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## Charting collective knowledge: Technology-enhanced professional learning

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# CHARTING COLLECTIVE KNOWLEDGE: TECHNOLOGY ENHANCED PROFESSIONAL LEARNING

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The workplace is an environment where powerful, deep and effective learning takes place through non-formal workplace learning, as well as through formal training and education. This article describes a mechanism to enhance learning at work by capitalising on collective knowledge within an organisation. Two scenarios are presented illustrating how individual and group learning and performance may be improved. These scenarios are based on empirical data of knowledge work practices within a multinational organization.

## The value of connected knowledge

In the current economy, the main source of competitive advantage for organisations is knowledge. Successful companies are those that can rapidly *create* new knowledge, *contribute* it to the knowledge pool of the organisation, and locate, collect, *consume* and *connect* relevant knowledge to solve complex problems. This mandates a faster and more effective cycle of knowledge creation and action based on new knowledge. Knowledge-based industries are characterised by a continuous redefinition of organisational goals along with radical and discontinuous change. Increasingly organisations need employees to able to respond to emerging needs by taking more responsibility for their own learning and development. Rapid adaptation to these emerging needs requires effective talent management and, critically, a reduction in time to competence. 'New crew' must be capable of getting up to speed quickly through self-regulating their own learning. They should be able to discover and integrate knowledge from many different sources in order to gain key competencies. They must be able to draw on the collective knowledge of experts and peers in groups or networks, using relevant technologies. In this sense, collective knowledge can be defined as the aggregation of knowledge in people, practices, and machines.

There is a direct correlation between an organisation's potential for problem-solving and the way in which it uses its collective knowledge base. The organisational knowledge needed to solve key challenges is no longer solely in the mind of one individual or even one team. Increasingly, solving work problems depends on the complex and evolving *collective knowledge*. Employees have to be able to use, create and share knowledge within their organisation to maintain the quality of this collective knowledge and to ensure the long-term competitiveness of the organisation. Individuals need the appropriate skills and tools to consume, connect and contribute to the collective knowledge and to draw upon the collective knowledge for learning.

There are several issues affecting an organisation's ability to connect knowledge for collective learning. Firstly, *the fragmentation of knowledge is increasing*. Knowledge is subject to more and more division and dispersion, arising from increasing specialisation, division of labour and diffused sources of innovation. In multinational companies, fragmentation can be exacerbated by the variety of disparate local processes, systems and tools for knowledge sharing. Fragmentation of knowledge can have dangerous consequences – inefficiency, duplication, insufficiently informed decisions. The knowledge needed to solve a problem may exist, but may not be visible and available to the right people in the right place at the right time. Therefore it is important for organisations to be able to c*onnect knowledge residing in systems and individuals,* by integrating and organising fragmented, diffused and thinly-dispersed knowledge. Central to connecting knowledge is the ability of organisations to leverage the power of formal and informal networks and communities through strategies, processes, as well as technological tools that support retrievable, reflective and embedded communication around knowledge creation and consumption. The IBM Global Human Capital Study (2008) surveyed 400 HR executives from 40 different countries representing private, public and not-for-profit organisations across a variety of industries and geographic locations. The study  revealed that only a small minority (13%) believed their companies were "very capable" of identifying specific expertise within organisation – many companies - recognise that they cannot yet *systematically* locate expertise. The majority of those companies that rated themselves as "very effective" at locating experts use some form of employee directory that includes information about an employee location, contact info, reporting chain, skills and credentials, and pointers to others within an individual's personal network. One challenge is that these methods of 'expertise location' require that individuals maintain their own information.

In the IBM survey, only 15% of surveyed organisations reported using technology that enables automatic profiling of skills, expertise and personal networks. Yet organizations and individuals have to find effective ways to source and **consume** knowledge from an increasingly wide range of resources and services, through searching or using, based on the actions of others. Typically, individuals will use simultaneously formal resources (Open Educational Resources, articles, e-books, podcast videos or audio resources) along with dynamic, informal resources (wikis – such as Wikipedia, blogs, Twitter feeds and so on).

Secondly, *individuals must be able to connect and collaborate with others* to innovate, solve problems, and create and share knowledge. It is not lack of technology that inhibits knowledge sharing and collaboration. In the IBM global survey, only 28% of the companies saw lack of technology as the issue. It is organisational silos (42%), time pressure (40%), and misaligned performance measures (37%) that were considered to be impeding organisations ability to connect knowledge.

Thirdly, organisations experience *difficulties in identifying and tapping into external sources of knowledge*, building external expert networks and leveraging external communities. Organisations have been experimenting with radically new forms of tapping into the collective knowledge that exists outside the organisation. A few prominent models have emerged: 'crowdsourcing' and 'ideagoras', which have also been termed the "eBay for innovation"; prosumption, a process of harnessing consumer communities through co-innovation simultaneously placing consumers as producers; open source R&D and precompetitive knowledge commons. There are just some of the approaches companies have been using to enhance their ability to use collective knowledge (Tapscott and Williams, 2008).

Fourthly, *organisational and cultural barriers impact the ways knowledge is used*.

Educational systems and many cultures and societies train individuals from an early age to be dependent on authority figures (teachers, parents, experts, managers) to direct them in their learning and work. Social technologies decentralise and democratise communication, sharing and production of knowledge – however work practices in many organisations pose barriers to critical thinking, innovation and collaboration. Individuals need to take control of their learning and work, but organisations must give up some control too. Organisations should support different models of work and individual skills development, which enable - or at least do not hamper - creative thinking, innovation, peering and sharing. The concept of *wirearchy (http://www.wirearchy.com/)* is emerging as an alternative form of organisation based on increasingly horizontal communications and interaction between people, made possible by use of new technologies for communication and collaboration.

Some organisations are already addressing these key issues by adopting radically new approaches to learning that empower and equip individuals to draw upon and feed into the 'collective conscious' distributed across the organisation and beyond. Similarly, individuals must develop new habits and behaviours in learning, networking and knowledge sharing to become better, self-regulated knowledge workers.

## Charting collective knowledge

Through empirical research, we have proposed a mechanism for connecting individuals to others with similar goals and development needs, creating networks of people who may support each other in work and learning (Littlejohn, Milligan and Margaryan, 2011). We term this mechanism 'charting'. Charting enables an individual to manage his or her interactions with relevant people and networks, make sense of data, information and knowledge that he/she requires to achieve his/her learning goals, and create and contribute knowledge. Charting incorporates four key activities/processes:

1. Consuming knowledge created by others;
2. Connecting with other people to network, collaborate and find knowledge and experiences necessary to achieve one's learning goals. This activity is concerned with networking. Connecting knowledge (eg resources, personal reflections) to create an individually tailored view of the knowledge and understanding they possess about a given topic and how different topics interrelate within their personal world-view;
3. Creating new knowledge and
4. Contributing this knowledge to the collective.

These four components represent a set of intertwined activities rather than discrete linear steps. They represent the primary mechanisms by which an individual employee interacts with the collective to attain their goals.

Charting can be implemented as a web-based platform that allows integration of and with an individuals' existing tools learning (Littlejohn, Margaryan and Milligan, 2009). The charting platform is underpinned by powerful algorithms, data mining mechanisms and analytics that allow social and semantic search, recommendations, personalisation and other mechanisms for connecting with relevant others and finding, filtering, evaluating and assessing knowledge.

Although charting is fundamentally personal learning, in the sense that it is individually-initiated and individually-motivated (the organising principle for charting is individual's learning goals), it is not an individual learning process. Charting aims to create" common capital (e.g., re-usable knowledge) via the selective accumulation of shared by-products of individual activities motivated, initially, by personal utility." (Convertino et al, 2010, p.15). While individuals may use a charting system to fulfil their personal learning goals, at the same time the system would "enable the accumulation of critical by-products" such as detailed interaction traces and individual contributions (e.g., a wiki page, a bookmark). When aggregated, these become a resource for the community" (ibid).

Imagine if a new employee setting her learning goals could dynamically look up another individual's plan and see how they reached their learning goals. Charting would facilitate this since it is both individually focused and collaboratively enabled allowing individuals to use other peoples' knowledge and experience to refine and achieve their personal goals. Goals and motivations are continually reviewed as the stages of self-regulated learning (forethought, performance and self-reflection) are carried out simultaneously. Individuals would benefit from seeing how others with similar goals achieved them and their reflections on the process.

Charting draws upon the metaphor of the 'wisdom of the crowds' (Surowiecki, 2004) the idea that large groups of connected people are better able to solve problems and foster innovation. In this metaphor the individual is recognised as a key contributor to the wealth of collective knowledge – not just explicitly in terms of contributing discrete resources, but also implicitly through emergent patterns and information in the system such as ratings and usage data, to provide additional cues as to quality and utility of resources.

Over time, the knowledge held by the collective is enriched by the contributions of the collective, and individual members learn from each other's reflective practice; and benefit from seeing how other's solved problems, the resources they used and the routes they took to learn. Figure 1 illustrates how an individual might **consume** knowledge from various sources, **connect** with others within and beyond their workplace and how they might **create** new knowledge and **contribute** it back to the collective. Alongside these activities, each individual can **chart** the collective knowledge needed to attain their learning goals. Charting involves the combined operations of consuming, connecting and contributing to collective knowledge

## How an individual might chart collective knowledge: a usecase

Sally is an experienced drilling engineer in a global energy company where she has worked for several years. Typically, Sally works in multi-disciplinary project based teams where she is expert in her particular discipline. Over her time with the company Sally has developed a strong network of contacts with different skills and experience. These networks consist of other employees in her company, contractors who are affiliated to the company on a project by project basis, and professional contacts who work for external organizations (for example product suppliers, who will have precise technical knowledge of their own products).
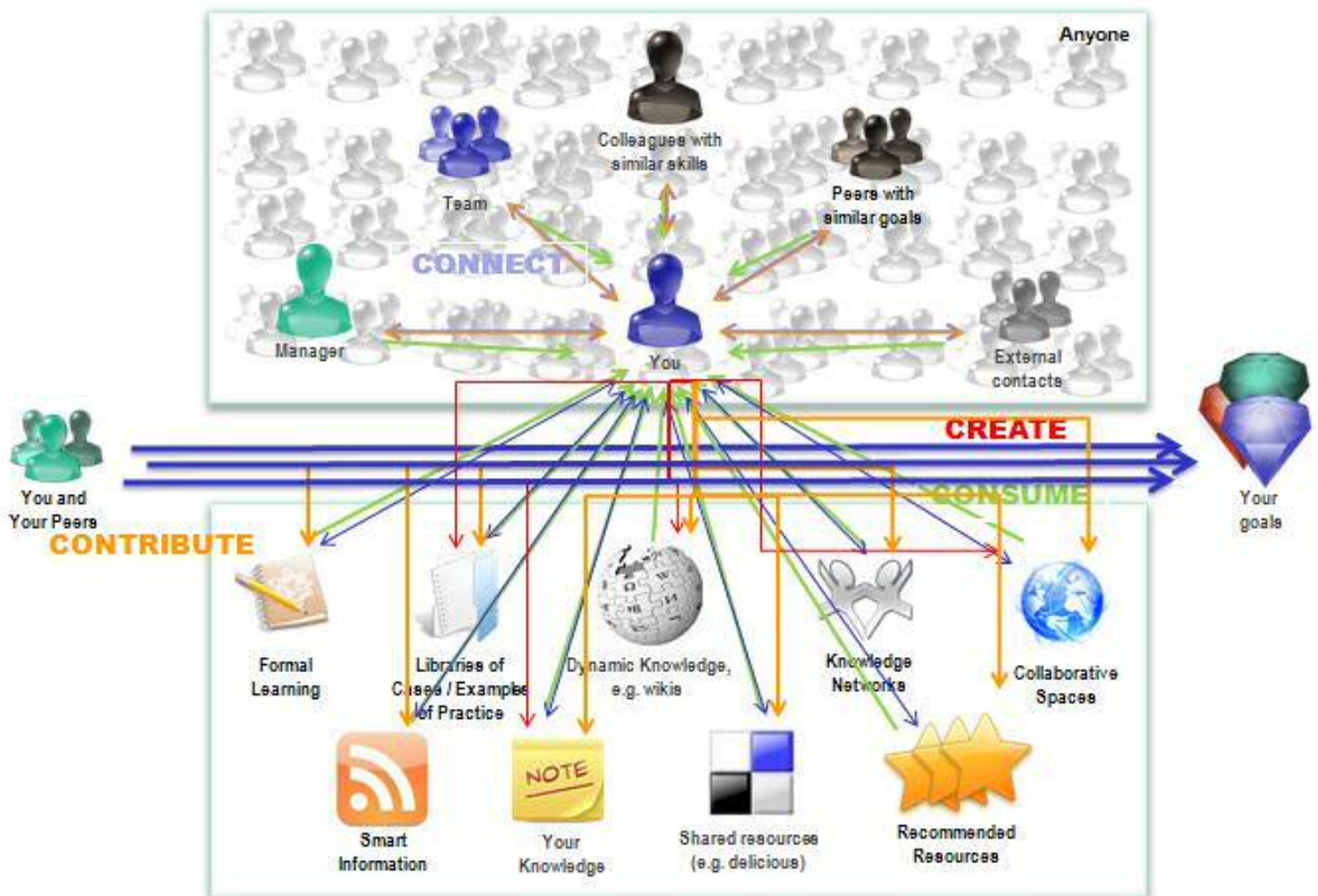


Figure 1: Charting and collective learning

Sally also has a network of her own professional contacts drawn from colleagues from past projects, along with external colleagues from her membership of other communities. Sally's work is heavily knowledge based and a large proportion of her time is spent accessing and interpreting existing knowledge held within and outside her company, as well as working in project teams to create new knowledge in the form of design specifications and research reports. As her work is heavily dependent on collaborating with others, the tools she uses must not only fit her own needs, but also interface with tools used by others. For the whole team, the range of tools used should fit closely with each individual's own working habits, to ensure that sharing within the group does not become an extra, unnatural task.

A key component of Sally's work environment is the 'Charting System' she uses to organize her work and learning. The charting system connects Sally to others through her work goals. As teams come together to collaborate, goals can be negotiated and refined, and shared. The system allows Sally to structure her work around her current work tasks, linking to others who share those tasks. Sally can constantly refine and re-prioritise her actions to ensure she effectively achieves her goals. As time passes, completed tasks are lost from view, replaced by current priorities.

Sally also uses the Charting tools, to agree a set of personal learning goals for the year with her manager. Some of these goals will relate to explicit tasks and projects and may be clearly defined. Others will relate to longer term career development goals and will be (initially) less well defined. Sally and her manager identify an initial set of resources and people that will be relevant to achieving these goals and these are recorded within the charting tools. Sally continues to engage with this process throughout the year, utilising internal and external resources (websites, wikis, directories, indexes and knowledge sharing fora) to help her achieve her goals.

The Charting system allows Sally to manage her work and learning through four complementary sub-activities of charting:

*Consuming knowledge* Sally uses search tools to find resources which have been created and used by others who were involved in similar tasks. Recommender tools can be used to identify new resources (those who read x, also found y useful) whilst rating tools can be used to fine-tune these recommendations (did you find this resource helpful?).

*Connecting* to others with whom Sally shares task goals or similar skills and interests. The charting tool allows comparison of Sally's own skills (recorded initially via a skills audit then dynamically updated as new skills are acquired) and task goals with those of her peers and colleagues. For her own personal development, Sally can identify the next steps for her own development by seeing how others have achieved similar goals.

*Creating new knowledge* by combining and extending sources (people and resources and personal reflections etc) to create a dynamic, faithful and individually focused view of the knowledge and understanding Sally possesses about a given topic, and how different topics inter-relate within her personal world-view. This sense-making process is continual, and ensures that the knowledge space evolves with the ideas of the individual, their network and the whole collective.

*Contributing* new knowledge to the collective - create evidence which is relevant to specific tasks and (in the future) to the whole collective. As Sally works, her outputs automatically become part of the knowledge held by the collective. Newly created resources are automatically tagged and augmented with secondary usage metadata as the resources are viewed and utilised by others.

## How project teams might chart collective knowledge: a usecase

Project teams bring together groups of experts with a requisite range of skills. The Charting system can bring teams together through their use of collective knowledge. The 'My Network' section of the Charting system shows all the members of the team and how they are connected to her current network (using degrees of separation similar to LinkedIn), recommending connections with new contacts. Team members share the overall goals for the project but may be involved in only a subset of the activities defined. The Charting system reflects this, showing each team member a personal view of the key activities they are involved in.

The system allows the team to connect through their work and learning goals, suggesting similarities with previously completed tasks (by semantic analysis of the wording of tasks for example). When each individual does some work related to a particular task, the resources created are automatically tagged and made available to the other team members. Integrated collaborative spaces provide a locus for co-working as follows:

- *Idea tools* encourage team members to capture ideas as notes attached to resources: capturing new thoughts (tacit knowledge) and integrating them with established (explicit) knowledge.
- *Communications tools* capture asynchronous and synchronous conversations in the context of the resources that they relate to.
- *Value boxes* allow each viewer a simple way of highlighting useful resources for themselves or others.
- *Search tools* enable discovery of new ideas using an algorithm which takes into account these ratings, the tags, and temporal indicators (how long since a resource was created or last viewed).

Each individual maintains a personalized view of the team's collective knowledge. The system can alert team members to new items may be relevant based on tagging or origin. The system can highlight people who may be useful to work with. This stimulates creativity within the team by widening perspectives and stimulating reflection on work tasks and goals.

## Conclusions

Charting collective knowledge is a way of supporting personal and collaborative learning by allowing employees to make better use of the collective knowledge emerging through work practices. In this conception of learning, the individual is recognised as a key contributor to the wealth of collective knowledge – not just in terms of discrete resources, but also through reflection, gaining experience, developing reputation, forming trust based relationships, and benefitting from emergent patterns and information in the system such as ratings and usage data, to provide additional cues as to quality and utility of resources. Over time, the knowledge held by the collective is enriched by the contributions of the collective, and individual members learn from each other's reflective practice; and benefit from seeing how other's solved problems, the resources they used and the routes they took to learn.

A Charting environment requires an open architecture connecting advanced Web 2.0 services including charting services, accessible via a variety of interconnected devices. A prototype interface is currently being tested at Glasgow Caledonian University.

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