How will we know?
Investigating the future of knowledge production, consumption and sharing

By the National Research Council Canada
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You are invited to spend time in the not-so-distant future

Knowledge management practices and initiatives are challenged by, and evolving through, the increasing complexity and interconnectedness of the knowledge domain, and the need for new KM paradigms and tools that combine and extend the techno- socio-cultural foci of traditional KM activities.

This document has been prepared as a backgrounder to set the stage and inspire discussion by addressing the following question:

What are the major trends that have the potential to affect the future of knowledge production, consumption and sharing?
This research explored the interplay between various trends influencing the evolution of knowledge work. As we did, we continuously bumped into a set of tightly meshed contextual factors underlying each of these trends, pointing to the value of relationships in the creation of knowledge and business value.

These factors highlighted an underlying tension between:

- Trust and fear
- Collaboration and competition
- Transparency and control (privacy/security)

These factors reverberate in various social, technological, ethical, legal, economic, political and environmental fronts and are present both internally between employees and externally in relation to partners and competitors.

The following pages highlight five thematic areas in which the foremost trends and influences converge:

- The Porous Organization, (Context - knowledge production)
- The Connected Nomads, (Tools and processes affecting future knowledge production and consumption)
- Interactive Knowledge, (Knowledge sharing and production)
- Augmented Insights, (Information analysis and Foresight)
- The Rise of the Living Data, (Data Management)

You will notice that we are “talking from the future” within these thematic areas, with a fluid time horizon ranging from the very near future (as little as 1-2 years, as with mobile and social technologies) to 15+ years down the road (as with artificial intelligence and automation of knowledge work).
Driven by the benefits of collaboration, organizational knowledge is unlocked, circulating across organizations, countries and sectors of society. Innovation is spurred by encouraging non-specialists to think openly and share ideas with the specialists capable of translating their visions into reality. Transient advantages outperform stable competitive advantage models. Scientific enterprises are transformed from the primary producers of knowledge to facilitators of collaborative innovation and managers of collective digital assets. Trust and relationship management strategies top the C-Suite agenda.

Intellectual property models redefined
Distributed IP ownership models have emerged from the dynamic management of strategic alliances and outsourcing partnerships, thereby accelerating knowledge flows and commercialization processes. Knowledge mobilized through social relations is valued as an economic resource, with evolving sets of control and profitability mechanisms. Government RTOs are challenged by financial restrictions and procurement roadblocks.

Open government, open science, open data
Openness is a widely established working model in science, government, and data. After years of experiments, learning initiatives and the arrival of the millennial generation in the workplace, models of open dialogue and stakeholder engagement drive evolution in science and government. Participative user-centered, public-private-people partnerships innovation models such as living labs and open labs replace tech transfer programs and drive many R&D initiatives.

Boundaries are vanishing
Distance, frontiers and delays have vanished - everything is local and immediate. The push for openness, the complexity inherent in the scientific issues of the day, and the global nature of business are conspiring to blur institutional boundaries. Knowledge flows are shifting from top-down to multi-directional, with information being shared freely within and between organizations and the public. Leadership is expected from everyone.
The connected nomads

Technology is transparent and centered on value and knowledge creation. Processing power resides in the cloud and fog, with augmented worker capabilities, facilitated collaboration and social interaction. With career volatility and instant team configurations, people are interacting and moving from multiple organizational and social networks at a rapid pace. These changes give rise to many new forms of virtual interactive collaboration as knowledge products are produced through social media-like tools. With smaller, intuitive, wearable and sensor-packed devices, people are immersed in personalized information feeds, networked everywhere, in real-time. Virtual currencies and the sharing economy account for an even greater percent of economic activities.

Social networks and communities

Social technologies used for business purposes are having an impact on practice, engagement, and expertise. They cluster functionality around sensemaking, unleash creative forces and foster adaptive working relationships and group dynamics. Connecting and sharing of information across organizational and global boundaries raises the productivity of knowledge workers by 20-25% through streamlining communication and collaboration, breaking down silos and extending the company’s knowledge and expertise networks.

Mobile technology

Communication is instantaneous at marginal costs. Advanced wireless networks offer seamless transition between office and home mobile applications (apps) and data services. Mobile apps improve productivity and delivery of service by integrating communication more directly into distributed knowledge work and providing continuous interaction with colleagues and customers. Everyone and everything is expected to always be “on” and accessible. Access permissions, data security, merging corporate and personal content and the use of unsanctioned IT services are the critical parameters of operational environments.

Virtual workers career fluidity

Global virtual workers are prevalent, with contractors and collaborators moving swiftly from one organization to another, rapidly connecting and accessing the expertise and knowledge base of organizations. Developing a shared language across communities replaces knowledge capture and transfer issues as a knowledge management focus. Employers compete for talent as corporate values are scrutinized by candidates. Personal resumes are replaced by web profiles and social-based rating systems.
Knowledge work has become interactive for more employees who, without specialized training, engage in self-serve intelligence gathering and routine analysis through personalized dashboards. Advanced collaborative analytics heightens the value of engagement with clients and partners outside of the organization. Decision making and innovation processes are being transformed through easier access to collective knowledge and collaboratively created insights. Crowdsourcing allows for the influx of new knowledge and greater connections within and beyond corporate boundaries.

Collaborative analytics and decision making
Intelligence analysis and decision support are performed through collaborative and iterative data modelling with clients and experts. With integration of visualization and collaboration directly into knowledge work tools, the focus stays on the analysis, and the work flow and productivity are no longer interrupted as with stand-alone collaboration tools (e.g. chat, email). Participation facilitates sharing and socializing of findings and decisions.

Crowdsourced Innovation
Knowledge is widely dispersed and the suite of expertise needed to bring new ideas to fruition is rarely housed in a single organization. The creation of intelligence and innovation takes a distributed, participatory approach, reducing costs and accelerating time to market for those organizations willing to crowdsource their innovating. Knowledge work is increasingly performed via participative models as the Work shifts from searching for contributions to synthesizing and building upon or co-creating outputs within and for the community.

Plugged-in agile knowledge
Data science moves from the specialist to a range of employees. Workers make use of self-serve, agile analytic tools and expect flexibility and usability from their dashboards. Analytics is embedded in transactional systems and data usage is plugged into day-to-day operations and decision making, ultimately impacting financial, organizational and personal performance.
Augmented insights

The combination of advanced analytics, interactive visualizations and artificial intelligence autonomously finds new patterns in complex data and delivers personalized, prescriptive advice. Scientific discoveries and business efficiencies are increasingly made through automated identification of connections in unstructured data, challenging the role of theory and the human role in interpreting knowledge. Human intuition adds value to strategic decisions and business innovation. Predictive and prescriptive analytics are incorporated into less than 25% of business analytics projects but deliver at least 50% of the business value.

Artificial intelligence (AI)
Advances in computational speed, machine learning, and natural user interfaces allow computers to aggregate information faster than the human brain and interpret and evaluate the results. Machine learning excels at the complex analytics used to monitor activities, understand the root causes of issues as they arise and accurately forecast future trends on the horizon. AI increasingly handles tactical and operational decision making, freeing knowledge workers and managers to focus on the strategic.

Prescriptive analytics
A rise in prescriptive analytics will go beyond generating foresight and anticipating the future (predictive analytics), to define a preferred course of action for reaching future goals. Sophisticated analytic tools augment knowledge workers’ skills, supporting tasks that rely on complex analyses, subtle human judgments and creative problem solving.

Knowledge-work automation
Advances in AI will make it possible to automate many knowledge workers’ tasks that have long been regarded as impossible or impractical for machines to perform. The greatest benefits are found in applying knowledge work automation to areas that boost employee productivity, creativity and allow for bottom up innovation. Managers have learned to let the organization run instead of controlling it, and have spent the last decades transitioning people and departments affected by the complete replacement of knowledge workers by machines.
The rise of the living data

Data no longer lives in static repositories. Data has been restructured into dynamic ecosystems with open access and open standards to ensure accessibility and interoperability on any platform, by anyone. Data is managed using ontologic and semantic structures, making search and analysis more meaningful and more effective for non-specialists. Datasets, both big and small are routinely mined to produce meaningful, actionable analysis and insight.

**Information governance**

With records being born digitally and an ongoing redefining of what constitutes a 'record', records management shifts to information governance, focussing on proactively managing data and information throughout their lifecycles. Work-in-progress, structured, unstructured and semi-structured information all require governance including protection from deletion, unauthorized use, and premature disclosure. Open standards are implemented across the board to address preservation and interoperability issues.

**Data ecosystems**

As data expands in volume, variety and velocity, data curation is moving to the forefront, with machine readability and findability becoming critical concerns for records/data managers. Traditional databases and information sources are replaced by living data ecosystems. Automated ontologies, semantic web and inference technologies enhance search relevance, real-time analytics and data visualisation by building connections between information/data sources into the structure of each system.

**Data ownership and access**

Data access and ownership is democratized as usage restrictions are minimized for both published research and their associated data sets. A change in corporate and scientific culture is underway to adapt to the ideals of open knowledge sharing. Competitive edge and value creation is driven by organizational capacities to identify, merge, analyse and integrate findings from a multiplicity of data sources.
References