

Auros Knowledge Systems Make Knowledge Active

CIMdata Commentary

Key takeaways:

- *Knowledge must be easy to record, review, comprehend, and apply.*
- *Knowledge is applied throughout product lifecycles and is often viewed in a comparative way (peer reviews, similar products, field failures, etc.).*
- *PLM/PDM/ALM systems manage resulting design throughout a product lifecycle, but institutional knowledge lasts longer than any individual product's lifecycle.*
- *Knowledge has a lifecycle related to proven practices and technology application.*

The application of experience, knowledge, and practice are hallmarks of any successful enterprise. When solving problems, whatever their source, one often relies on recorded, reliable, peer approved knowledge gained through experience. The practical use of knowledge changes as the underlying technology changes, but at a duration much longer than a product's lifecycle. Most products have histories of small incremental improvements where the manufacturing, service, and use of knowledge is stable. The next product benefits from the application of institutional knowledge. Successful management and application of knowledge reduces recurring mistakes and improves efficiency.

What is Knowledge Management

Design and release systems, typical tools for product design and manufacturing, are not optimized for the lifecycle of knowledge. Learnings often come from experiences not anticipated by the original designers. The capture, indexing, and application of these experiences is a valuable corporate knowledge asset. Managing these insights builds a knowledge base and often provides competitive advantages.

Auros' Journey

Auros Knowledge Systems emerged from the automobile engineering community, seeking to radically improve how organizations around the globe capture, share, and reuse knowledge. Fulfilling this need at Ford, GM, and other companies has made Auros a leading enterprise solution for a fundamentally new approach to managing technical knowledge—called 'Knowledge Aware.'

Auros Knowledge Systems was founded during the time that computer aided design (CAD) was expanding in mass production companies. While CAD and product data management (PDM) solutions, and now product lifecycle management (PLM) solutions, have rules applied to specific designs many lack an intuitive and reliable approach to managing and provisioning institutional knowledge that applies across multiple products and designs. Auros nurtured a growing community inside large manufacturers to develop a notion of making institutional knowledge active, where engineering processes became aware of captured knowledge. Knowledge was not represented in some paragraphs of insight, like an entry in an encyclopedia, but was inherently active (e.g., knowledge was actively reused by knowledge-based engineering (KBE) applications in design automation). KBE applications included solutions for packaging and interface challenges for a family of necessary but auxiliary parts on automobiles. Examples include oil dip stick routing and wiper design aids. For instance, the wiper application enforces federal Motor Vehicle Safety Standards (MVSS) rules based on

percentage of windshield that must be cleared by a wiper system. These are but a few examples of design automation enabled by Auros' Knowledge Systems tool. Another important domain for active knowledge is the provisioning of manufacturing best practices as applied to the development of the Bill of Process (BoP) to include techniques learned from experience in mass production. Examples of this type of institutional knowledge include bending, casting, melting, and assembly rules and best practices. A key aspect in applying institutional knowledge is that a comprehensible piece of knowledge must be easy to learn. This is best accomplished by limiting (or right-sizing) the supporting prose. To this end, Auros developed their Knowledge Packet concept with guidelines on what a good knowledge packet contains. Another concept is that multiple knowledge packets can be combined and provisioned together as a set to accommodate real world complexity.

Organic Growth to Broader Audiences

Three factors have been instrumental in Auros Knowledge Systems' success: ease of knowledge capture, design automation with actionable requirements (dimensions and performance), and timely application of knowledge packets synchronized with a product plan. Let's explore each one.

Knowledge capture often comes from a learning experience (examples include a field failure or a failed validation test). The person who authors the conclusion, creating a form of knowledge, is almost never the original designer who is familiar with the PLM and ALM tools. The authors of this knowledge are often experts in demand. The user experience to capture knowledge is driven by familiarity and ease of use. This helps avoid multiple mouse clicks required to associate knowledge to a specific design, which is usually very time consuming. So, the system to capture knowledge must have a very different user experience. Furthermore, the knowledge gained from experience is often judged and approved by an expert group. Their ease of reviewing and approving knowledge is critical.

Rules and key measures captured in executable knowledge packets can be accessed by design automation and assembly tools to remove human error and to speed packaging work. The first such applications of this type were developed and in use in the mid-2000s. However, not all knowledge is inherently applicable to CAD, CAE, and other digital tools. Nonetheless, these types of knowledge packets are still structured in a way such that the knowledge consumer can quickly determine the appropriate course of action.

Applying knowledge packets at the best time is also critical. It can be overwhelming to apply all institutional knowledge consistently to a new product. Companies develop a succession of phases and gate reviews to decide key design points before proceeding to the next phase. Being able to see that specific knowledge to be applied for a specific phase helps manage the application of knowledge in a timelier and consumable fashion. Figure 1 shows an example of a Best Practice.

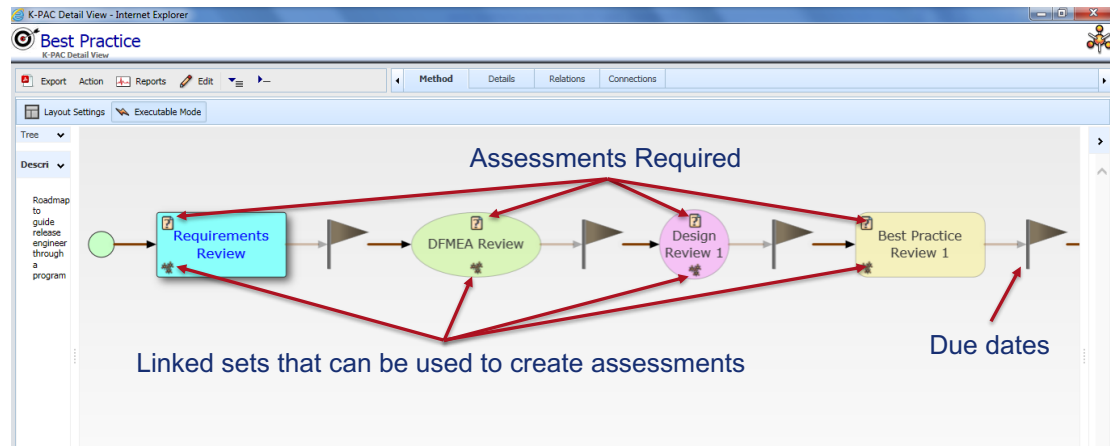


Figure 1—Best Practice Knowledge Use Process
(Courtesy of General Motors and Auros—Knowledge Aware 2018)

Finally, knowledge can be captured at any time and acted upon by any product, regardless of its point in the lifecycle. Peer reviews and field response teams often have a need for the latest experience to be applied to fixes or design evolutions. Active knowledge can be very important for new technology introductions where experience is lacking. Being able to proactively review and apply field insights early in a product's lifecycle is beneficial to consumers and OEMs. As peers see the application in use, expansion occurs to many learning situations where discovered knowledge wants to be applied to other products throughout their lifecycles. Auros Knowledge Aware support these concepts as described in Figure 2.

KNOWLEDGE AWARE / what is it?

The Knowledge Aware approach is a coherent and comprehensive, enterprise-level Knowledge Management strategy and technique.

Unlike traditional knowledge management solutions, the Knowledge Aware approach captures and validates knowledge, breaks it down into digestible bite-sized pieces of knowledge, and delivers it to employees and team as they work, when they need it. Instead of searching for information, employees encounter reusable knowledge directly within their flow of work, allowing them to make more qualified and robust decisions.

Some of the common benefits organizations find with the Knowledge Aware approach include:

- Elimination of recurring mistakes,
- Improvement in workforce efficiency,
- Preservation and sharing of knowledge,
- Reduction in engineering variation, and
- Reduction in the enterprise IT footprint.

Figure 2—Auros' Knowledge Aware Key Concepts
(Courtesy Knowledge Aware 2019, www.kaconference.org)

The journey from passive knowledge to active knowledge has key attributes that have been captured and published in the Knowledge Aware Maturity Model. Similar to CMMI for software and systems, the Knowledge Aware Maturity Model shown in Figure 3 provides a way for organizations to assess where they are on the journey to active knowledge management. The Knowledge Aware user community has embraced this maturity model to help them guide their improvement plans.

Knowledge Aware Maturity Model

	LEVEL 0 Lagging	LEVEL 1 Forming	LEVEL 2 Expanding	LEVEL 3 Strategic	LEVEL 4 Extended Strategic
Scope of Enterprise Engagement	<ul style="list-style-type: none"> No Communities of Practice or weak cohesion within Communities 	<ul style="list-style-type: none"> One Community of Practice or One System of Communities of Practices 	<ul style="list-style-type: none"> Multiple systems of Communities of Practices 	<ul style="list-style-type: none"> Enterprise level systems of Communities of Practices Organic complexity (Community of Practice to Community of Practice relationships) evolving around systems of Communities of Practice, Bottom-up 	<ul style="list-style-type: none"> Supply Chain and partner knowledge sharing Managed 'knowledge leasing' across partners
Retained Knowledge	<ul style="list-style-type: none"> Documents or ad hoc repository / database No Knowledge Packets 	<ul style="list-style-type: none"> Knowledge Packets migrated from legacy documents / databases 	<ul style="list-style-type: none"> New Knowledge Packets generated by lead users Increasing use of value tables to model knowledge (upgraded 'executable' Knowledge Packets) 	<ul style="list-style-type: none"> New Knowledge Packets generated across the enterprise Knowledge Packet shared (push/pull) across Communities Knowledge Packet single 'gold source' for standards, learnings, methods, practices... 	<ul style="list-style-type: none"> Knowledge Packet exchanged within Supply Chain Key learnings integrated across the enterprise
Knowledge Allocation	<ul style="list-style-type: none"> Limited or no allocation (Knowledge is viewed as passive 'reference' information, search / seek model dominates) 	<ul style="list-style-type: none"> Organized experimentation with Assessments (allocation of knowledge) Knowledge Packets serve as improvement of replaced documents 	<ul style="list-style-type: none"> Assessments integrated into key workflows driving improved outcomes by leading Communities Assessment measurables used to further improve program performance 	<ul style="list-style-type: none"> Assessments broadly used to drive project performance and decision making across all phases of engineering Assessments integrated in modeling environments for continuous verification and in-context decision support Certainty in knowledge reuse Engineering processes are 'Knowledge Aware' 	<ul style="list-style-type: none"> Optimized verification and decision support across value chain Experts able to focus on innovation
Organization Demand and Health	<ul style="list-style-type: none"> No bottom-up growth of retained knowledge No quality controls on documented knowledge 	<ul style="list-style-type: none"> Leadership inspired, top-down push for growth Sparks of bottom-up demand-based growth from individuals 	<ul style="list-style-type: none"> Growing bottom-up demand, less dependent on Leadership led growth 'Vitality' statistic measured and available to improve quality control of knowledge 	<ul style="list-style-type: none"> Virtuous Cycle begets increasing levels of demand leading to organic growth 'Vitality' statistic used to refine and manage signal-noise of communities and Knowledge Packets (consistent quality control) Closed-loop learning and continuous knowledge sharing is a durable enterprise capability 	<ul style="list-style-type: none"> Benefits of a 'learning organization' realized Supply Chain advantages in knowledge sharing Bottom-up demand from Supply Chain partners
	PASSIVE KNOWLEDGE				ACTIVE KNOWLEDGE

Figure 3— Knowledge Aware Maturity Model
(Courtesy of Auros)

CIMdata believes that the Auros Knowledge Management solution offers an appealing choice for any discrete manufacturing company who has the need to capture and proactively apply knowledge. Application is especially valuable in companies that produce similar products in parallel, year after year. The Knowledge Aware Maturity Model allows a company to quickly assess where they are on the knowledge management journey. Capture of knowledge relies on experts with less and less time and ease of use is paramount. Auros Knowledge Aware solution is proven given its diverse applications beyond designers.

About CIMdata

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