

Full Spectrum Innovation

Knowledge Management for Innovation

Defining Knowledge Management

An organisation's use and application of knowledge is becoming ever more important. Many industries are seeing increasing challenges, which in turn demand highly co-creative solutions. Innovation has always relied heavily on knowledge – especially in the creative crucible where radical ideas first form^{1,2} – but this reliance intensifies as the focus shifts from single inventions to a complex mix of many high-value technologies^{3,4,5}. Effective knowledge management is key to delivering these high-impact and high-value technologies ever more greatly needed.

Knowledge management (KM) ensures that knowledge creation and use throughout an organisation is effective; producing a high quality 'organisational memory', separate from individuals. This is beyond the simple application of repositories: storing knowledge away in seldom used and difficult to access databases. True KM synthesises knowledge into the organisation, providing the right knowledge, to the right person, at the right time, with the right context. Much like in our own lives, where challenging situations trigger helpful memories, organisations need their own organisational memory that automatically leaps to action in response to difficulty.

Finally, businesses increasingly find that the value of knowledge comes less from simple ownership, and more from effective use. Thirty years ago, knowing an engineering formula 'by heart' was critical. Today an engineer can access that formula for 'free' at the touch of a key - making their ability to understand and flexibly apply a formula across projects, needs, and disciplines of much deeper value. KM therefore not only builds organisational memory, but drives a new way of working, where existing knowledge is more rapidly and effectively used in the 'real-world', with more work hours focused on creating high-value outputs, over simply re-treading old ground.

What Do We Mean by Knowledge?

We should here take a moment to define knowledge. Crucially, knowledge is not information. Knowledge is the use of information in context, creating a useful understanding of a system/process. Recognising a traffic light as red is information. Seeing the red light and knowing to stop, that is knowledge. (see Table 1)

	Sensing	Data	Information	Knowledge	Wisdom
Sophistication	Sensing	Facts	Meaning	Understanding	Judgement
Example	Photon detection	The colour is red	The light is red	Stop at the light	Safe navigation

Table 1: Relationship between knowledge and information

Organisations gain value from knowledge when it is applied to produce organisational 'wisdom' – meaning simply the ability to make smart, informed, judgements. Having stopped at a light, 'wisdom' allows us to navigate the route from London to Nottingham, as well as wait for the rain to stop, check our oil, and fill up with petrol before starting. Organisations who apply knowledge safely and reliably navigate their ecosystem. This is the organisation doing the right things, in the right way, for the right

reasons; an ability which is not fixed, but constantly evolves as a system marrying people, process, technology, structure, and culture.

The Challenge: Abstract to Concrete

The above is an abstract definition of knowledge management; useful as a guide, but lacking concreteness. What we need is an understanding of ‘real’ effective KM on the ground. What does it achieve? How is it structured? What is the process by which it’s built? This deeper understanding allows us to develop the usable, valuable, system itself.

Many organisations are tempted to turn to academic literature for this clarity. KM is still published on in academia, though not as widely as it once was. Utilising this academic knowledge can be a challenge, however, with most analyses highly abstract^{6,7,8,9,10}; failing to ‘touch the ground’ in concrete form. Alternatively, KM models are developed (or analysed)^{11,12,13} but for a specific scenario, or narrow parameter, limiting their usefulness.

More fundamentally, focusing only on the management of knowledge sources ignores the deeply important human elements. Simply having knowledge available in a repository doesn’t result in effective application and use. Equally important is the process by which knowledge can be effectively accessed, and used by people. This is the true practical application of KM: which begins with a definition of *what effective knowledge management achieves* (see figure 1), touching on, and improving, many areas of a business. KM is, by its very nature, holistic - rarely valuable in addressing a simple, single ‘reductive’ challenge.

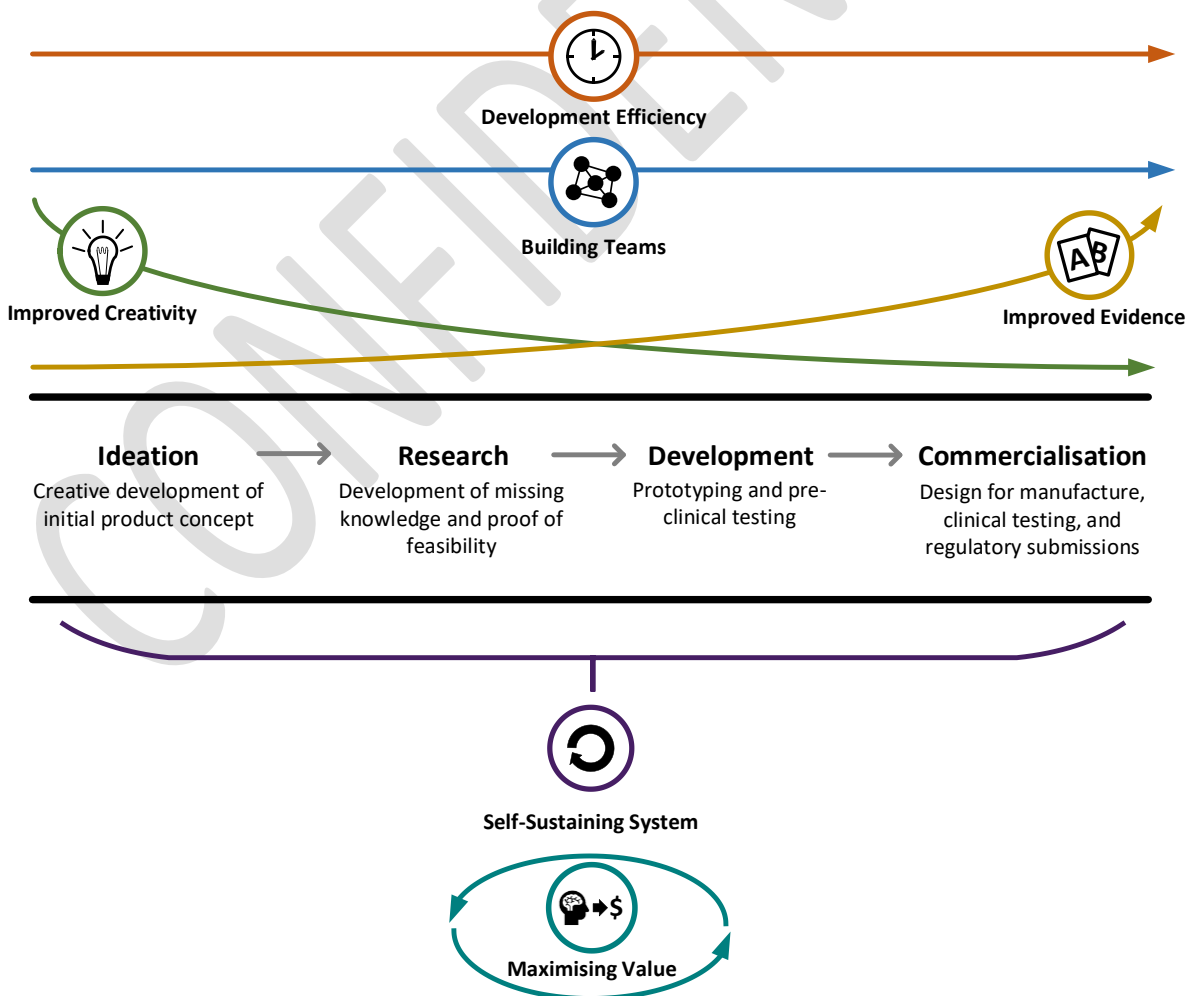


Figure 1: Influence of each KS benefit topic area across the development journey

Getting Concrete: What does KM achieve?

Improving Creativity and Products



Organisations often find greatest benefit of effective KM is an improvement in the quality and range of new products developed. This is, however, still an abstract target. What do we mean by this, and how does it occur?

In a lot of cases, innovative product development relies on teams acting creatively to build value. A truly creative team flexibly, effectively, and uniquely combines knowledge across a range of diverse disciplines¹⁴. Effectively managing knowledge supports this creativity by increasing knowledge availability and diversity, while creating more space for the team to practice/focus on its useful application. The creative capability built in this way improves innovation - as the successful generation and realisation of creative concepts.

These benefits extend beyond creativity alone. Building an effective KM system in this way also fosters the early anticipation of development risks, generation of higher quality design inputs, and the resolution of complex and multi-domain scientific challenges.

As businesses better manage their knowledge they are empowered further by using their organisational memory to ever better effect. Organisations often find that knowledge generated for past products can inform the design and development of future ones - minimising time-consuming experimental investigation. The development of syringes feeds into the development of autoinjectors, for example, and issues relating to compatibility between a pharmaceutical and fluid flow-path material are relevant to both.

This capability can become highly sophisticated, with a standardised set of components and assemblies with known, documented interactions. Organisations who build this capability into their KM system build value far beyond improved development efficiency. The approach fundamentally refocuses their development teams, moving away from the re-treading of old ground, and towards new – and therefore high-value – knowledge/concept development.

Improving Evidence, Proof, and Regulatory Submissions



The burden of proof, and scientific rigour required for approval in highly regulated industries is on the increase. In healthcare, for example, both the FDA and the new European Medical Device Regulations (MDR) require organisations to provide the output of their design process *and* full scientific reasoning behind their design decisions. In fact, this has always been enshrined in quality management standards such as ISO13485, but is now coming under increasing scrutiny both from notified bodies and national regulators.

Organisations who implement effective KM deliver to these increasing expectations, inherently capturing, categorising and storing knowledge – including design reasoning – throughout the development process. A knowledge capable organisation can simply and easily retrieve these records as part of any regulatory submission, being catalogued and easily searchable. In the same manner organisations collect, store and retrieve detailed information that improves their proof of invention position, as well as protection of their intellectual property.

Past regulatory records can also be used to effectively and efficiently lessen the overall regulatory burden. Well-designed systems help define relevant regulations for new projects, and how to achieve compliance.

Enhancing Development Efficiency

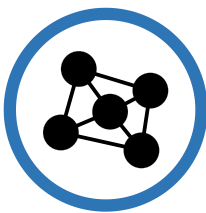


By implementing KM, organisations can substantially improve their development efficiency. Access to the right knowledge, for the right person, at the right time, with the right context, has a hugely positive multi-dimensional impact. Handovers across the development journey become smoother and faster. The number of design mistakes, errors, and failures is reduced, in turn reducing the frequency of costly repeated work. The result is better, faster and cheaper products.

Teams can extend this efficiency beyond device design alone. As organisations gain better appreciation over, and visibility of, their knowledge gaps they are further capable of separating high-value R&D from low-value - building a unified and synergistic research backbone, that optimises R&D value and Return on Investment (RoI).

Lastly, as organisations better manage their knowledge, individuals and their working environment see a significant positive impact. Staff productivity increases, and staff feel empowered, when they have access to needed information. This improved productivity and empowerment leads, again, to improved creativity and so innovation capability. It also promotes performance as the key driver of authority in the organisation, over the hoarding and control of knowledge via organisational gatekeepers. In this way capability – the direct ability of a staff member to deliver to the needs of the organisation – becomes instantly more important than simple knowledge years.

Effectively Building and Using Teams



The small 5 to 15-person team is the engine of any organisation, and the effectiveness of these teams is not simply the sum of individual experience. When organisations construct teams, interpersonal dynamics, roles within the team¹⁵, and the way the team works together all have a huge impact on effectiveness¹. As an organisation establishes their KM system, they become able to see, directly, which individuals and teams are producing the high value knowledge driving high returns and profitability over both the short and long term. Organisations can otherwise really struggle in trying to predict this, dependant as it is on a range of interacting factors. Recording the knowledge produced and who generates it is the first step in determining where value is built in the organisation, providing both insight and tools for building effective development teams.

Secondly, KM builds a common language and set of concepts between and across all teams in the organisation - improving intra-team communication, facilitating the transfer of staff between teams, and reducing confusion/lost time within projects. An organisation-wide, synergistic approach to knowledge boosts both the operation of teams, and the interoperability of team members.

Maximising Value Generation from Knowledge

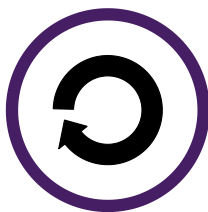


When organisations build a KM system, the key benefit they receive is the optimal use of their existing organisational knowledge. As effective KM spreads, projects move from being largely existential, isolated efforts, to deeply connected and synergistic ones. In the low KM case, transfer of useful developments from one project to another is reliant almost entirely on the efforts of individuals. Hard-won inventions, created at huge cost over many months, become single use; with the low KM organisation missing out on large amounts of on-going revenue.

This chance element is greatly reduced where knowledge is effectively managed. The development history of the organisation is not only made available to every employee, but links between old work and new opportunities are actively highlighted. Inventions no longer rely on a single application for overall RoI. Instead, they continue to bring value to the organisation over the course of many years in combination with new, high-value developments. Such an approach makes optimal use of existing IP, driving substantially higher long-term RoI from R&D.

The KM system actively fosters this change in approach, by helping track long-term R&D value from individual technologies. In building a clear map of the organisation's knowledge, strategic R&D planning is improved, with critical knowledge gaps quickly and easily identified. This inherently improves not only short-term R&D, but long-term strategic investment: creating a robust organisational research backbone.

Enabling a Self-Sustaining Knowledge Ecosystem and Culture



Eventually all these disparate elements and areas of improvement can be brought together. Addressing KM strategically throughout the organisation shows that knowledge is a valued asset, empowering employees to build, foster, and preserve it. As knowledge is better catalogued and distributed, capability becomes the core differentiator of performance. At the same time, employees are encouraged to generate knowledge through capability, with that knowledge capability trackable and public. This incentivises and builds better knowledge generation across the organisation, resulting in a true knowledge system and culture.

Importantly this system also insures against knowledge loss, by ensuring knowledge exists separately from individuals. When individuals leave a low-KM organisation, the knowledge they have tends to leave with them. While an effective KM system allows knowledge to be 'owned' by individuals – who can quickly deepen, elaborate and train it in others – all knowledge also exists fully in the KM system itself. The loss of an individual may require the training of a new authority from the organisational memory, but that knowledge is never fully lost in the same way as when it resides within a single individual.

This is a vital concept. At its core, knowledge is value, and by its very nature is a value store that depreciates much more slowly than tangibles. It can also *increase* in value, particularly when combined with new advances across disparate disciplines within an organisation. The recording and preservation of knowledge in organisations, independent of individuals, preserves value while producing improvements in products, evidence, efficiency, teams, strategy, environment, and culture. The holistic and self-supporting nature of KM, properly channelled, results in benefits across the organisation of enormous compound value.

Going Deeper: What does an effective KM system need?

Like the benefits of KM described above, the process of KM touches on every aspect of a business. It is also distinctly not a technological process alone. The BSI produced a good practice guide for knowledge management in 2005¹⁶, which included the following observation:

“KM is no longer seen as merely the provision of large-scale software systems or providing the pipes required for knowledge flows. KM practitioners have long recognised that such an infrastructure approach is in itself not sufficient. Rather, successful KM will attempt to infuse new knowledge behaviours, and hence change the way people access, store, share and create knowledge”

An effective KM system is an interlink of people, technology, structure, process and culture. Like the layers of an onion, each ‘lower’ strategic level sits within the context of the ‘higher’ ones, with all levels working in harmony to produce the full KM system. Returning to the BSI:

“One of the main reasons that many KM projects have failed is precisely because they did not make a strong linkage with other functions and management trends and therefore did not engage the ‘hearts and minds’ of all key stakeholders”

When an organisation develops a KM system, the focus is to define the process, structure and desired culture within the ideal system. Technology/tools are then found to fill process or structural stages where needed. There are an overwhelming range of tools on the market related to KM, each focussed on different aspects: content classification, content capture, document management, storage systems, communication, and collaboration management. All alone fail to realise the totality of benefits from KM, or even a significant subset. Each must be utilised in combination within a structure that fits the specific KM needs of an individual organisation to be fully effective.

A good way to understand this is to think of the broad level structure/workflow of a ‘ideal’ KM system (figure 2). Most tools are applicable to one or more elements within the overall structure. Content capture tools such as electronic lab books can be used as part of the generation, recording and conversion of knowledge. Content classification structures such as taxonomies or ontologies – perhaps driven by Artificial Intelligence – are focused exclusively on its conversion and categorisation. The most common form of tool, repository structures, can take many forms, but typically only address storage, categorisation and searching. The combination of tools alongside the people centred process is what ultimately builds the complete KM structure.

This structure, however sophisticated, must therefore still sit within a wider KM process. It is easy, but terminal, to ignore the human element inherent in KM - an approach likely only to result in a hugely expensive failure. We can see a clear example of this at the very early stages of the process outlined in figure 3.

The value of the system is only as good as the as the quality, and quality-of-recording, of the knowledge generated. This is a people function. More importantly, KM is less a process, than a competence. It is a way of doing. Success is driven by how much individuals trust, engage with, and adhere to the system. The process is the main support here: building the ‘way of doing’ into the organisation’s culture and linking the people and non-people elements into a single holistic structure.

Based on this, the cultural elements of KM become clear. Individuals must truly understand, trust, and see the value of the KM system for it to be effective. The system is only a framework and catalyst for deeper cultural change around knowledge in the organisation. It installs the management of knowledge as ‘just something everyone does’, rather than a truly distinct and separate process.

So, taking all of this into account, what could a KM system 'look like'? Figure 4 shows a summary of a possible system, including the interlinks between people, technology, structure, process and culture. This gives a broad overview of the key system elements and shows the various tool 'types' needed to be found/developed as part of the process of KM implementation. Of course, there is a deeper level of detail to be attached to this overall structure to build a complete system. This deeper detail is, however, organisation specific, developed in response to a business's current knowledge structure, culture, and the intended benefits of the fully realised KM system.

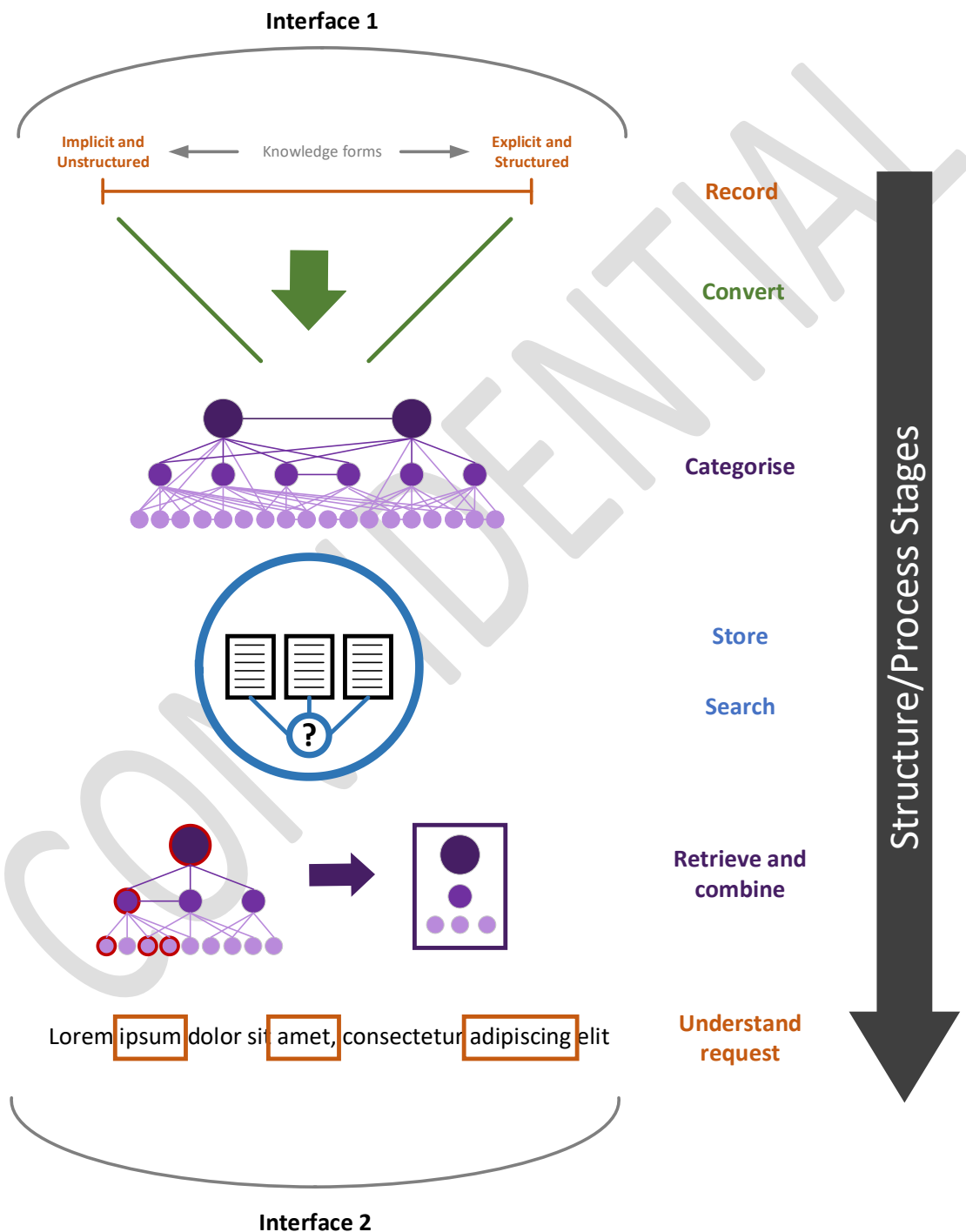


Figure 2: Knowledge Management Structure Overview

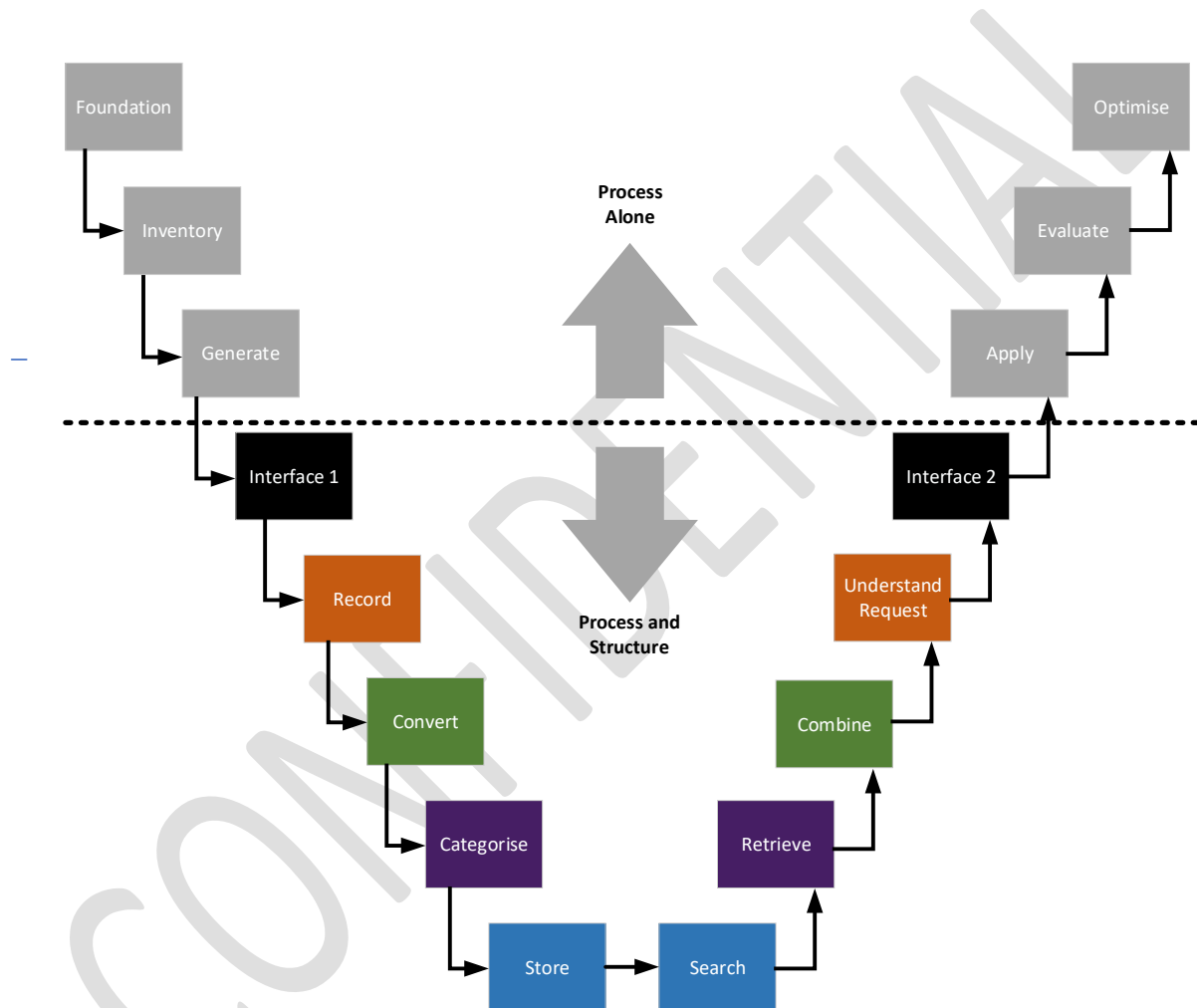


Figure 3: Top Level Knowledge Management Process

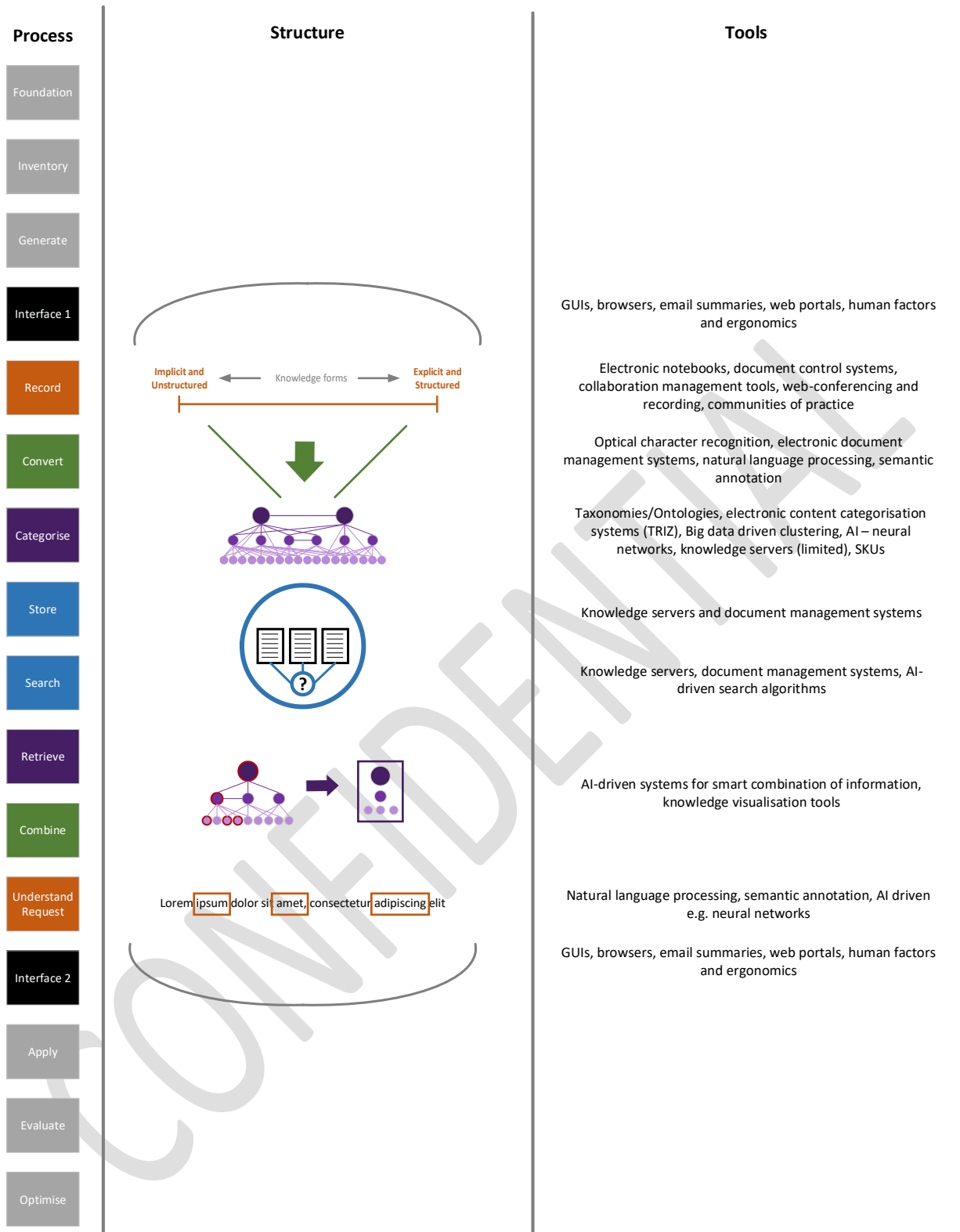


Figure 4: Combined Knowledge Management Overview

How to begin

Like the system itself, where to begin is highly organisationally specific. Despite this, many organisations implement a broadly similar process. The first steps involve deeply investigating their existing knowledge architecture, defining what they wish to achieve, and identifying the gap between their current and ideal system - before planning and delivering the system itself.

Building a new KM model must inherently instil a new way of working and thinking within employees. This involves change management in its most fundamental form, requiring careful planning, engagement and implementation, for example invoking a 'Lewin' style change management approach¹⁷. The process must overcome a range of diverse barriers – such as a lack of framework, inherent unwillingness to share, inability to recognise or articulate knowledge – which must be addressed early in the project design.

Immediate first steps therefore focus on establishing the objectives of the project, and the target benefits. This sits alongside an audit of the current handling of knowledge in the organisation to form the evidence base for future development and implementation. Importantly, it is only when a clear idea of the 'shape' of the KM solution becomes clear that individual technical solutions start to become relevant. FSi can provide guidance and support in these early stages of shaping the KM approach and journey, as well as developing and implementing the KM solution itself.

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