a planning application management system developed by a state agency, the Local Government Computer Services Board (LGCSB), was introduced and adopted by several LAs. Across all LAs, applications were still submitted as paper documents, with manual data entry and the digitisation of documents (by scanning them) performed by LA staff (see Figure 2). Not all forms of planning applications were processed within these systems, with a number of specialist applications handled separately, a situation that remains in place in 2024. Shortly afterwards in 2003, the ePlan shared service, again developed by the LGCSB, was launched, providing open online access to selected components of planning applications. This was accompanied by local variants of ePlan for the LAs using APAS. APAS and iPlan were adopted in part to modernise planning services with the move to e-government, and in part to try to gain processing efficiencies and cope with a surge in planning applications as the Celtic Tiger property boom grew (annual housing completions were 19,652 in 1991, rising to 49,812 in 2000, and reaching a peak of 93,419 in 2006; Kitchin et al., 2016). Given that the process of assessment and workflow remained largely the same, with just the medium changing (paper to digital), digitalisation did not form a critical juncture that radically altered planning practices.

While there were refinements to iPlan, APAS and ePlan during the 2000s (and its local variants, such as planning.applications.ie used by the four Dublin LAs), and the number of LAs using them increased, there was little further digitalisation of the data ecosystem. In part, this was due to the property crash that began in 2007 with a slowdown in property development and levelling off in property prices, followed in 2008 by a significant fall in both (Kitchin et al., 2012). In Ireland, the financial crash of 2008 was caused by the over-development of property rather than by sub-prime investments (for example, the 2011 census revealed that 238,948 units were vacant (excluding holiday homes), with 14.5% of all units in the state being vacant (CSO, 2012)). By 2009, the Irish economy was in severe trouble resulting in a €85 billion IMF-EU bailout in November 2010 (Kitchin et al., 2012). Due to a massive contraction in government revenue, LA's net budgeted expenditure fell from 5.029 billion in 2008 to a low of 3.911 billion in 2015, a fall of 22.2% (DEHLG 2008, DECLG 2015) and LA staffing fell from 35,007 in 2008 to a low of 26,630 in 2015, a reduction of

8,377 (23.9%) (DPER 2024). Such cuts created capacity issues in the delivery of services and limited innovation.

Figure 2: The development and control data ecosystem in 2004



Bolded text = Planning data system or digitally mediated means of capturing, processing or storing planning data.

2010-2020

From the early 2010s, a number of organisational and technical developments took place with regards to the planning system and the development and control data ecosystem designed to: (1) institutionally reform the organisation of planning; (2) align and start to standardise data work and outputs across Irish planning authorities; (3) massively extend the digitalisation of planning processes so that planning documents, planning work and decisions were captured within and mediated by digital systems; and (4) interconnect planning data work and the sharing of data and decisions across scales from the local to the national. Digitalisation was a major component of these reforms, introduced for three principal reasons: to increase efficiency and to be able to do more with less; to provide data that would enable stronger evidence-informed planning policy (the absence of which had clearly contributed to creating the conditions for the crisis); and to increase transparency and provide greater oversight of the development and control pipeline.

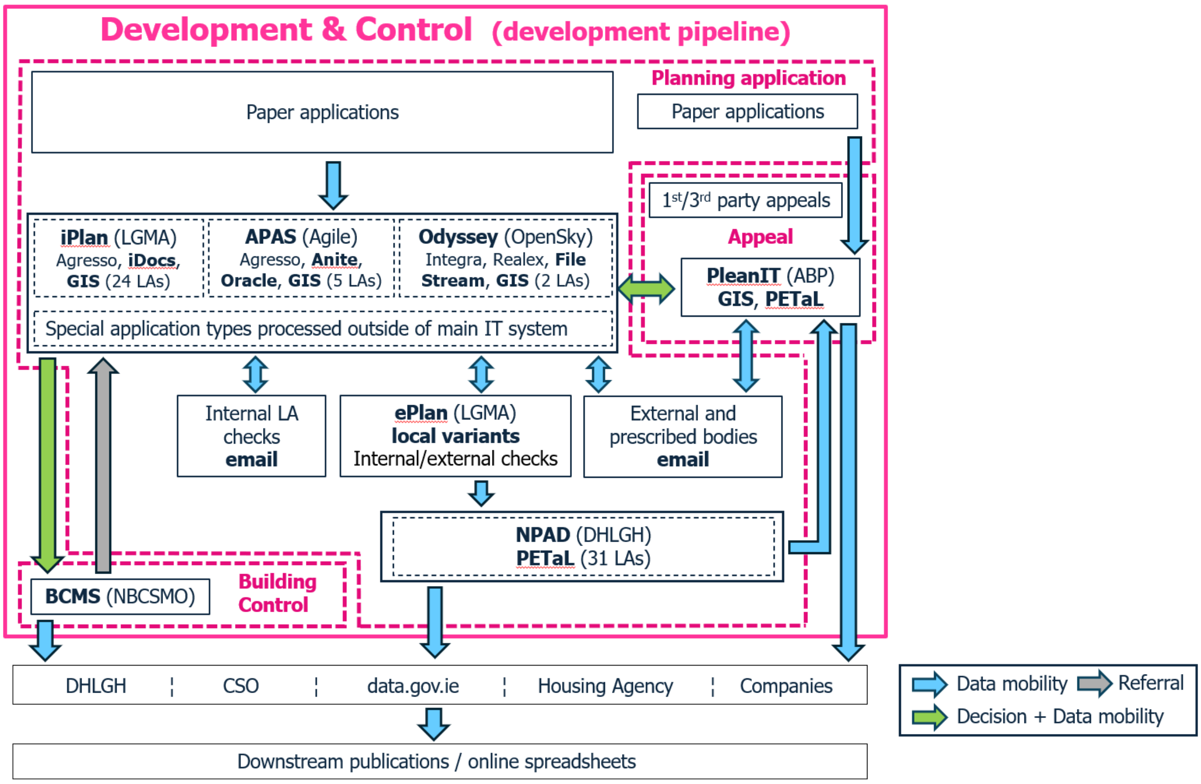
In 2013, planning application forms, which up to this point had varied across LAs, were standardised nationally, though within two years their format started to drift as LAs re-customised the form. In 2014, 88 local planning authorities were reduced to 31 (all LAs) with the eradication of 56 town councils and borough corporations, consolidating planning expertise and eradicating smaller, more voluntary-based authorities that had weak IT capabilities and capacities. In 2015, the LGMA (the Local Government Management Agency, the successor of LGCSB) launched the eplanning.ie site, a centralised portal to access ePlan services. In the same year, the two Cork LAs transferred from using iPlan to a new commissioned system, Odyssey (developed by OpenSky) to manage their planning applications due to the functionality and scope limitations of iPlan.

In 2016, the BCMS was launched as a shared service, administered by the new National Building Control and Market Surveillance Office (NBCMSO) hosted by Dublin City Council. The rationale for the BCMS was to provide a single, national system to allow all LAs to track the discharging of responsibilities with regards to the Building Control Act 1990 by building control authorities, building developers, and construction professionals (e.g., monitoring commencement, notices, compliance certificates, statutory documents, and completion). The development of the BCMS was prompted by the introduction of new regulations (S.I.9 of the Building Control Amendment Regulations 2014) concerning the commencement and certification of construction works (Dwyer-Bond et al., 2019). These regulations were a response to poor building control monitoring and the construction of thousands of buildings during the Celtic Tiger property boom with structural and material issues and inadequate fire safety measures (Ahern et al., 2018).

Also in 2016, the National Planning Application Database (NPAD) was introduced by the DHLGH (Department of Housing, Local Government and Heritage) to collate basic information on all planning applications nationwide into a single database viewable using an online interactive mapping interface. NPAD extracts and imports selected data (up to 25 fields) from each LA's ePlan site using an automated ETL (extract, transform, load) process (PETaL). The site provides a means to browse all proposed developments from local to national scale in a single view, rather than searching addresses within individual LA ePlan systems. In this way, patterns of proposed development could be observed. The following year, An Bord Pleanála (ABP), the national body for planning appeals, launched Plean-IT, a management and GIS system, to aid its case processing and assessment. With the introduction of the General Data Protection Regulations (GDPR) in May 2018, necessary adjustments were made to information shared within ePlan to remove personal data (e.g., phone numbers, email addresses; though name and address of applicant remains) and other sensitive data (such as specific personal information stated in cover letters).

In a few short years, the planning development and control data ecosystem had been significantly transformed (see Figure 3), with a marked increase in digitalisation and datafication, though in all cases planning applications were still paper-based, being digitised and entered into a planning management system on receipt. In the case of ABP, while Plean-IT aided case management, the organisation remained a paper-based enterprise with all electronic correspondence printed out and added to paper files to meet statutory requirements.

Figure 3: The development and control data ecosystem in 2017

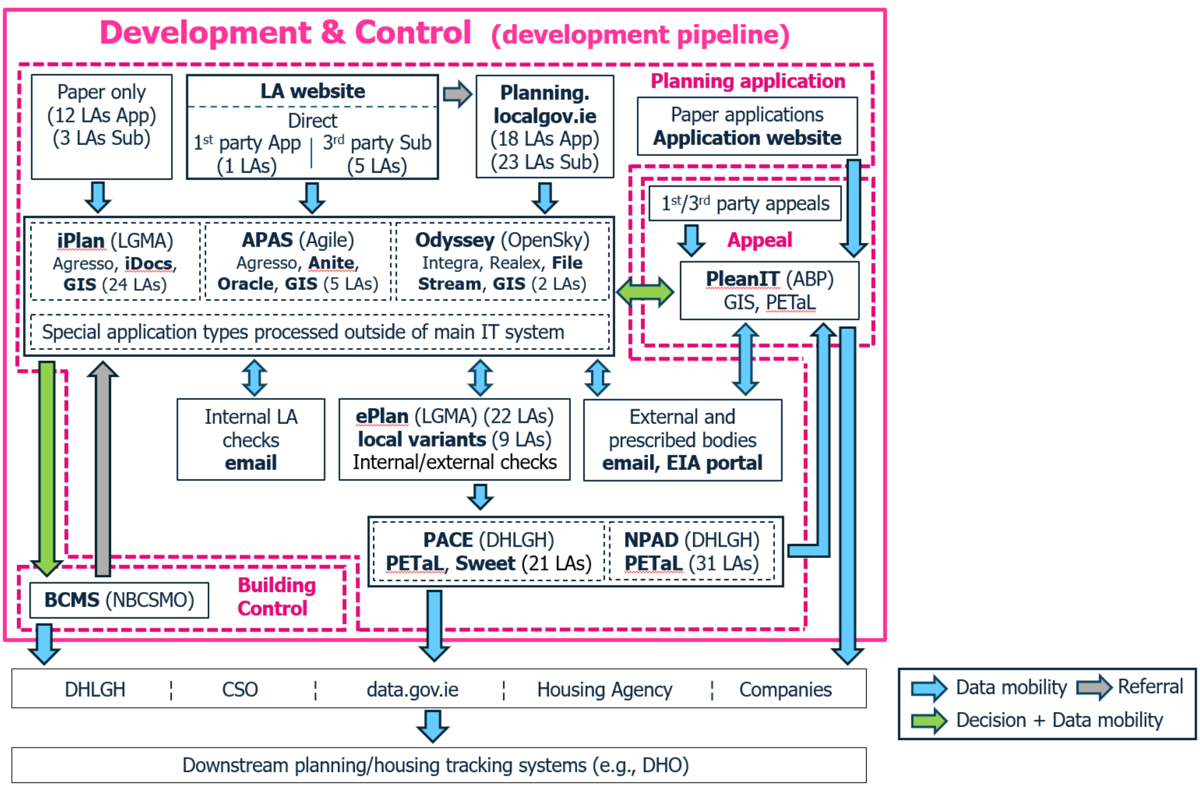


Bolded text = Planning data system or digitally mediated means of capturing, processing or storing planning data. Anite, iDocs, File Stream, Oracle are document filing systems. GIS is used to view spatial data. Agresso, Integra, Realex are financial systems used for paying planning fees. PETaL is an extract, transform, load utility.

2020-2024

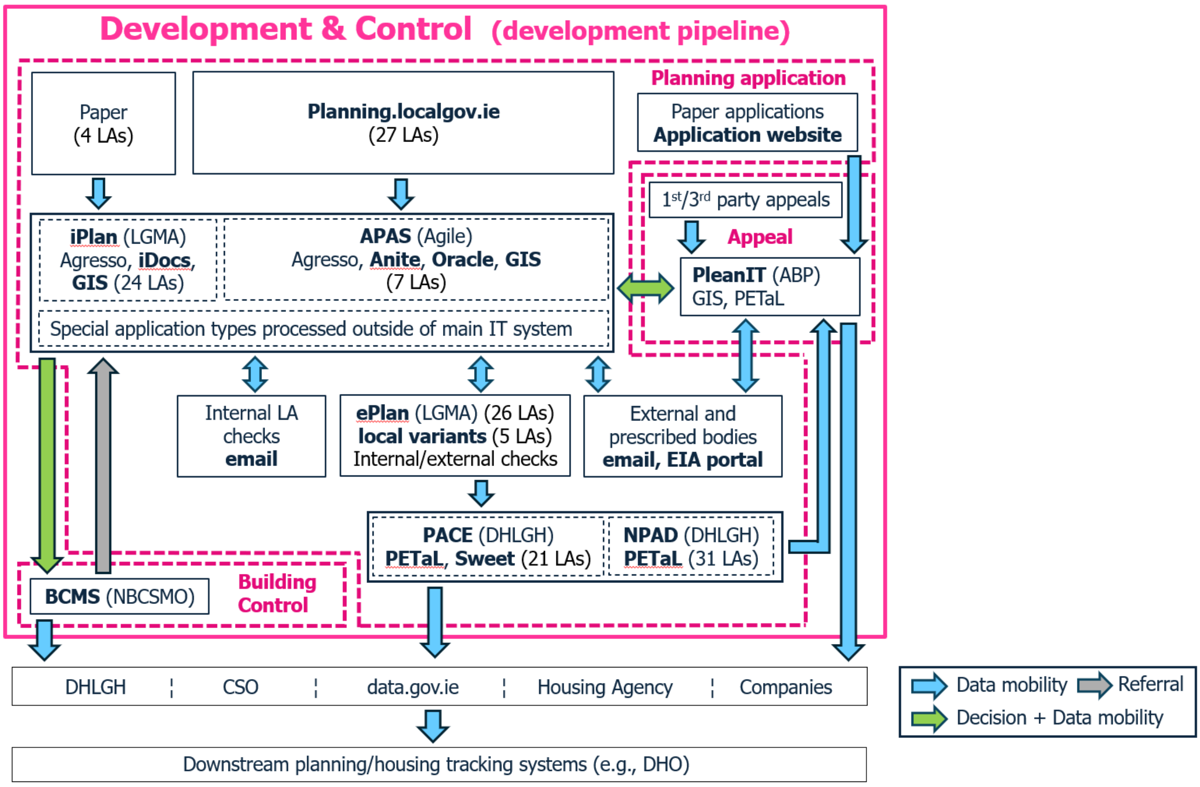
At the start of the 2020s, two new elements were added to the data ecosystem (see Figure 4). The Planning Application Capture Environment (PACE) was launched in 2021. Developed by Ordnance Survey Ireland (now Tailte Éireann) and DHLGH, PACE provides a standardised tool for digitally capturing the site boundaries of planning applications, pulling these data into a nationwide mapping system. More significantly, in 2022, the LGMA piloted planning.localgov.ie, an online portal for the submission of planning applications and third-party public feedback about applications as webforms and pdf files. Initial pilot LAs were soon followed by early adopters so that by August 2023, 18 LAs had adopted the portal for submitting applications and 23 LAs for third-party feedback. In one case, a LA had created their own online submission portal. In every case, LAs would still accept paper-based applications.

Figure 4: The development and control data ecosystem in August 2023



This period is characterised by a drive towards fully digitalising the data ecosystem by increasing the use of planning.localgov.ie, ePlan and PACE. In the year after our fieldwork significant change had taken place, which we captured through follow-up discussions with key stakeholders. An additional 9 LAs were using planning.localgov.ie to manage submissions and just four LAs only accepted paper applications (with an intention that this will be zero by the end of 2024). The two Cork LAs had moved from using Odyssey to APAS. Four more LAs were using ePlan rather than local variants, and four more were using PACE.

Figure 5: The development and control data ecosystem in August 2024

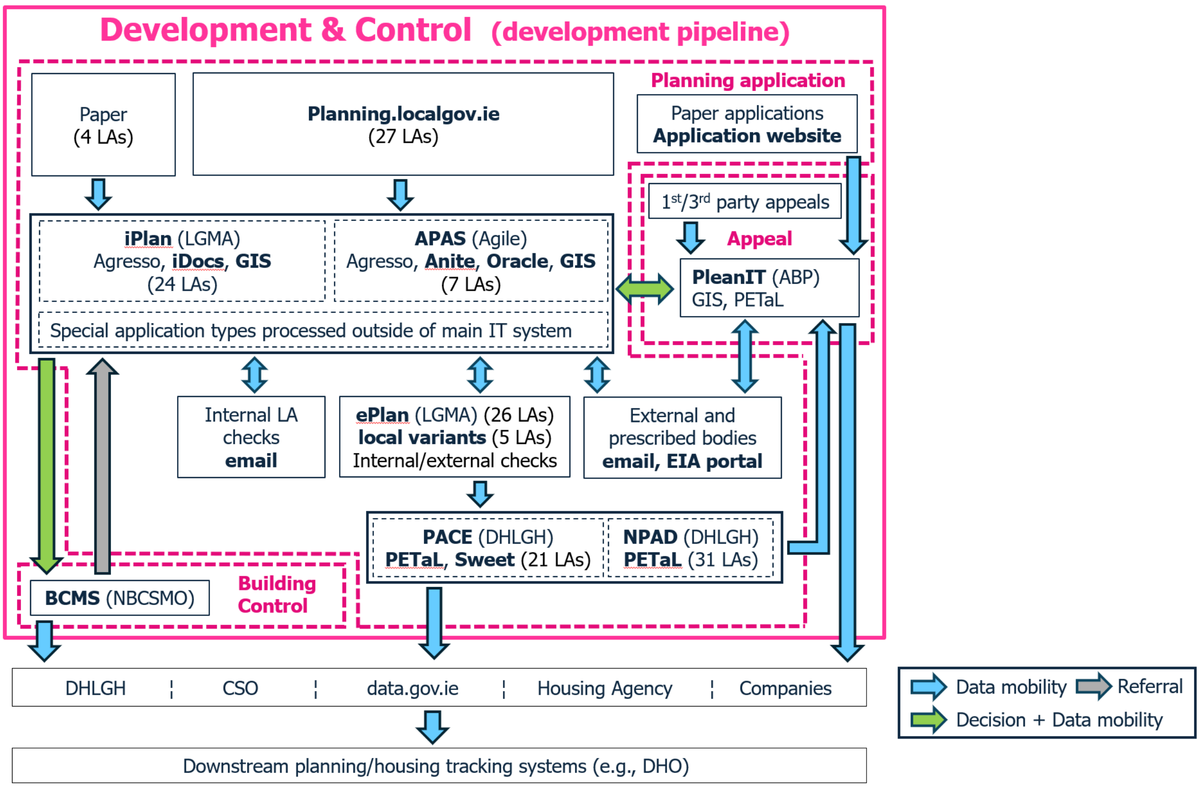


A number of concerns were also being raised around the design, utility and fit-for-purpose of some of the data systems, and the composition and functioning of the data ecosystem as a whole. At one level, the various data systems and the data ecosystem were seen to be performing their primary role. The planning application management systems (APAS, iPlan, Odyssey) enabled the management of cases and to be able to make an informed decision. The BCMS enabled building control to be monitored. NPAD enabled a nationwide view of the actual and potential development pipeline. Necessary data could be transferred between data systems. However, it was also the case that the data systems were suboptimal for the additional tasks that they were now being asked to perform, especially related to data requests, and a number of data frictions (Bates 2018) existed that limited inter-relationships between data systems. By 2020 Ireland was deep into the next wave of an on-going housing crisis, now characterised by a shortage of stock (caused by over a decade of very low construction rates and rising population), rapidly increasing rents and property prices, and a high rate of homelessness (10,271 in January 2020, rising to 14,486 in August 2024) (Hearne 2020; Government of Ireland 2024). The development pipeline is critical to addressing these issues and for meeting government-set housing targets. As the holder of considerable volumes of planning and construction data, the planning application management systems, BCMS and Plean-IT were viewed as key evidence sources for tracking progress.

However, these were systems designed to manage cases, make decisions and monitor compliance, not to produce standardised data nationally or run bespoke data reports. APAS, iPlan and Odyssey each possess their own data architecture (with varying database design, data standards, data ontologies and data dictionaries). They have different workflows and capture data through different means (iPlan and Odyssey make extensive use of free text fields, and Odyssey and APAS make strong use of check boxes and drop-down selections). Moreover, limitations in functionality meant that several specialised applications (e.g., those made under Sections 5, 35, 42, 44, 57, 247 and Parts V, VII and XI of the Planning Act), continued to be handled outside of planning application management systems. In the case of BCMS, data entry is self-reported by builders, architects, planners and surveyors often into open text fields, meaning data do not follow any prescribed format and there is considerable scope to misreport activity and compliance reducing data quality and veracity. Data capture then is not standardised across data systems. Moreover, tracking individual developments through the development and control system is difficult due to lack of a consistent ID reference number across systems, with a proposed development receiving unique IDs at pre-planning, planning, appeals, and construction stages. It is also difficult to extract requested data from these systems. For example, it takes a planning officer approximately a week every month to extract the required data for the compilation of official planning statistics by the Central Statistics Office because there is no automated process. Planning authorities are regularly receiving special-run data requests from the DHLGH and through Freedom Of Information (FOI) media requests that likewise take considerable time to process.

As a consequence of these issues, two reviews have been implemented. From 2022 until the time of writing, an inter-departmental group led by the Department of Taoiseach (Prime Minister's Office) has been reviewing the BCMS and scoping out the possibilities of a major overhaul of data entry procedures to address its two primary weaknesses: the lack of shared indexical data (ID reference) tying the BCMS submissions to the planning application system; and lack of standardisation and data quality due to open text fields and self-reporting. A proposed solution is to create a shared ID reference number, which when entered into the BCMS on building commencement will pre-populate fields with relevant information, and to replace open text fields with drop-down menus with fixed categories for selection. In August 2023, the LGMA and DHLGH started a scoping and consultation study for a new, standardised national development and control system. This study consisted of an initial visioning and articulation process, devising and exploring possibilities with various stakeholders to reconfigure the data ecosystem so that 31 LAs would use the same set of IT systems, configured in the same way, with standardised data ontologies and workflows, and from which it will be easier to extract data (see Figure 6). If this transition were to occur it would produce workflow and data standardisation and significantly reduce data frictions. The next stage of the project is to scaffold into place the mandate and resources to enable such a harmonised data ecosystem to be created.

Figure 6: The likely proposed development and control ecosystem for 2027 if approved and adopted



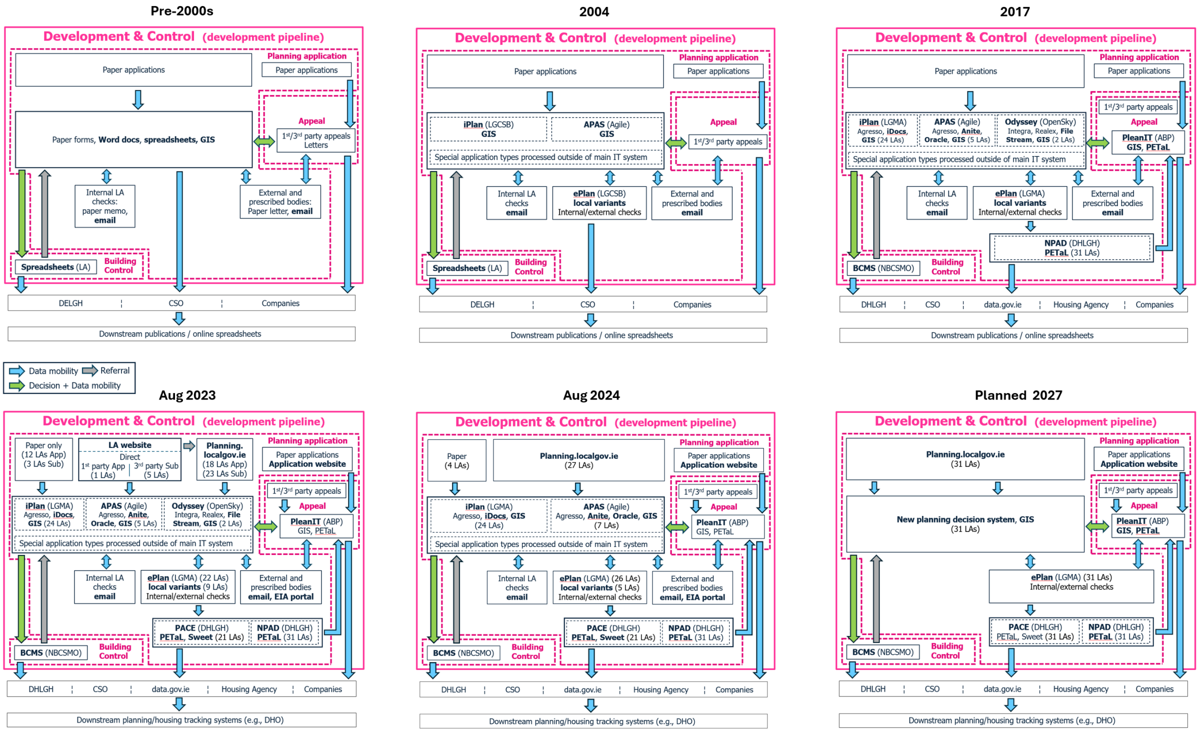
Discussion and Conclusions

Our case study has demonstrated, on the one hand, the contingent, emergent nature of the development of a nationwide data ecosystem over time, and how technologies are scaffolded into the ecosystem at different times to produce a layered and multiply overwritten palimpsest; and on the other hand, how everyday planning practice has become a thoroughly digital enterprise as paper-based systems and processes are replaced and augmented by digitally mediated ones. Here, we draw out the main observations and implications related to these two contributions, paying particular attention to the process of digitalisation and how data ecosystems evolve over time.

As Figure 7 highlights, the planning development and control data ecosystem in Ireland has undergone considerable growth and change over 25 years becoming progressively digitalised and shaped in relation to wider contextual factors, such as the demand for greater evidence-informed policy and practice in the wake of the collapse of the Celtic Tiger property boom. Over time, the data ecosystem became more complex as new data systems were introduced and scaffolded into place. While this enhanced the delivery of planning services and produced more system-wide evidence to inform policy, it also produced data frictions and hindered the ability to compile standardised data nationally. More recently, there has been a drive to create increased harmonisation and standardisation of data systems across LAs. The charting of the on-going transition of the data ecosystem reveals five important features of its emergence that give rise to its palimpsest qualities, which we believe will also be the case for other technical infrastructures.

First, there was no long-term vision or articulation for the digitalisation and the production of the data ecosystem. When APAS and iPlan were introduced there was no sense of starting a process that would produce the kind of data ecosystem in place in 2023. Indeed, up until that year, the time horizon of development was always a handful of years, focused on the next incremental change as a new data system was articulated and scaffolded into place. In this sense, the data ecosystem has largely been jerry-rigged together with no underlying blueprint. It is only in 2023 that an attempt has been made to map the system in its entirety, including all the data mobilities, the data-informed decision points, and data dictionaries, to review the efficacy of the component data systems and the overall data ecosystem organisation, and to vision and articulate a revised, harmonised data ecosystem.

Figure 7: Digitalisation and the emergence of a planning development and control data ecosystem over 25 years



Second, the initial architects of the transition to a digital data ecosystem were heirs not inventors (Rose, 1990). An embedded paper-based system for processing planning applications, appealing decisions, and monitoring building control was already in place, designed to meet the conditions and demands of a set of nationwide regulations and laws. The visioning process is therefore circumscribed by a desire to simply replace an analogue system with a digital version of the same set of processes and procedures. Initially, this digitalisation applied solely to making applications and sharing these with the public. Later developments similarly consisted of digitalising existing systems of work: the BCMS iterated on existing procedures for monitoring building control systems, and Plean-IT for planning appeals. At the same time, there is innovation in these data systems, with new forms of data captured and additional data tools made available. In the case of NPAD, while being a novel system and service, it is dependent on eplanning systems for its data, and its design and architecture is tailored to be able to extract, store and map such data.

Third, there is contingency and variability in the processes and timing of digitalisation and make-up of the data ecosystem, with different organisations following slightly different paths. Initially, the LAs could choose to procure whatever planning application management system they wanted. The four Dublin LAs plus Wexford selected APAS, the rest iPlan. Some were early adopters, while others persisted with their paper-based system for a while before adopting APAS or iPlan. In the case of APAS, due to its modular open design, each LA could configure the system to suit their own desired design and workflow. Indeed, the five APAS systems in 2023 were quite different to each other in terms of how they were configured. The introduction of Odyssey added a further data system design to the data ecosystem. It is only in the 2010s that there is evidence of a shift towards some harmonisation and standardisation with planning application forms being standardised in 2013, eplanning.ie providing a single portal to ePlan systems, and BCMS and NPAD being provided as national, shared services. And it is only in 2023 that a national review recommends eradicating variability in the data systems used and their associated data ontologies. This variability in the paths taken by different actors requires a genealogical approach to capture these differing trajectories.

Fourth, the unfolding development of a data ecosystem is saturated with power, which to date has received scant consideration in the data ecosystems literature. A data ecosystem has multiple actors, with differing agendas, competing interests, and varying degrees of autonomy. Government is structurally organised, with governance, management and reporting lines that direct or compel actors to act in particular ways. These can be resisted or subverted through tactics such as minimal compliance and delays, particularly when alterations to workflows are substantive, involve staff retraining or redeployment, and conditions such as understaffing and limited resources exist. While our study did not focus on documenting power relations within the data ecosystem, it was clear from interviews that there is a long-standing tension between LAs and the DHLGH regarding levels of autonomy, resourcing and change management that undoubtedly contributes to data frictions and influences the composition, operations and development of the data ecosystem (see Author et al., forthcoming).

Fifth, our analysis has focused on the long-term, emergent, contingent nature of a data ecosystem. Such contingency is also evident in the day-to-day operations of the constituent data systems and the data ecosystem as a whole. As our respondents told us, and as we observed through the walk-through interviews, the rhythms and tempos associated with each data system are never fixed, varying with respect to the data practices of individual workers, changing workflows, prioritisation decisions, delays caused by glitches and under-resourcing, and other technical and social factors. In our view, there is a need to examine how daily planning practices and processes unfold, their micro-temporalities, and what these mean for how data ecosystem gradually changes through citational shifts rather than the introduction of new technologies.

Finally, there are now a reasonable number of studies that have examined the introduction of specific digital technologies, such as GIS, 3D spatial media, online consultation platforms, and building information modelling, into planning and their effects on practices and outcomes. However, there is little consideration of the more general trend of widespread digitalisation and datafication of everyday planning practices, such as processing planning permission applications, and the institutional organisation of planning. Our case has highlighted how planning practice has become a thoroughly digital enterprise as paper-based systems and processes have been replaced and augmented by digitally mediated ones. Indeed, there is no part of planning work that evades digital mediation – even those aspects of the Irish system that are still paper-based are documents prepared using software (e.g., word processing, CAD, GIS, spreadsheets) that have then been printed. Digitalisation and datafication have had many effects, relating to the temporalities of development and control (speed and efficiency), resourcing (doing more with less through labour replacement), increasing the evidence base to inform decision-making, and shifting the institutional arrangements between stakeholders. There is a need to further explore the nature and consequences of these effects on planning and development.

Acknowledgements

The research reported in this paper was funded by the European Research Council (no. 101052998) and the Local Government Management Agency. The research received ethical approval from Maynooth University Research Ethics Committee and the Ethics Review of the European Research Council. During the research regular meetings were held with the LGMA Research Advisory Group and we are thankful to Dr. Bernie O'Donoghue Hynes, Tom Elders, Tara Kerrins, and Holly Morrin for facilitating access and providing direction and constructive advice and feedback. We are grateful to all the interviewees for spending time to explain and demonstrate their work and the systems they use. Thanks to Mairéad Phelan and Ronan Glynn of the National Building Control and Market Surveillance Office for insights into BCMS. Thanks to Oliver Dawkins and Danielle Hynes for feedback on an initial draft.

References

Ahern, E., Bescos, C.J. & Desai, A. (2018). Evaluating how Ireland has improved building regulations compliance and energy efficiency. In Elsharkawy, H., Zahiri, S. and Clough, J. (eds) *Proceedings of International Conference for Sustainable Design of the Built Environment SDBE 2018*, London. pp. 421-432.

Allen, W.L. & Vollmer, B.A. (2018). Clean skins: Making the e-Border security assemblage. *Environment and Planning D: Society and Space*, 36(1): 23–39.

Bannon, M.J. & Bradley, B. (2007). *Planning Modern Ireland: Irish Planning and the Role of UCD*. UCD Planning, Dublin.

Bartley, B. (2007). Planning in Ireland. In B. Bartley & R. Kitchin (eds) *Understanding Contemporary Ireland* (pp. 31-43). Pluto Press, London.

Bates, J. (2018). The politics of data friction. *Journal of Documentation*, 74(2): 412–429.

Boland, P., Durrant, A., McHenry, J., McKay, S., & Wilson, A. (2022). A 'planning revolution'or an 'attack on planning' in England: Digitization, digitalization, and democratization. *International Planning Studies*, 27(2), pp. 155–172.

Carse, A. & Kneas, D. (2019). Unbuilt and unfinished: The Temporalities of Infrastructure. *Environment and Society: Advances in Research*, 10(1): 9–28

Coutard, O. (2024). Shifting regimes of historicity and the control of urban futures through Infrastructures: Continuities, ambivalences, and tensions in the Anthropocene. In J-P. Addie, M.R. Glass & J. Nelles (eds) *Infrastructural Times: Temporality and the Making of Global Urban Worlds* (pp. 72-94). Bristol University Press, Bristol.

Crowley, U. (2009). Genealogy method. In R. Kitchin and and N. Thrift (eds), *International Encyclopedia of Human Geography*, vol. 4 (pp. 341–344). Elsevier, Oxford.

CSO (2012). *Profile 4: The Roof over our Heads*. Government of Ireland, Dublin. https://www.cso.ie/en/media/csoie/census/documents/census2011profile4/Profile_4_The_Roof_over_our_Heads_Full_doc_sig_amended.pdf

Daniel, C. & Pettit, C. (2021). Digital disruption and planning – use of data and digital technology by professional planners, and perceptions of change to planning work. *Australian Planner*, 57(1), 50-64.

Datta, A. & Muthama, D.M. (2024, online first), Sorting paper: The archival labour of digitising land records in Kenya. *The Geographical Journal*. https://doi.org/10.1111/geoj.12581

Dawes, S.S., Vidiasova, L. & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, 33(1): 15–27.

DECLG (2015). *Local Authority Budgets 2015*. Dublin: Department of Environment, Community and Local Government, Dublin. Gov.ie, https://assets.gov.ie/111386/41aa9b02-446d-4188-8e5e-d86ea87faca0.pdf

DEHLG (2008). *Local Authority Budgets 2008*. Department of Environment, Heritage and Local Government, Dublin. Gov.ie, https://assets.gov.ie/111397/f4ede5e2-1f1c-4491-b3f6-300b49506d8c.pdf

DeLanda, M. (2016). *Assemblage Theory*. Edinburgh University Press, Edinburgh.

DPER (2024) *Databank*. Department of Public Expenditure & Reform, Dublin. https://databank.per.gov.ie/Public_Service_Numbers.aspx?rep=SectorTrend

Dunleavy, P., Margetts, H., Bastow, S. & Tinkler, J. (2006). *Digital Era Governance: IT Corporations, the State, and E-Government*. Oxford University Press.

Dwyer-Bond, E., Casey, B. & Coates, D. (2019). Developing data sources for a Commercial Property Statistical System (CPSS) in Ireland, International Conference on Real Estate Statistics, 20-22 February 2019, Luxembourg. https://www.cso.ie/en/media/csoie/methods/methodologicalresearch/commercialproperty/ICREA_Ireland_2019.pdf

Engels, J.I. (2020). Technical infrastructures as products and producers of time. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, 28(1): 69– 90.

Foucault, M. (1977). *Discipline and Punish*. Allen Lane, London.

Gelhaar, J., Groß, T. & Otto, B. (2021). A taxonomy of data ecosystems. In T.X. Bui (ed) *Proceedings of the 54th Hawaii International Conference on System Sciences* (pp. 6113-6122). HICSS, Honolulu.

Government of Ireland (2024). Homelessness data. Gov.ie, Dublin. https://www.gov.ie/en/collection/80ea8-homelessness-data/

Grzymala-Busse, A. (2011). Time will tell? Temporality and the analysis of causal mechanisms and processes. *Comparative Political Studies*, 44(9): 1267–97.

Halfmann, G. (2020). Material origins of a data journey in Ocean Science: How sampling and scaffolding shape data practices. In S. Leonelli & N. Tempini (eds) *Data Journeys in the Sciences* (pp. 27-44). Springer Open, Cham, Switzerland.

Hearne, R. (2020). *Housing Shock: The Irish Housing Crisis and How to Solve It*. Policy Press, Briston.

Hughes, T.P. (1987). The evolution of large technological systems. n W.E. Bijker, T.P. Hughes, and T. Pinch (eds) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (pp 51– 82). Cambridge, MA: MIT Press.

Kaltenbrunner, W. (2015). Infrastructural inversion as a generative resource in digital scholarship. *Science as Culture*, 24(1): 1-23

Kayanan, C. M., Heaphy, L. & Moore-Cherry, N. (2024). Policy, planning practice and the lived experience in a changing Ireland: Provoking thoughts for/of change? *Irish Geography*, 56(1). https://doi.org/10.55650/igj.2023.1484

Kennedy, H., Poell, T. & van Dijck, J. (2015). Data and agency. *Big Data & Society*, 2(2): 1–7.

Kitchin, R. (2022). *The Data Revolution: A Critical Approach to Big Data, Open Data, and Data Infrastructures.* 2nd edition. Sage, London.

Kitchin, R. and Lauriault, T. (2018). Towards critical data studies: Charting and unpacking data assemblages and their work. In J. Thatcher, J. Eckert & A. Shears (eds), *Thinking Big Data in Geography* (pp. 3–20). University of Nebraska Press, Lincoln.

Kitchin, R., O'Callaghan, C., Boyle, M., Gleeson J. & Keaveney, K. (2012). Placing neoliberalism: The rise and fall of Ireland's Celtic Tiger. *Environment and Planning A* 44(6): 1302 – 1326.

Kitchin, R., Hearne, R. & O'Callaghan, C. (2016). Housing. In W.K. Roche, P. O'Connell & A. Prothero (eds) *Austerity and Recovery in Ireland: Europe's Poster Child and the Great Recession* (pp. 272-289). Oxford University Press.

Koselleck, R. (2000). *Zeitschichten. Studien zur Historik*. [Layers of Time: Studies in Historiography]. Frankfurt a.M.: Suhrkamp.

Koselleck, R. (2018). *Sediments of Time: On Possible Histories*. Stanford: Stanford University Press.

Kuppler, A. & Fricke, C. (2024). Between innovative ambitions and erratic everyday practices: urban planners' ambivalences towards digital transformation. *Town Planning Review* https://doi.org/10.3828/tpr.2024.41

MacLaran A & Kelly S (eds) (2014). *Neoliberal Urban Policy and the Transformation of the City: Reshaping Dublin*. Basingstoke: Palgrave Macmillan.

Monstadt, J. (2022). Urban and infrastructural rhythms and the politics of temporal alignment, *Journal of Urban Technology*, 29(1): 69-77.

Moss, T. (2021). Usable infrastructure pasts: Mobilizing history for urban technology futures. Presentation at the 'Infrastructural Times' workshop, Network on Infrastructural Regionalism, Regional Studies Association, online event, 14–18 June.

Nadim, T. (2016). Data labours: How the sequence databases GenBank and EMBL-Bank make data. *Science as Culture*, 25(4): 496-519.

Offner, J.- M. (1993). Le développement des réseaux techniques: Un modèle générique. *Flux*, 13-14: 11-18.

Oliveira, M.L.S. & Loscio, B.F. (2018) What is a data ecosystem? In A. Zuiderwijk & C.C. Hinnant (eds) *Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age*. ACM, New York. Article 74.

Potts, R. & Webb, B. (2023, online first). Digital planning practices: benchmarking planners' use of information and communication technologies (ICTs). *Planning Practice and Research*, https://doi.org/10.1080/02697459.2023.2216492.

Rast, J. (2012). Why history (still) matters: Time and temporality in urban political analysis. *Urban Affairs Review*, 48(1): 3–36.

Rose, R. (1990). Inheritance before choice in public policy. *Journal of Theoretical Politics*, 3: 263–91.

Ruppert, E., Isin, E. & Bigo, D. (2017). Data politics. *Big Data & Society*, 5(2): 1–7.

Sanchez, T.W., Shumway, H., Gordner, T. and Lim, T. (2022). The prospects of artificial intelligence in urban planning. *International Journal of Urban Sciences*, 27(2), 179–194.

Scassa, T. (2019). Ownership and control over publicly accessible platform data. *Online Information Review*, 43(6): 986–1002.

Smith, M.L. (2016). Urban infrastructure as materialized consensus. *World Archaeology*, 48(1): 164– 78.

Tanweer, A., Fiore-Gartland, B. & Aragon, C. (2016). Impediment to insight to innovation: Understanding data assemblages through the breakdown–repair process. *Information, Communication & Society*, 19(6): 736-752.

Tutton, R. (2017). Wicked futures: Meaning, matter and the sociology of the future. *Sociological Review*, 65(3): 478–92.

van Dijck, J. (2014). Datafication, dataism and dataveillance: Big Data between scientific paradigm and ideology. *Surveillance & Society*, 12(2): 197–208.

van Schalkwyk, F., Willmers, M. & McNaughton, M. (2016). Viscous open data: The roles of intermediaries in an open data ecosystem. *Information Technology for Development*, 22(S1): 68–83.