CATAPULT Connected Places

#PLANTECH

Transforming the digital architecture of planning

A critique of planning software today and the pathway to a more open, innovative and interoperable planning software landscape

April 2020

Table of Contents

Definitions

API – Application Programming Interface, a computing interface to a software component or a system, that defines how other components or systems can use it.

Back-office systems – The administration system used to process a planning application.

CIL – Community Infrastructure Levy, a planning related charge which can be levied by local authorities on new developments in their area.

Data schema – The framework for structuring a data entry. The schema outlines what information can be included in a structured data object and what data type it should be. For example, see here for a data schema of a person.

Development Management – the regulatory process by which a local planning authority controls development and the use of land.

Documents – Non-machine-readable (or difficult for machines to read) documents most commonly in PDF form (not JSONs as with document databases).

Emerging Planning Software – refers to a range of new and innovative software tools and services that have emerged in the UK market in the last few years that offer new ways to carry out various planning-related tasks.

GDPR – General Data Protection Regulation, a regulation in European Union Law.

GIS – Geographic Information Systems

Legacy Planning Software – refers to software currently in wide use across local authorities not employing the use of emerging technological advancements.

LLPG – Local Land and Property Gazetteer, the master address dataset maintained by a local authority.

Local Planning Authority – a local government body empowered by law to exercise urban planning functions for a particular area, most often, the local council.

Plantech – the use of existing and emerging technologies to build 21st-century future-ready and flexible planning tools, systems and software.

Red Line – polygonal line on a cadastral-like map that identifies land to which a planning application relates.

Section 106 – also known as Unilateral Obligations, a tool sought by local planning authorities to mitigate the impact of a development on a local community and infrastructure and secured by a legal agreement.

Structured data – Information organised in a way that is machine-readable and adheres to a predefined schema.

```
{application:
      {applicant:
            {name: Joe Bloggs,
            address: 1 Main Street, Anytown,
            email: joe.bloggs@example.com,
            …
            },
      property:
            {uprn: 1234,
            uses: residential,
            site-area: 1,000,000,
            …
            },
      …
      },
      …
}
```

Unstructured data – A block of information not adhering to a specific data schema rendering it non machine-readable. For example, paragraphs of free text inside a PDF.

Application Form

Section 1
Applicant Info:

Name: Joe Bloggs
Address: 1 Main Street, Anytown
Email: joe.bloggs@example.com
…

Section 2
Property Info:

UPRN: 1234
Uses: residential
Area: One million
…

Introduction

Ten years ago Marc Andreessen wrote "Software is eating the world"[1] – if only someone would put urban planning on the menu. In an increasingly digitised world, technology could enable urban planners to make better value judgements on policies and development proposals. Software should provide access to evidence and more information, all with the aim to inform better planning decisions.

But the software offerings of today are not yet fit for this purpose. Using today's planning software presents a constant battle between learning the software, creating workarounds for limitations in the software, formatting documents to export, and then importing back into the software. All of which consume huge amounts of time that should be devoted to the actual practice of urban planning.

This is what planning software should really be for.

Since 2016, Connected Places Catapult and its predecessor, Future Cities Catapult, has been exploring a digital future for urban planning. Under the moniker of Plantech, we have been looking at how existing and emerging technologies can be leveraged to build a truly 21st-century future-ready and flexible planning system. We have nurtured Plantech from a nascent concept with a small number of prototypes, into what is now a truly global community that is accelerating productivity and rapidly growing a market.

This white paper explores the intricacies and consequences of this emerging future system and provides guidance for planners, central government and decision makers, local authorities, investors, innovators and those looking to disrupt the status-quo. We also outline opportunities within the emerging planning software landscape by presenting our vision of what a future system could look like, so that government, local authorities and other stakeholders are better equipped to shape planning software in the future.

Our approach

To arrive at the insights and recommendations in this paper, we undertook qualitative research across the planning industry. This involved interviewing a varied selection of organisations and individuals across the planning industry. We interviewed new planning technology providers, gaining insight from findings of their earlier work, barriers to entry and visions for the future. We also spoke to council planning department leads involved in the decision-making and procurement process associated with buying these softwares. In addition, we spoke to IT administrators within local authorities about the management and configuration of the planning software they look after. And we shadowed users of these softwares, to understand more about how the software is designed, how it is used in practice (which is often different) and pain points for users.

To ensure deep domain expertise in planning, as well as technology and data, the Catapult's Digital Planning and Applied Data and Technology teams collaboratively researched and produced this report. Owing to its broad scope and multidisciplinary approach, we believe our view of the software landscape is comprehensive and draws on industry-wide best practice.

Planning practice is effectively split into plan and policy-making and development management. This means that there are two fairly distinct software systems in operation for each. The systems used for plan and policy-making are in less need of an urgent overhaul than those used by development management. Similarly, development management processes, by virtue of being a regulatory activity rather than a policy activity mean the software used are far more complicated. For this reason this research is focused entirely on development management software.

1 Marc Andreessen (2011) Why Software Is Eating The World

1. Today's planning software landscape

A concentrated market

The English planning software market is predominantly made up of a small number of large suppliers. This has resulted in oligopolistic behaviour, as defined in by David M. Mandy in his book Producers, Consumers, and Partial Equilibrium. An important feature of an oligopolistic market is the interdependence between the small number of firms, resulting in strategic pricing and product offerings[2]. In planning, this has meant that legacy planning software firms offer very similar products so that customers are familiar with their offer. In this report we will not seek to distinguish the cosmetic differences between software products; conversely, we aim to group these services by their functional similarities, primarily looking at their role in the planning process.

2 For example, Idox proudly publicises its "exceptionally strong market position" – https://www.idoxgroup.com/investors/

Back-office software

The current suppliers of planning back-office software offer end-to-end solutions. This means their solutions allow users – primarily planning officers – to manage a planning application from submission to the authority through to when a decision is made. Most software of this type facilitates storing, indexing, searching, generating and editing the documents for a planning application. Additionally, there are some structured data associated with each application – such as the applicant name, assigned planning officer, address etc. – all of which are also stored. We will focus on two providers, Idox and Northgate, as our research showed they are the predominant providers to English planning authorities, but it should be noted that there are other companies offering similar services.

Idox

Idox provides multiple back-office planning software applications and is the most common provider to local authorities, with over 90% of UK local authorities as customers of their product range[3]. The Idox planning products in use today are Acolaid, Uniform and Tascomi, with Uniform being the latest added to this suite. Idox provide document storage, management and reporting, GIS (Idox are gold partners with Esri, a GIS service provider) and a public-facing portal as well as various other additional modules, including ones for Building Control, Environmental Health, Housing and Licensing amongst others.

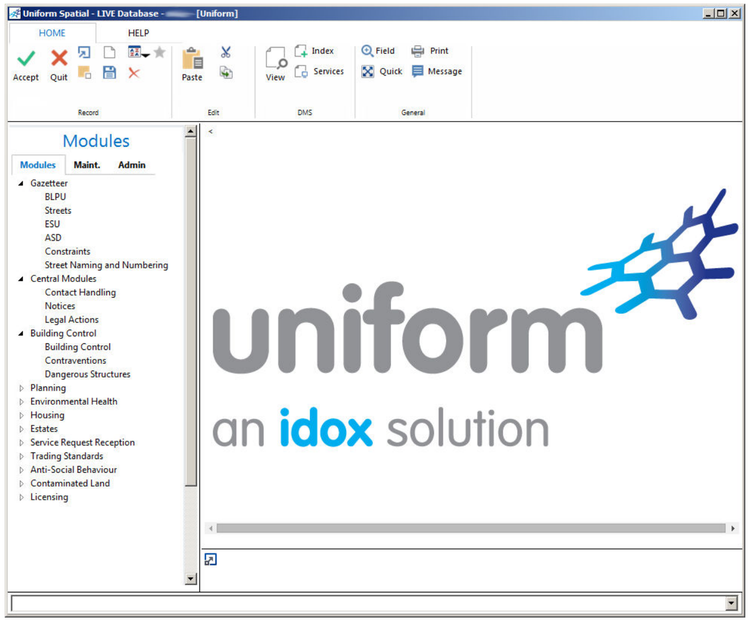


Figure 1: Uniform Modules

Tascomi

Tascomi, now an Idox company, offers a web-based planning solution called Planning. Planning spans the planning process from pre-applications, through to decisions and enforcements. It is web-based, mobile friendly and has flexible configuration. Tascomi Planning integrates with their online portal service Council Direct. Despite now being an entirely integrated part of Idox, Tascomi is still perceived as an emerging light in the world of planning software. In discussions with various authorities we encountered expectant enthusiasm amongst officers towards the upcoming rollout of Tascomi within their offices as they perceived its extra configurability as a valued remedy to much of what ails the legacy planning software they use.

Northgate

Northgate, like Idox, have a whole suite of products and services. They provide multiple end-to-end planning software such as Assure, M3 and iLap. Assure is the latest in the suite and offers web-based, mobile-friendly and cloud-hosted services. The Northgate suite includes an online portal and application submission module.

Others

There are various other software that local authorities use but are less common such as APP by Civica, APAS by Agile and MasterGov Planning by DEF.

3 https://www.idoxgroup.com/public-sector/local-government/

Application submission systems

Up until 2002 planning applications were submitted directly to the local authority, primarily by paper and delivered by post or by hand. Today, local authorities receive the bulk of each application in electronic formats such as PDF documents (but may also include DOC, XLS and others) via a web-based gateway. These documents are then, in the case of authorities that are still paper-based, printed out for use, whereas authorities working paperlessly, access the documents via computer software and document management systems mentioned above.

Planning Portal

Planning Portal was established by the UK government in 2002 to provide a common online entry point to planning information and the digital submission of planning applications and has, since 2015, been partially privatised and is now a joint venture between the Ministry of Housing, Communities and Local Government and TerraQuest, a private entity.

Planning Portal functions as a single gateway for all local planning authorities in England. Applicants submit their plans through input fields (some validated, others not) and document submissions. This information is sent to the relevant planning authority via a one-way communication, with no means of accessing Planning Portal after it has been sent. This means that any amendments to the application cannot be done in Planning Portal. To do this, validation officers will either request a resubmission or contact the applicant directly. Issues can arise however as payment is taken by Planning Portal, alongside a processing fee, which is then passed onto the Local Authority – frequently with a delay between payment processing and payment receipt by the Local Authority. This delay means that the Planning Authority can not start the timer on the 14-day validation period without confirmation of payment from Planning Portal, often causing friction and confusion between applicant and planning authority.

In 2008, the 1App service was introduced. This helped standardise data entry and reduce variation in applications. Today, the 1App connector allows application documents and data submitted through Planning Portal to be directly integrated with back-office systems. Over 90% of planning applications now come through Planning Portal, which now provides support for building control and pre-app advice.

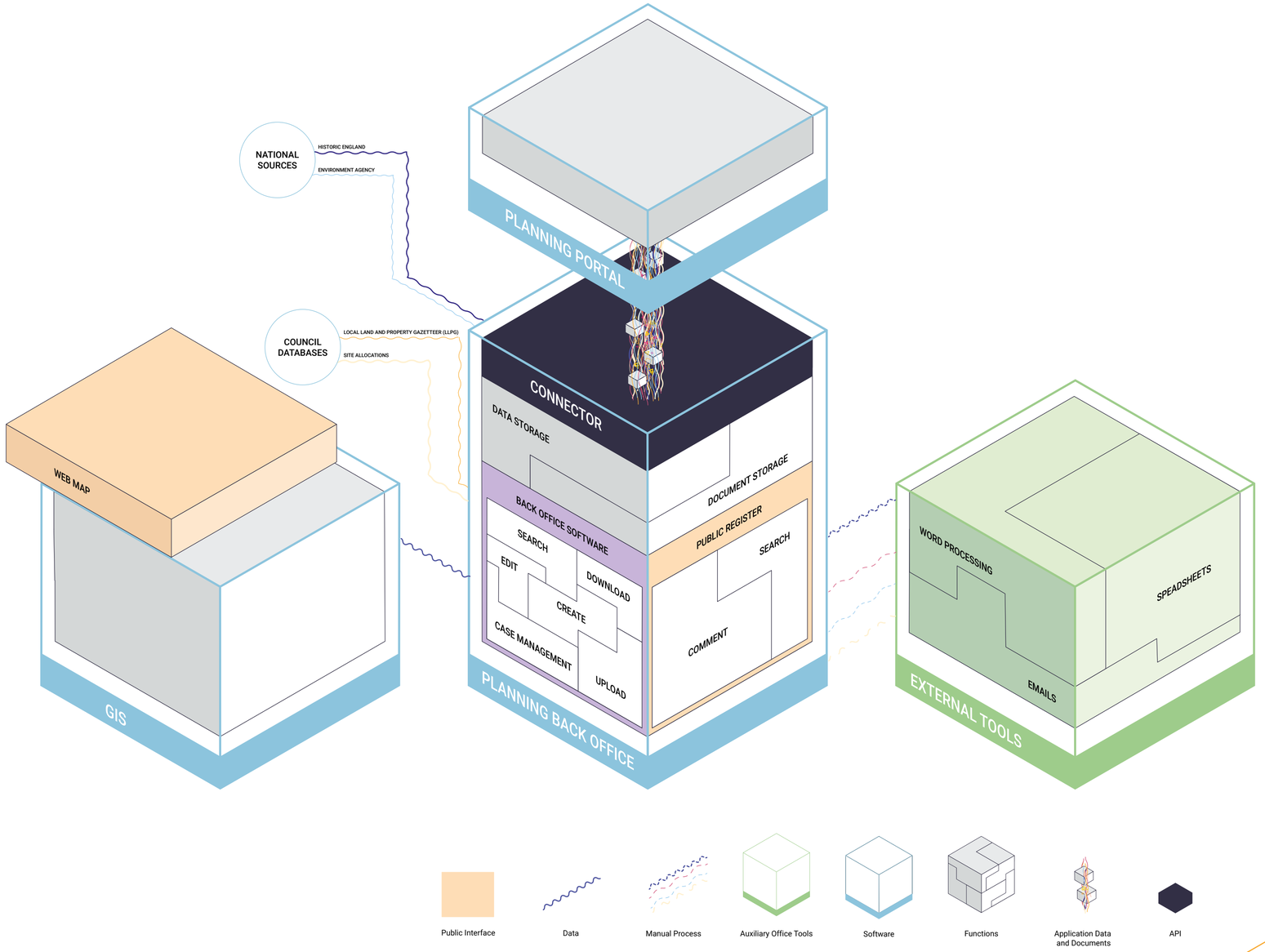
Other portal websites

In 2016 Idox introduced iApply as an alternative single gateway portal for planning application submissions. iApply has, since October 2019 ceased to be a nationwide service and between October 2019 and April 2020 was only available for submissions to a small number of local authorities. By April 2020 iApply had been completely discontinued.

High level architecture map of planning software today

Right is a schematic diagram illustrating problems of the current software landscape for planning. These key failings are detailed in Section 1.3 of the report.

A key understanding of the **architecture of the legacy planning software landscape is that the source of many of its problems stem from having a system that inherited paper documents from the planning system of post-war Britain.** Today the planning system continues to be built around paper documents that have been converted into electronic, fixed-layout flat documents that include text, fonts, vector graphics, raster images and other information – the most common type being PDF documents.



Currently, an application is submitted through Planning Portal as a combination of data about the application (for instance, address, type of application and description of works) and supporting documents like PDF plans, sections and elevations, PDF reports like a Design and Access Statement and a Heritage or Transport Impact Assessment. This is received by and integrated into the planning authority's back-office planning software via a unidirectional connector (1APP) which acts as an API between Planning Portal and the planning authority's system. The documents and data then populate the back-office document and data storage, which can be accessed via the front-end of the back-office software. Assessment is carried out manually, by reviewing documents and files stored within the system (floor plans, consultation responses, clarification emails with the applicant, etc.). In addition, national and local data sources may be manually called upon. For example, lists of technical consultees and their contact details, address details of neighbours from the LLPG (stored physically or elsewhere on the officers' computer) and floodplain shape files from the Environment Agency (stored in GIS). Validation, case management, assessment and decision tasks can be carried out accordingly. This largely involves a number of manual processes, with the planning officer moving between the back-office software, GIS tools and other auxiliary work tools.

Once an application becomes valid (after all necessary documents have been received and correct payment made) the statutory clock begins to tick. So, for example, in order to write a statutory letter notifying neighbours to the site of the application and its details, the officer will generate a template using the back-office software, but will then proceed to edit that template in Microsoft Word, or a different word-processing tool. Simultaneously, the officer will be able to make the application and its associated documents live and accessible via the Planning Register, which is a public-facing web front-end offering the public access to view and comment on live applications and view previously determined applications. In a similar way, the back-office software allows the officer to amend application data and supporting documents through the entire lifecycle of the application by allowing them to create further templates or upload documents they may have received by email (or in some cases on CD or USB drive) as negotiations over the application proceed, all the way through to its determination, or decision.

While local authorities will be using GIS for their internal processes, more often than not the Web Map portal version of this displays only planning constraint information for public access. From our research we have found that there are relatively few authorities where the portal also presents planning application information (such as geo-referenced red line boundaries). Due to limited operability between GIS and planning back-office software, where geo-referenced data exists it tends to need manual loading into GIS.

Failings of planning software today

Document not data management

Planning Portal allows an applicant to submit a planning application as a series of PDF documents together with supplementary application data submitted via a web-based form on the portal. This is sent to the local authority as a series of documents and an XML file. This seemingly trivial process, which exists due to the direct digitisation of a paper process, has a profound knock-on effect on the entire planning process: almost all of the information contained within the application is received as a document containing unstructured data, which in turn dramatically shapes the whole planning software landscape.

It means that **the most effective and successful planning software to date have been those concerned with efficient manipulation of documents.** Currently, the market leaders offer various permutations of document storage, allowing the user to create, read, update, share, export and delete documents whilst keeping track of the relationships between these. Each software offers only limited structured data entry, some of which is entered by users (for example, planning officers) and some read from the Planning Portal XML file. The result is essentially a document management system.

The reliance on document management in planning causes a number of pain points. Unstructured data embedded within documents prevents interoperability with other services, automation of processes, reducing and detecting invalid applications, limiting the ability to screen proposals against policy and the opportunity to link real planning information to long term monitoring. We heard from our interviews that these limitations have forced planners to find manual workarounds, and increased the amount of menial administrative tasks – such as copying and pasting content between programmes, some of which are even being taught as part of their training.

Tragedy of Interoperability

A key barrier to change and innovation is a lack of interoperability in the legacy planning software market. A hallmark feature of oligopolistic markets is the high barrier to entry for competition. Many legacy planning software lack the provision to work with other software, meaning it would be easier to buy the module from the current provider, rather than procure a new innovative competitor's offering. Apple have been known to employ similar strategies: in 2016 Apple removed the universal headphone jack, widely used across headphone providers. The absence of this universal port stifled competition from other headphone producers, allowing Apple to dominate the headphone market[4]. Currently, legacy planning software offer significantly limited integration with other services. Applications – often referred to as 'connectors' which facilitate 'connections' or integration between various packages – do exist, but when these are made available, it is often a costly and inflexible attempt to patch over a hole in the software service. The most common 'connector' is '1App' which facilitates connections between Planning Portal and the various back-office software applications.

Fundamental to the problem of interoperability is the lack of standardised data (see Section 1.3.6) and, in particular, the lack of standardised, open APIs. Unlike other industries, there is a distinctly closed culture in the planning software landscape. Whilst other sectors such as banking, news, travel and health, have embraced API-based services, creating an ecosystem of integrated and distributed products and services, other than 1App, which is unidirectional, we have been unable to find any API-based services amongst the legacy planning software providers, including the two biggest players. Single-provider interoperability (software built by the same provider that can self-interoperate) has led to one provider offering multiple services, and the user finding themselves unable to procure further services externally.

4 Kastrenakes, J. (2016, September 8). The biggest winner from removing the headphone jack is Apple.

Linking planning and GIS data

Geographic Information System (GIS) mapping has become a fundamental tool for many planners engaged in processing planning applications and preparation of planning policy. But the relationship between GIS mapping and planning systems is an exemplar of what could be termed a Tragedy of Interoperability in the planning software landscape. Some software packages offer built-in GIS facilities such as Uniform by Idox. Even though this internal module gives the user more functionality, it doesn't allow for other specialist GIS providers to integrate their services or allow the consumer to choose which GIS service they want to use.

In most cases, data stores behind GIS-mapping applications are the source of important information, such as planning constraint information or consultation address details. As a result of the lack of interoperability, this sort of information needs to be manually copied across from GIS databases to planning softwares. Not only is this a time-consuming process but it is ripe for automation due to its repetitive and structured nature and where, ideally, this sort of important data would not be tied to GIS systems it could be used and mapped in numerous assorted ways.

Bundling of service and data storage

A key aspect of legacy planning software is the tying together of data services (software) with data storage (data centres). Coupling storage and service provision in one package has negative consequences. The provider and maintainer of the coupled systems effectively lock the user in to their proprietary standards and structures, making it difficult and often expensive for the user to migrate to a new service. For example, one local authority indicated that their software vendor set up an agreement whereby data is stored with third parties (ie. data banks) and that the procurement agreement does provide a clause by which the local authority they may obtain the data stored should they need to. The local authority however sees this as too risky to request due to contractual complexity. As a result users are often inclined to upgrade and extend their entire current system, instead of looking for the most suitable service and/or service providers.

Bundling of services

Combining the lack of interoperability with the coupling of storage and services leads to a single end-to-end planning software environment, which can leave the user locked-in to a single vendor. Current planning software providers offer their service across the entire planning application process[5]. These large, all-purpose packages are often limited and inflexible, and extending their capability requires expensive upgrades and add-ons. In addition, providers offer smaller bespoke tweaks for customer specific issues which then require the customer to hire a consultant from the provider to complete.

No standardised data schema

As outlined in Section 1.3.2, the lack of structured data is restricting the efficiency, transparency and use of planning software. However, for planning to move towards use of structured data successfully and to ensure principles of interoperability, standardised data structures must be developed and adopted at scale.

The structured data that can be transferred between the applicant and the back-office system via Planning Portal adheres to a standardised schema that is defined by Planning Portal, but not publicly available. The application is then received as a combination of structured data and documents via proprietary 1App connectors. Councils with different back-office software and different forms of the 1App connector integrate the structured data with their planning software to a different extent. For example, the connector between Planning Portal and Idox's Uniform will be different to a connector between Planning Portal and Northgate's Assure by virtue of the two software applications having completely different internal structures. Once ingested, it is uncertain how the planning software stores and manages the structured data. As there is little or no integration with other services currently, and when there is it is costly and time consuming, it is likely that each software is performing the data storage and management differently.

5 (often with the exception of CIL and S106 services, which relate primarily to post-approval stages of work and, from our research appear to be handled most often by Exacom, a modular standalone provider)

No human-centred design

Most existing planning software is configured for planning, as opposed to designed for it. The current process is supported with existing tools, but there are a multitude of workarounds and manual hacks required for this to be the case. These hacks result in inefficiencies, time delays and financial implications and costs to local authorities. Available planning software applications do not place user-experience and usability at their core, but instead how a user interacts with the software is often dictated by the predetermined processes baked into the software functionality.

There are two key user groups in the planning process: back-office planning staff and the applicant. The current system fails both of these user groups. The back-office staff have to wrangle and strain to adapt their bespoke and council-specific processes to the rigid frame of the software, leading to more work, slower decision-making and frustrating blockers. The applicant meanwhile is met with an opaque view of the process once the application has been submitted, only gaining infrequent glimpses into the status of their application, and with inefficient communication channels between them and planners.

Summary

We have highlighted seven key failings that characterise and restrict the current planning software landscape. These failings continue to pose major barriers to the way new technologies can be harnessed for the benefit of planning practice. Critically, in benefiting planning practice, new and emerging technologies will contribute significantly to the better and faster delivery of new developments, such as critically needed new homes.

2. Emerging technologies

We believe there is a significant opportunity for improved planning software. A few emerging technologies are already tackling some of the failures of the current system. These emerging software applications do not all displace the legacy planning software providers directly, but form parts of a newly expanded digital planning service. Therefore, the adoption of the new technologies must come in parallel with a change in systems and processes.

There have already been moves to address some parts of the existing system. Reducing Invalid Planning Applications (RIPA) is a collaborative project funded by the Ministry of Housing, Communities and Local Government's Local Digital Fund. Hactar, Snook and the London Borough of Hackney have collaborated on Submit My Planning Application (SMPA) and the London Borough of Southwark together with Open Systems Lab developed PlanX. The London Borough of Southwark also collaborated with Unboxed to explore the Back-office Planning System (BoPS).

Detailed below are common themes that run across these projects, and how they are realised in these projects.

Common themes in emerging planning services

Structured data and common schemas

A common theme among the majority of emerging services is that they are built around structured data. Structured data is a way of organising information in a way that is easily understandable to both human and machine. For example, biological taxonomic classification is a data schema – it allows for each new species to be referenced and indexed in a consistent way, using a common set of parameters (e.g. Kingdom, Phylum, Species, etc). This allows for organisms to be compared, stored and queried much more efficiently.

Similarly, a planning application contains lots of information – the applicant's name, the date of receival, the type of application, and much more. A data schema would allow this information to be organised in a reproducible, consistent and intuitive way that would make comparing, updating, searching and analysing applications much easier. In addition, logic trees can be constructed based on the schema to ensure that only the relevant information is submitted in the first place, and that the information submitted is correctly formatted, reducing the number of invalid applications. This has been demonstrated as part of the RIPA project, which has created a set of schemas that could replace some of the planning documents submitted with an application.

Having common, standardised data schemas is essential for the wider adoption of data-driven, rather than document-driven, planning services. Capturing and passing data in this way would generate a richness of data that will unlock insights previously unimagined.

Invalid planning applications are often caused by the payment of incorrect fees and missing documents. Figure 2 presents the typical breakdown of reasons for invalid applications from Wycombe District Council. Structuring the content of an application in a standard and machine-readable way allows for live validation and error detection for an application during the submission process, similar to the way PlanX facilitates self-triage by identifying issues in advance of making an application.

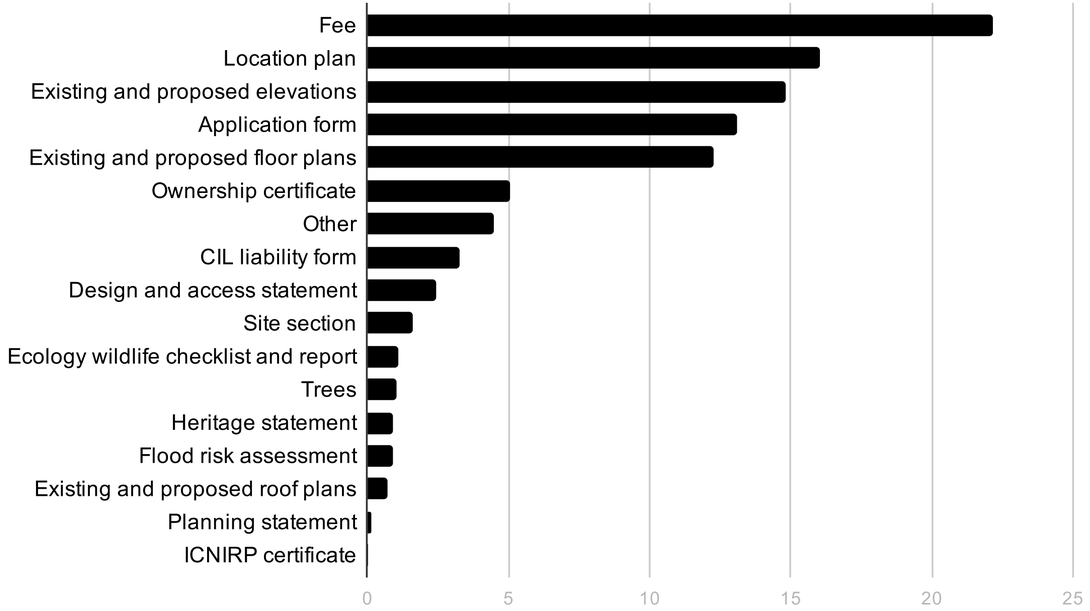


Figure 2: Typical Breakdown of reasons for invalid applications – Wycombe District Council

Using standardised data schemas facilitates data-sharing between services by enabling a common understanding of the contents of shared data 'packets'. The process by which these 'packets' of data are sent must also be standardised, commonly achieved through standardised Application Programming Interfaces (APIs).

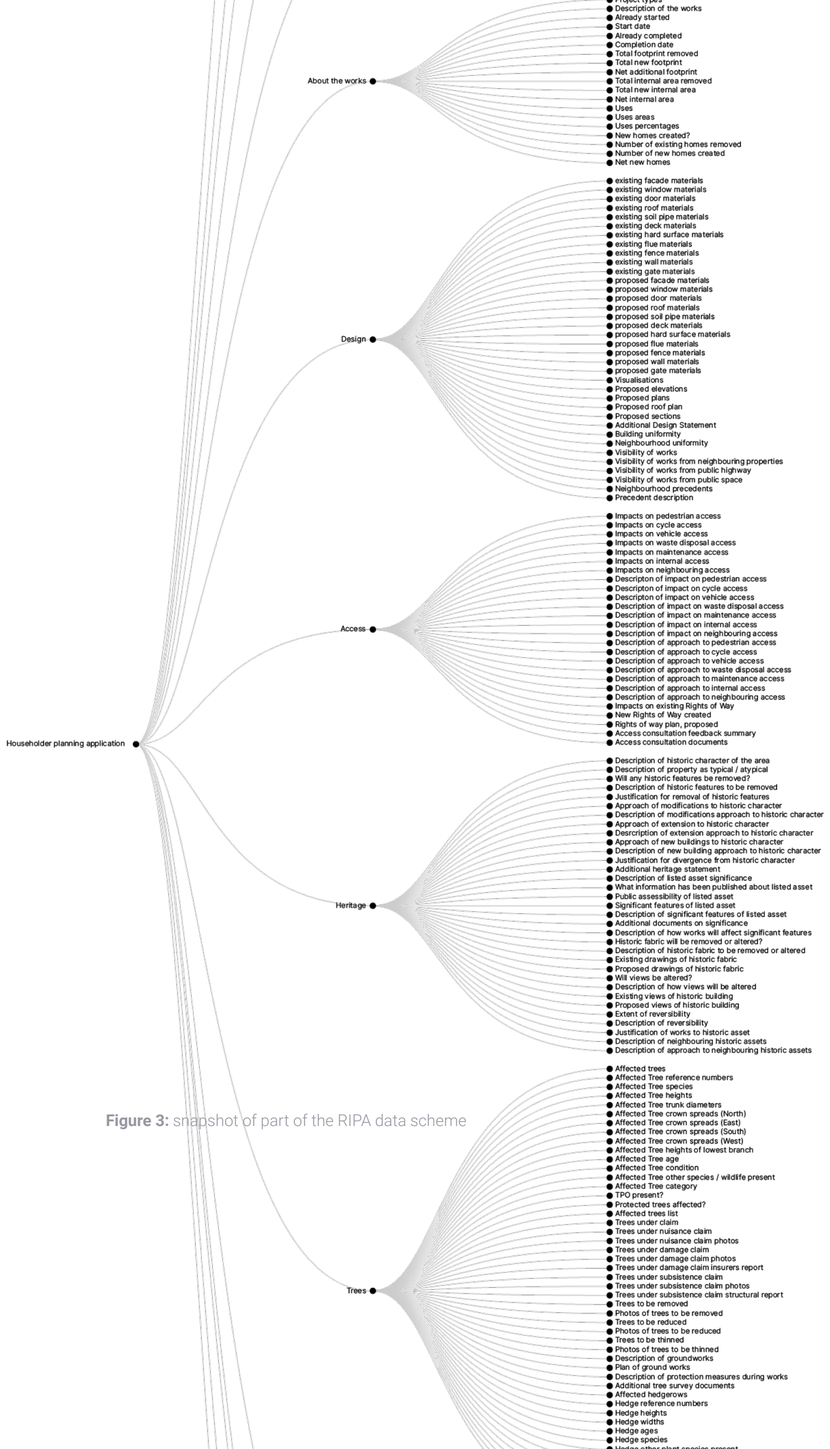


Figure 3: snapshot of part of the RIPA data scheme

Open and standardised APIs

APIs allow software applications to communicate and share information with each other. APIs provide information transfer between a server and a client. The client makes a request to an API endpoint, and the server provides a response. Essentially, APIs act as bridges for data between software applications. There are various standards and protocols used by APIs. For web APIs the REST framework is commonly used.

Open and standardised APIs are essential to facilitating interoperability and the wider adoption of common data structures. SMPA aims to guide householder applicants through the submission process, helping them include the right information, accurate and complete documentation and to pay the correct fee, the latter of which is particularly error-prone. To achieve this, SMPA collects structured data from the applicant that adheres to an open data schema. The schema, designed to be open, updateable and extendable, ensures SMPA is sustainable in the fast changing landscape of Plantech. The Planning Portal schema was judged unsuitable for their application, as it was outdated and highly rigid. This was by virtue of the schema having to accomodate all application types for all local authorities using a multitude of back-office systems.

SMPA uses the Python data structure library schematics to enforce and validate the schema, allowing the data structuring to be decoupled from the querying and storage.The structured data that is collected, alongside supporting documents, is stored in a schema-less RethinkDB database. The back-end is then exposed through a modern RESTful API, built around the OpenAPI specification, and is hence designed to be interoperable with any other application. The API is only useful when the data is efficiently queryable, hence the overarching need for standardised, structured data.

The front-end of the application uses a logic tree to determine which questions are relevant based on the information submitted by the applicant, aiming to reduce the amount of irrelevant data in the submission. The application details are then made available on a public user-interface. This entire service is only made possible through structured data, and by constructing a transparent and standardised API. SMPA is designed to interface with other back-office system providers, and their API specification and schema design is open. This encourages an ecosystem of services, where SMPA is just a single part of a system of interoperable, modular applications.

User-centred design

A key failing of legacy planning software is their unintuitive, inflexible and sometimes outdated user interfaces. **Amazon and Netflix did not need to train people to use their service - they created a superior service that actively responded to the needs of users in a dynamic way, with an intuitive layout.** An emerging theme across all new planning technologies is the emphasis on software that is designed for planners. The planning process is complex, non-linear and often requires specific expertise and knowledge. Currently, planners not only need to understand planning as a process, but also how that process maps onto a digital system. This often involves workarounds and 'hacks' outside of the planning software, for example using an Excel spreadsheet to reformat consultee addresses. By closely aligning the design of the user experience with the way that planners engage with the planning process, digital planning can be more efficient and less frustrating.

The BoPS team developed a prototype which was designed to interface with other emerging public facing services such as PlanX and SMPA. In addition, it was designed to account for future planning registers and the London Development Database (LDD)[6]. The BoPS team conducted extensive user research across multiple district, city and London boroughs. The focus of the research was on how planning officers and planning managers use software to process an application. Some of the key findings were that planning is non-linear, information is hard to find and there is little standardisation of many parts of the process. The BoPS prototype is focussed around delivering a useful service for key users based on core design principles.

The resulting application pulled structured data from Hackney Council SMPA and displayed applications at all different stages on one easy-to-use user interface. The user (case officer or planning manager) is able to navigate through applications, selecting from multiple choice dropdowns and filling out free text boxes answering specific questions. The application is designed around the user-experience and efficiently fulfilling the requirements of the user. This is a clear example of the design of the software responding to the needs of the user, and not the user reacting to and adapting to the capabilities of the software. The BoPS project also outlined a clear business case for this type of product, estimating an average annual cost saving of £481,838 per council. This is achieved by reducing the time spent on processing applications by 35%[7] if this service was rolled out for all application types.

While BoPS considers the user experience from the perspective of the planning officer both SMPA and PlanX are an example of user first design from the perspective of the applicant. By offering a self-triage process, these software have evolved the application process into a simple, easy to use one.

Modular by design

A consequence of the adoption of common data structures and open APIs is that services can be modularised. End-to-end, the planning process requires many steps, actions and interactions. The process can be partitioned into discrete units, or modules, each with a single job and well defined interfaces. This will allow local authorities to procure the best solutions for each module of the planning process without major disruption. This would also drive down costs for upgrades and replacements and increase the quality of the service accordingly. Modularisation makes updates and swap-outs genuinely simpler as they are protected from the full system complexity.
This would be a considerable step change for the current planning process, enabling new innovators and disruptors to enter into the digital planning landscape, and reducing single-supplier lock-in. All of the new software applications analysed in this report (SMPA, RIPA, PlanX, BoPS) fit within the vision of a modular planning system. These services have been designed with interoperability at their core – BoPS can pull application data from SMPA, and has future plans to integrate with PlanX and RIPA. The PlanX APIs allow bidirectional access with other software modules. The data structure of planning applications developed by RIPA is open and collaborative.

6 Envisaged as a 'live hub' of development information managed by the Greater London Authority and containing details of all planning consents meeting criteria agreed with the London boroughs.

7 Back-office Planning System (BoPS) Alpha phase report

Digital transformations in other industries

The built environment sector, and planning in particular, are not the first industries to undergo digital transformation. In fact, McKinsey & Company's Digitization Index[8] would suggest that according to E.M. Rogers' Diffusion of Innovation Theory, planning is likely to sit somewhere at the tail end of the late majority[9] of adopters.

Other industries such as healthcare, banking, manufacturing, transport and tourism have already undergone significant transformations and are helpful in understanding best practices for the digitisation of planning software. One unifying or repeated thread that emerges from all of these industries is the game-changing role played by APIs in the digital transformation of each and every one of these industries. Other industries have optimised interoperability by adhering to data standards and applying facilitating APIs. In fact, in one reference to the way APIs have and continue to transform the health industry, it is identified that they have taken the industry to a whole new level of interoperability.

An example of how an API can promote digital transformation and innovation in the transport sector is Transport for London(TfL)'s "Unified API". This API provides access to TfL's open data for use in third party software and services. This has allowed for the development of applications like CityMapper, Waze and Moovit.

The banking sector has seen digital transformation through the aggregation of data and the definition of open standards – for example through the Open Banking initiative. This has worked well for private clients and the business sector as a whole, but most importantly for the banks themselves. Benefits have led to cost savings, service optimisation and a reduction in transaction times.

Our research has uncovered that the greatest challenge to digitisation within the healthcare sector was standardisation. Without standardised data formats, the capabilities and utilisation of APIs is significantly restricted.

It is worth noting however that whilst APIs may appear on first inspection to be a 'silver bullet' for interoperability problems, they do pose their own set of challenges and won't cure existing problems in the planning software landscape on their own. For instance, APIs will need to be created in a custom way to suit the needs of the sector and service they are providing.

What resonates most significantly with the planning sector is the proliferation of outdated or non-API enabled technologies. Like planning, many within the healthcare sector are still using, and worse still, even procuring old technologies that are incompatible with API technology.

8 McKinsey & co. Digitization Index
9 Diffusion of Innovations, Third Edition – Everett M. Rogers, p. 21

Legacy planning software applications are glorified document management systems with challenging and clumsy user interfaces.

What if we strip document management back to the basics and remove the complicated user-interface?

What if a planning authority used Google Drive to manage planning processes in the council?

Planning applications would still be submitted as digital documents – but these documents would be saved on Google Drive.

Planning reports, notices, decisions and communications would all be produced and shared via Google Drive, primarily Google Docs and Gmail.

For these tasks there isn't much of a departure in terms of functionality from the software currently in use.

Google Drive allows the user to create directories – so documents received and documents produced could definitely be kept together.

Google also employs an increasingly clever search tool that allows the user to identify Google produced/ saved documents by simply typing in keywords. So searching for things would be easy.

While legacy planning software often offers a caseload management tool like a traffic light system, planning officers tend to manage their cases using Excel sheets and manual lists. Google Sheets offers a direct and easy-to-access replacement.

Store any file

Keep photos, stories, designs, drawings, recordings, videos, and more. Your first 15 GB of storage are free with a Google Account.

Since Google Drive is a cloud based platform, there would be no issue with roll-out and remote working. It can also be used and accessed on multiple platforms and devices, including mobile phones, which would be particularly useful to planning officers on site visits.

However, the current software allows users to link applicant data to application documents with a unique application ID. It also allows users to interact with geospatial data and generate automated templates for letters. This could be mitigated with Google Drive Add-ons, e.g. Ultradox (automate processes in Google Drive) and GeoJSON Map Viewer. Additionally, each Google doc has an automatically generated unique ID.

Consequences and analysis of emerging planning technologies

To innovate responsibly it is important to consider both the intended and unintended consequences of your service. We therefore performed a consequence scan using the DotEveryone framework on the emerging digital planning innovations. This process aimed at identifying possible negative consequences of new technologies and outlining a mitigation plan. The framework also highlights the positive consequences and gives an understanding of how to enhance them.

Increased democratisation of planning

The patterns of practice we have seen so far amongst emerging software solutions show that **the transformation of the planning software landscape will inevitably mean that software used by planners will be designed, at least in part, by planners, not just configured by them**.

With an easier to understand system, more people will be able to engage with planning. This will likely lead to an increase in accurate and valid applications. As more people engage with and understand planning, we will also likely see a significant drop in enforcement activities as people gain a better understanding of how and what they need to do to comply with the system.

Truly user-focussed digital platforms are also likely to promote better methods of consultation, reducing the number of objections to proposals as well as overall costs associated with consultations. This will in turn lead to faster and more effective delivery of new homes, of the right types and in the right places, which is by default the core purpose of planning activity: to promote the greater good.

A new market for innovation in planning

The modular nature of new packages will inspire a new market for services, encourage innovation and disruption, and promote the evolution of the planning software market and similarly reduce users from being locked in. However, the development of new tools and applications and creating a new market for planning software will necessitate resource investment. The decision to invest these resources is an active decision to divest resources away from other parts of the economy.

Changes to revenue streams

Greater transparency and democratisation will mean better applications and more of them. Assumedly, automation will be key to assisting local authorities if the volume of applications increases. So, while digital transformation of planning tools used by councils may lead to an increase in the number of applications received, it may also lead to a significant loss of income. Pre-application meetings are a significant source of revenue for many local authorities as they charge applicants a premium to meet with council officers, to discuss a proposal before it is submitted. Even before the introduction of Planning Performance Agreements (PPAs) many schemes enjoyed more than just one pre-application meeting before submission. With the use of more effective ways of screening applications, including the automation of various tasks, new digital applications will do away with the need for pre-applications, potentially ushering in a massive blow to revenues.

Redundancies

There is also the human face of digital transformation. Supermarket checkouts are undoubtedly more efficient and save money, but former cashiers are now out of jobs. Planning admin officers are the oil that keep the wheels of planning departments moving and are the ones that would bear the brunt of automation. Planning admin officers process and validate applications, commence public consultation processes and ensure planners have the support to do their jobs. In a new digital world, software will fill that role and the changes this causes should be considered holistically, taking into account cultural and organisational consequences.

This is also true for planning consultants and agents who currently play a significant role interpreting and translating planning for mass consumption. A more accessible and understandable system means there will be less reliance on consultancy as digital tools enable other users to perform these roles. An holistic, ecosystem-centric view, that considers these stakeholders and their accumulated knowledge as well as the new markets created should be taken when strategically investing in the next wave of planning digitisation.

Subsumption and procurement

The way the planning software landscape is currently structured around a small number of big players means there is a chance that modular innovation could become subsumed into them. Whilst conglomerate acquisitions of smaller, emerging competitors are a useful strategy to prevent competition and protect market dominance, they also stifle innovation[10]. This has already started to happen. Our research with various local authority planners has uncovered that many are pinning their hopes on the roll-out across their offices of a new rising star – Tascomi – which is purported to offer innovative solutions to their back-office needs. However, Northern Ireland based Tascomi was purchased by Idox in 2019. Similarly, Idox's biggest competitor, Northgate (part of the NEC Corporation), purchased design studio Snook, part of the team behind SMPA, also in 2019. So when a new disruptor comes along, often we see that the existing big players buy them out and then cease to release new, innovative features. This further cements the oligopolistic behaviour exhibited in the market for planning software.

This presents a real risk to innovation by bringing us right back to where we are now – a small, closed circle of providers. Yet this is not the only barrier to new disrupters. As we set out earlier, the existing planning software landscape is often simpler and easier for local authorities to digest in procurement terms than a series of modular components from a number of different providers. **Even if new disruptors can survive subsumption and acquisition, it is uncertain whether they could survive local authority procurement.**

Plantech as a catalyst for local government innovation

The digital transformation of the planning system could also have a ripple effect on the mindset of local authorities. Councils tend to be slow-movers when it comes to transformation. Cash strapped, under strain[11], responsible for a huge number of local services and often bureaucratic, innovations can be difficult to prioritise, even if the long term rewards will be beneficial. However, the positive transformation of one service could catalyse this change more generally. Connected Places Catapult have seen how new packages and tools have the potential to open up opportunities for interoperability across other council services. Our work for the GovTech Catalyst, on housing monitoring reveals deep connectivity and potential for benefit across building control, council tax and the strategic planning of council services like waste collection, utilities, and schools.

Finally, digital transformation of planning software will also lead to the diversification and upskilling of existing staff, increasing digital literacy and broadening opportunities for talent markets with a focus on software engineering and data science to contribute to local services that are critical to some of our biggest challenges such as decarbonisation, and responding to the housing crisis.

10 Seru, A. (2010). Firm Boundaries Matter: Evidence from Conglomerates and R&D Activity. SSRN Electronic Journal. doi: 10.2139/ssrn.972056

11 Local Government Funding – Moving the conversation on; LCA, 2018

3. A vision for a new digital planning system

Design principles

The 6 Design Principles

Learning from the best practices of other industries, the emergent features of new technologies and the failings of legacy planning software, we have drawn up 6 key design principles for a future digital planning software architecture. These aim to overcome the problems we have identified in planning software and we believe that considering them when scoping, funding, procuring and delivering new solutions will lead to a planning system fit for our future challenges.

Principle #1:
Data, not documents

The transformation from a document to a data-based planning system is crucial and planning is lagging behind other industries significantly in this regard. Adapting to the processing of planning applications as structured data is central to creating an ecosystem for innovation. In itself, this transition might not seem innovative, but it enables a robust and flexible network of further digital services. This principle is the foundation for a connected, open and automated planning system. It allows for data to be manipulated, stored and shared between people and machines more easily and more efficiently. It will inevitably open up the data to be used far more widely across the ecosystem in tasks like plan-making and development-monitoring.

Principle #2: **Common data schemas**

Enabling structured data requires the creation and adoption of common data schemas. A data schema describes how entities are represented in data terms. When all modules in a system adopt the same data schemas, the barriers to data sharing are significantly reduced. For example, the digital transformation of banking and the rising number of innovative FinTech companies can be traced to the Open Banking Implementation Entity outlining industry-wide standards and data models. Although not all planning information can be captured as structured data, the RIPA project is already demonstrating a complete schema can be developed that creates a common format for planning applications with an emphasis on data. This is a key tenet of microservice architecture, which supports interoperability through message based communication. Standardising message formats will allow for faster and cheaper interoperability and replaceability of modules.

Attempts have been made, and ongoing projects exist, to develop a single, common planning application data schema. For example, the GLA Planning Data Standard, the Planning Portal Data Standard and the MySociety Single Register of Planning Schema. However, there is no consensus as of yet. Building on the work of others is crucial to developing an industry wide common data schema for planning applications. Further, the schema must be collaborative, open and updateable, i.e. version controlled and open-sourced to create sustainable, industry-wide buy in.

Principle #3:
Open and standardised APIs

APIs are critical to the interoperability of services. Allowing services to communicate with each other enhances the reach and utility of a single module,creating a system that is greater than the sum of its modules. APIs create an environment fertile for innovation, lower barriers for entry and fostering a spirit of collaboration. Time and time again, in a multitude of industries, opening up and sharing data through APIs has led to rapid digital transformation. But, similarly to data, APIs must be standardised to reduce complexity across different providers – adhering to new protocols for myriad different providers could increase the complexity and block the sharing of data. This can be mitigated by subscribing to standards such as RESTful API or GDS API standards principles alongside a common data schema. In practice, this could mean that all procurement agreements are based on the provision of APIs. Borrowing from the UNIX philosophy set out by Doug McIlroy:

> **“Expect the output of every program to become the input to another, as yet unknown, program.”**

This is how we build a planning system for the future, one that will no longer struggle to keep up with the present.

Alongside the technical benefits of opening up applications through APIs, by opening up new revenue streams, creating new partnerships and reducing the cost of integration, migration and replacement there is also a strong business case for local government to do so. Although this does come at the cost of the legacy planning software supplier who will lose the value inherent in holding the only key to the data.

Principle #4: **Modularity (unbundling)**

“Do one thing and do it well”[12]

This is the first Unix principle. It speaks to the modularity of software components built from simple parts connected by well-defined interfaces. Modular systems are an assembly of modules, which are defined by Kirk Knoernschild as “deployable, manageable, natively reusable, composable, stateless unit[s] of software that provide a concise interface to consumers.”[13] The modular approach reduces the complexity of large, monolithic systems from the software development perspective. Additionally, it is important to note that modules are not atomistic, and can be further divided into smaller submodules and subcomponents which themselves adhere to the modular philosophy. Modular components contain issues locally, and parts can be upgraded and replaced without breaking the whole. Alongside modularity, a new procurement model will need to evolve to cope with multiple providers. A modular planning system would be revolutionary, and would break the chain of reliance on a single provider and promote more competition and innovation for planning technologies. Economist W. Brian Arthur states that modularity “is to a technological economy what the division of labor is to a manufacturing one.”[14] This encompasses the types of benefits we are likely to see as we are able to handle more complex organisation of processes (e.g. procurement) and access greater gains.

12 [McIlroy78] The Bell System Technical Journal. Bell Laboratories. M. D. McIlroy, E. N. Pinson, and B. A. Tague. “Unix Time-Sharing System Forward”. 1978. 57 (6,part2). p.1902.
13 http://www.kirkk.com/modularity/2009/12/chapter-2-module-defined/
14 Arthur, W. Brian. The Nature of Technology: What It Is and How It Evolves. Free Press, 2009.

Principle #5:
Privacy, security and fairness

Although not obviously structural to a modernised planning system, encoding privacy, security and fairness into planning software is important to maintain a healthy ecosystem of services that is trustworthy and responsible. As data breaches have received more press scrutiny, distrust of data driven services has grown, and data-governance and information-sharing has become much more prominent in public digital discourse. Adhering to GDPR's 'Privacy by Design' philosophy and maintaining a high level of security when building and implementing software solutions will create a more trustworthy and robust system.

A consequence of unbundling data storage and service provision is that there is more opportunity to access data for building applications on top of the existing services. This must be facilitated in a way that allows equal access for all, which can be achieved by following the rest of the principles outlined here – namely open APIs to ensure interoperability and modularity to allow for connected, distributed service provision. An extension of the FAIR (Findable Accessible Interoperable Reusable) principles[15] could be used as a framework for ensuring high quality data stewardship and management to create an ecosystem for knowledge sharing and innovation.

15 The FAIR Guiding Principles for scientific data management and stewardship

Principle #6:
Ease of use

Current planning software has a range of functionality depending on the provider. That's because as things stand, the front-end and functional design of these software applications always centres around one question: what should a software application on top of a document management system be able to do in order to process an application? This answer results in software that can take an application from submission to decision, but which doesn't necessarily achieve that by prioritising the needs of the people that need to use the software or their experience of doing so.

The questions everyone involved in developing these software applications should be asking include: what users exist in the planning system, and what do they actually need at which stage of the process? How are they currently working, and how could the software make their work more intuitive, fluent and less laborious? The answer to these questions results in software designed with the user's experience at the heart of it. This will create planning software that is easier to use[16], and which will speed up the processing of planning applications and improve the quality of work for planners.

Similarly, our research reveals that the typical configuration for legacy planning software consists of a local client on the planners' machines and the document management on a local server. This makes it difficult for planners to access planning application information remotely, restricting remote working and working in the field. This also limits the use of mobile devices. Additionally, local client configuration adds further complexity for IT departments when rolling out software and updates and providing software assistance.

Web-based planning tools would facilitate ease of use as they will likely reduce IT problems with software and promote remote working.

16 Norman, D. The Design Of Everyday Things. Basic Books, 1988

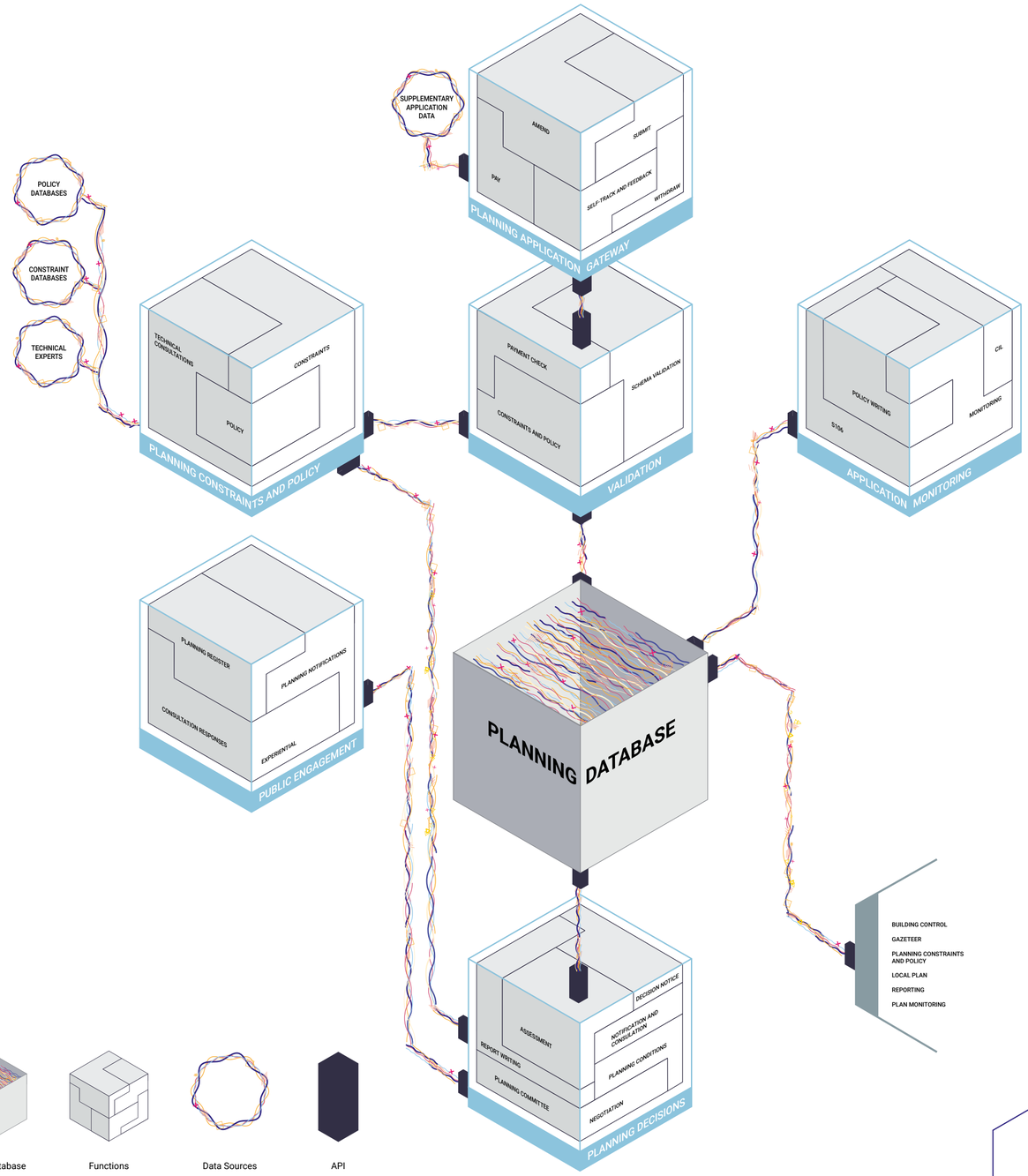
The principles in action

Our Vision

Based on our design principles, we have envisaged a future example of digital planning software architecture. This architecture mitigates the failures of the current system and builds on the progress of emerging innovations highlighted in this report. Our vision is predicated on modularity, openness and structured data. Actions are clustered into modules according to their similarity. Each module has bi-directional communication via RESTful APIs. We believe a new digital planning system following this architecture would reduce unnecessary administration, improve the experience for both planners and the public, and create a space for new Plantech innovations.

The entry point for an application is a public-facing submission portal which we are calling the 'Planning Gateway'. There could be many services, both national or local, that allow the public to submit, track, amend and withdraw their application. We believe this is the most crucial part of the application procedure, as it currently decides on the format and content of the information used in the entire digital planning process. Without this step executed well, all of the following steps are limited and suffer. At the submission portal, the applicant submits their application predominantly in a structured data format. This could be achieved by asking a series of relevant questions or it could simply be an interactive form – flexibility is left to the providers discretion but should be driven by an iterative assessment of user-needs and testing.

The outcome is that the planning application would then exist mainly as a structured data object. Supplementary data is pulled from other data sources at this point, such as OS basemaps, to help the applicant provide all the necessary information. Any necessary fees, such as application charges, can also be paid at this point. API's will allow for transaction information (ie. notification of payment) to be distributed to the Local Authority's in-house accounting tools and monies will be deposited into relevant accounts via direct communication between the payment function and online banking tools. Bi-directional communication channels between the gateway and the planning database must exist to allow the gateway to display tracking information and feedback on the application's progress.



Before being submitted to the planning authority, the application is validated against an application schema and against planning constraints and planning policy. The validation module queries a planning constraints and policy module that analyses the application contents against policy and constraint data sources, and sends back necessary information. For example, the application might need a heritage impact assessment if it is located in a conservation area. This application will be compared against a common data schema and tested to see if it contains the correct information in the correct format. If the application fails the initial validation check, the applicant will be notified and told to amend their application. If the application passes, it continues its journey onwards to the planning database.

A validated application would be stored in the planning database. The planning database could exist locally, nationally or be federated (that is, set up as a single centralised unit within which each state or division keeps some internal autonomy), but it is essential that it can be accessed through standardised RESTful APIs, and can be accessed by various groups with varying levels of access. The database will store all planning application data, including those in cases where supporting information will need to be provided in non-data-rich formats. The database will be updated by planning officers, through the decision process and the pipeline (applications pending a decision).

Once the application is stored, planning officers will be able to read and update the application through the assessment function in the decision module. The decision module will be the main interface for 'back-office planning' and it's core function is to assess the application and make a decision. This requires a series of actions that fall under this module, namely:

- case workload management
- assessment against policy and constraints
- statutory consultation
- notification
- negotiation
- report writing
- sending a decision notice, and
- setting out of planning conditions.

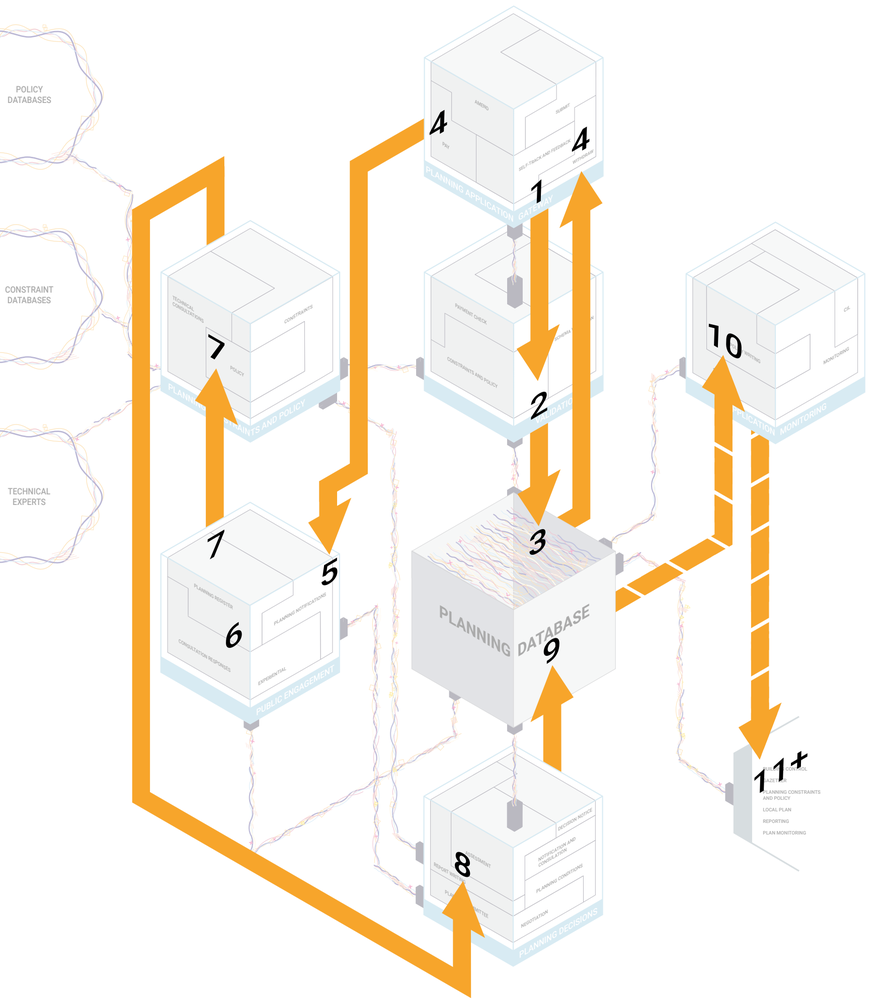
The interface will be built for planning case officers by reducing the administrative tasks and improving the useability for the functionality they need.

When assessing an application, a planning officer will query the planning constraints and policy data sources with the application data and receive detailed information regarding the application's compliance. For example, an application for a tall building will contain rich data relating to its maximum height, shadow paths, effects on wind patterns, access of natural daylight and sunlight into habitable spaces and impact on skylines and view corridors. All this information could be screened against the relevant data sources within the local authority's planning and constraints module.The constraints and policy module also links planning officers with the necessary experts – for instance, a local authority's urban design officer can provide feedback on the proposal. This differs from the way this is carried out today, because in this future system, the expert would have access to a back-office gateway to view and interact with all relevant application data, as well as policy, and be able to submit their response directly rather than via email or word-processed documents.

Another key aspect of the decision-making process is engaging with the wider public. This means the decision module must communicate with the public engagement module. Public engagement encompasses a searchable public planning register that allows members of the public to view up to date information on planning applications. It also includes consultation and notification, inviting public opinion and comments, and notifying relevant parties of any development plans. This is a clear springboard for new, innovative technologies. For example, using publically accessible application data to visualise new developments in experiential ways with augmented and virtual reality technologies. Through communication between the two modules, the decision module could collect feedback from public engagement.

Finally, planning data is available in perpetuity. Data can be used by the monitoring module to assess the performance of the scheme during construction and after completion. Similarly, the data can be used for the monitoring of the development in a locality as part of the plan making and policy writing processes.

Figure 4: This diagram demonstrates how the new software architecture would facilitate the development management process.



1. Submission

An applicant submits an application via the Gateway. They can use various tools to amend or withdraw the application and pay associated application fees. The Gateway module is intricately tied to the Validation module allowing a proposal to be triaged through the system once all necessary information is provided.

2. Validation

The Validation module consists of a number of tools that allow the application to be triaged through the gateway so long as all necessary tasks have been completed and the appropriate data supplied. The submitted data are validated against a common schema with the Schema Validation feature, ensuring the submitted application is structured in the correct way.

The payment is validated to make sure it has been initiated, received and is of the right value.

The Constraints and Policy feature verifies what necessary supplementary planning information will be required for triage – for instance a Heritage Impact Assessment for a scheme located in a Conservation Area.

3. Enters the Database

Once through the Gateway, the application lives in the planning database.

4. Live Application

The Self-track module allows the applicant (at any time) to track the progress of the application as it moves through the system. Once the application is successfully through the gateway, it becomes “LIVE” and the statutory clock begins to tick.

5. Statutory Consultation and Engagement

The Public Engagement module loads application data directly onto the Planning Register, and provides ways for the planning officer to notify statutory consultees – including offering a number of interactive and experiential tools for those interested, to engage with the proposal.

6. Collation of Comments

The Public Engagement module facilitates ways for people beyond the planning system to engage with the scheme and lodge their responses.

7. Decision-making

The Constraints and Policy module and the Public Engagement Module both provide relevant information necessary for an officer to reach a determination on an application.

8. Planning Decision

The Planning Decision module brings all the necessary information together to create a decision. An officer can assess the scheme, negotiate changes and amendments with the applicant (via the Gateway), prepare a planning decision report, set out Planning Conditions and navigate the Planning Committee all via the module. Once a decision has been reached and is ratified, a decision notice can be produced and the decision disseminated.

9. Updated Data

A finalised and determined scheme will live in the database alongside other determined schemes and schemes in the pipeline. Data is accessible via the Planning Register, a component of the Public Engagement module.

10. Post-application Tools

Where an application has been approved the Application Monitoring module can facilitate the processing of S106 and CIL agreements and payments. It can also facilitate monitoring of application forecasts. For example, if an application was expected to lead to 100 new car journeys a week and significant increases in the number of bats on the site, this module would facilitate ways to check if these actually did happen.

11+ Extensions to other services and purposes

Application data can be used for other relevant and/or associated services such as Building Control and the Council Gazetteer.

The live planning database will also assist with monitoring and reporting for policy and plan-making purposes, and assist with policy writing.

Figure 5: This diagram presents the modules that could be used directly for a planning application.

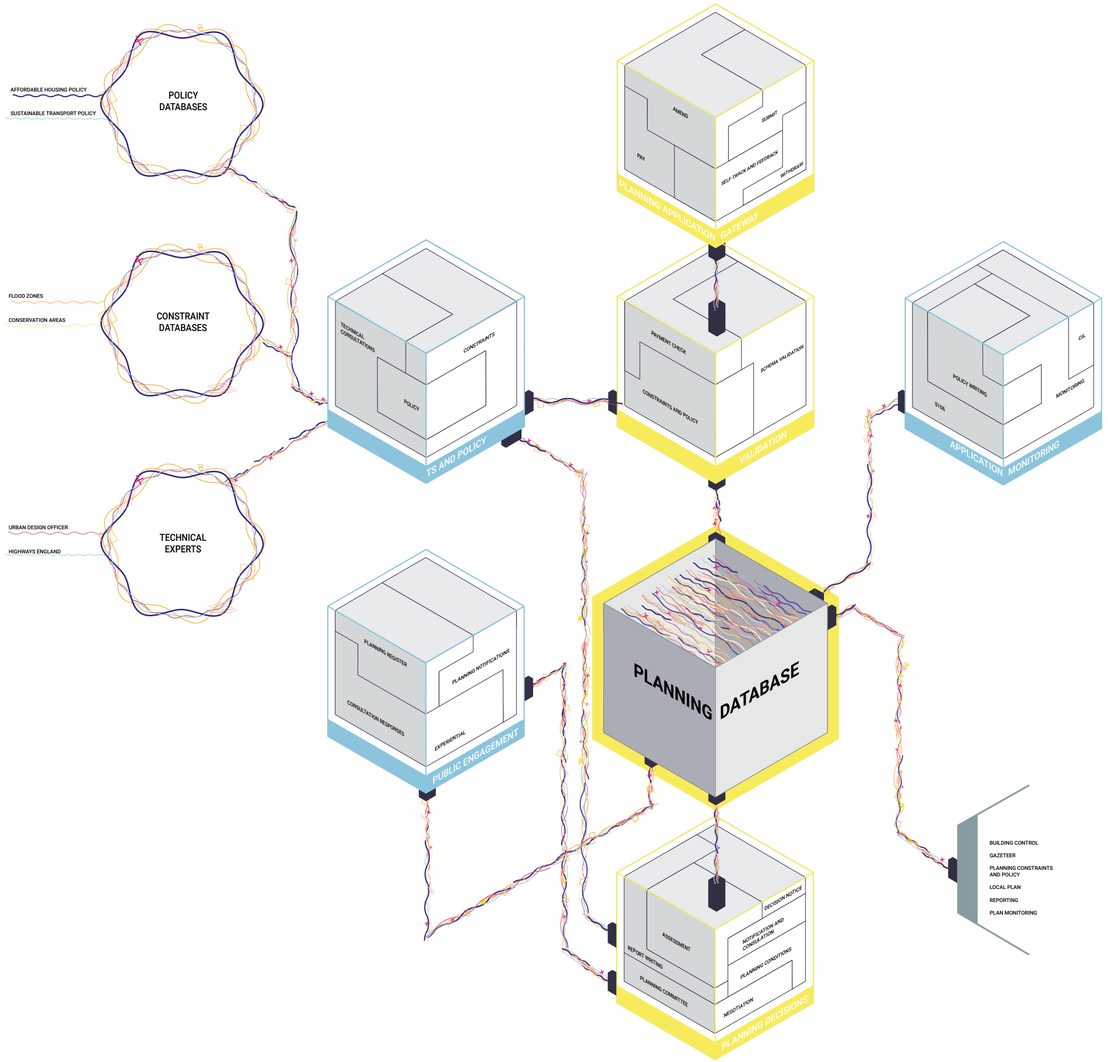


Figure 6: This diagram presents the modules that could be used directly for the decision-making process when considering an application.

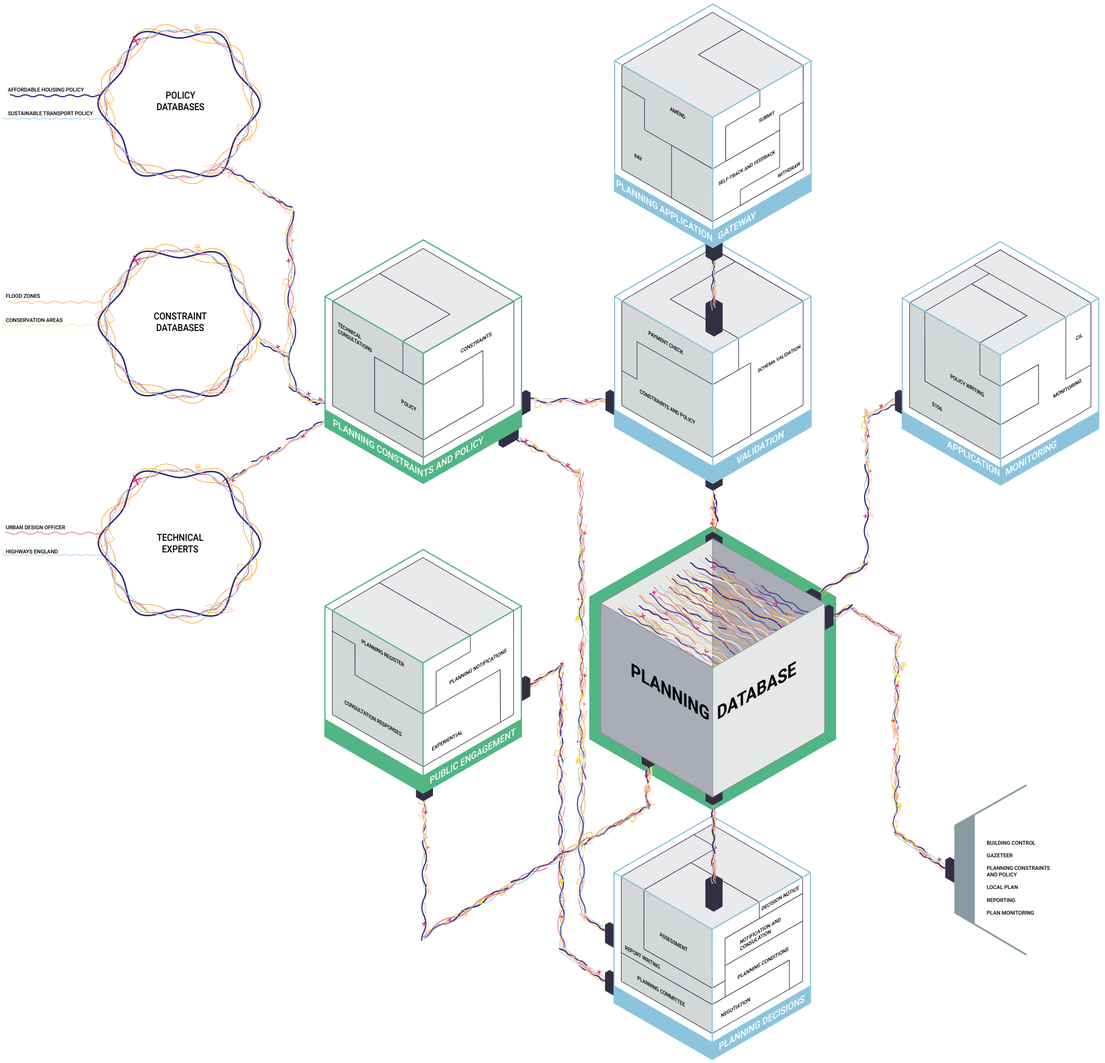
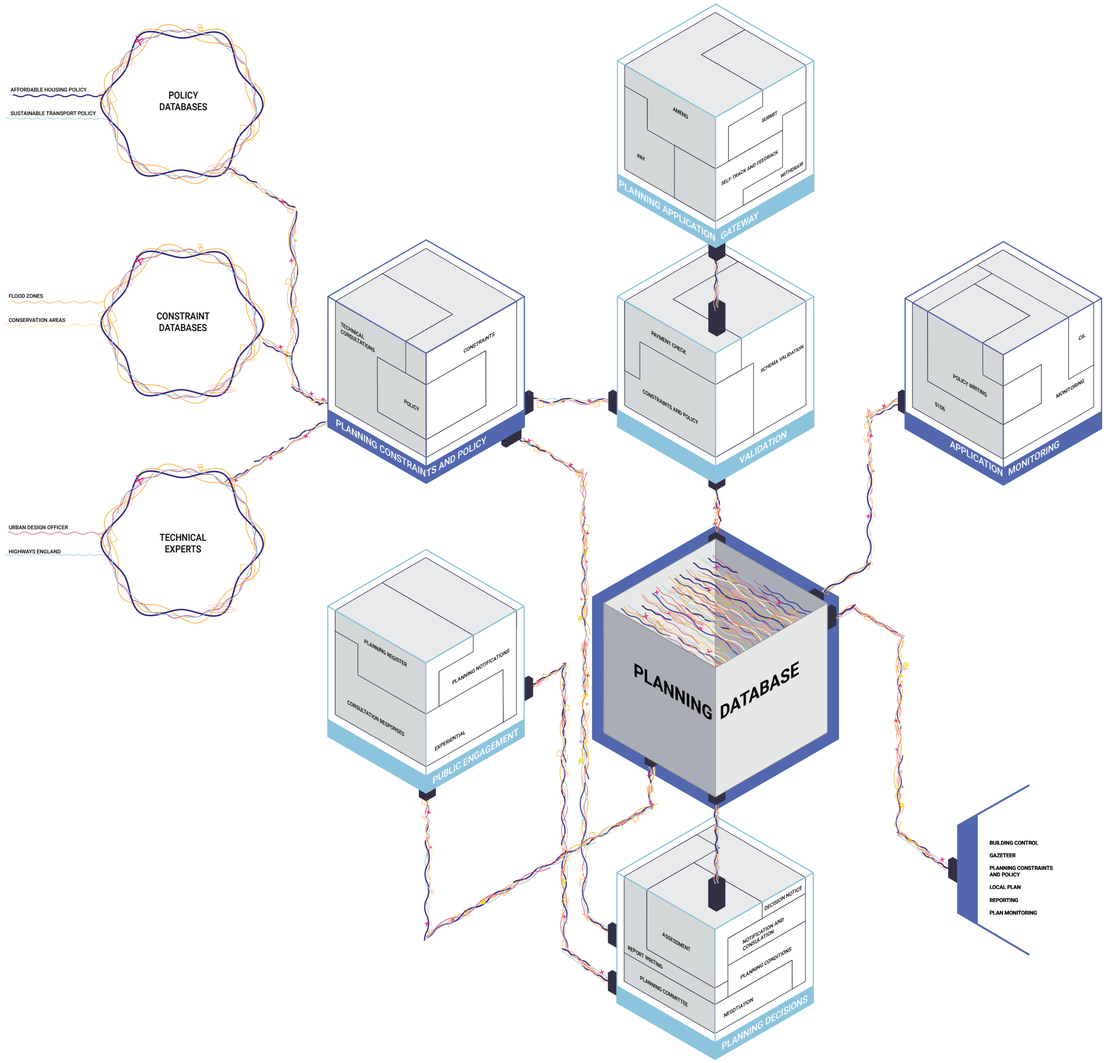


Figure 7: This diagram presents the modules that could be used directly after a planning application has received approval.



4. Things to consider next

This report is not intended as a prescriptive set of steps to cure the planning industry of its monolithic software affliction. Nor does this serve as a prediction for the future of the planning software landscape.

However, our research has shown that there are significant challenges with the status quo. The vision for a new planning system we've set out, and following the principles and ideas within this report will deliver a system that is more transparent, efficient and fit-for-purpose, and which will encourage innovation, competition and evolve over time.

Our vision is based on extensive research and insights, iteration, collaboration, discussion and consideration. Whilst the focus of our recommendations has been on the technology and software, these are derived from an understanding of the people and processes any new technology would be built for. We present it as one of many possible pathways to a future all-digital planning software landscape.

The first step to deliver transformational change will be to start with identifying and delivering ways to move away from the current reliance on documents. This is the source of the problem with the system, and without resolving this issue it will be near impossible to deliver real software change. This will require the development of standard schemas and governance models for how planning data are stored and collected.

Secondly, we must put the user at the forefront of our design. Software must be designed to serve the needs and goals of the user and be intuitive and easy to use. So, those responsible for procurement need to value user-research and service design and should prioritise products and services that have been developed accordingly. We need to further rethink procurement processes so that we invest in ways to learn about what users actually need before investing in a product.

Most critical however is that key players in the planning software landscape need to start to think about how to deliver a truly 21st century planning system. We look to the key shapers and funders of the planning landscape, central government, local authorities, the plantech community, and legacy planning software providers, to work towards delivering a planning system that responds to the failings we have outlined in this paper. We hope that by drawing on these principles in scoping, funding and delivering new tools, we will move towards a planning system delivered by a sustainable and vibrant market that can help us deliver the homes and services people need.

How these transformations will be funded will still need to be resolved. Much of the emergent software outlined above benefited from Research and Development funding from central government, but more will be needed to scale and run them. Local authorities cannot afford to develop and run their own instances of each new solution, and economies of scale will be needed. There will need to be new institutions and innovative business models to be able to continue to deliver and scale these innovations, as well as continued support from the government to fund further Research and Development, and possibly even service delivery.

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