

Harold **Jarche**

working in
perpetual
beta



ORGANIZING
FOR THE NETWORK ERA

*Principles and models to build human
organizations for an open networked society.*

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Harold Jarche

> Sackville, New Brunswick, Canada, September, 2016.

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Introduction

This is the fourth volume in the perpetual beta series. It began with *Seeking Perpetual Beta*, a synthesis of 10 years of blogging at [jarche.com](#). The next volume, *Finding Perpetual Beta*, specifically focused on personal knowledge mastery. *Adapting to Perpetual Beta*, published one year later, was an examination of leadership in the network era.

My intention with this fourth volume of the perpetual beta series is to provide a common framework from which others can test new organizational models and better ways of coordinating human work. This is not a recipe book. It is not based on best practices. I am setting forth what I believe may lead to some emergent workplace practices for the near future. Given the rise of automation, continuing income inequality, increasing human migration, and accelerating climate change, we have to think differently. This is my contribution to a new perspective on how people can work and learn together.

In the year since publishing the third volume, I have looked at how we can build organizations for the network era. *Working in Perpetual Beta* is intended to provide principles, frameworks, and models to start the task of creating work structures that respect and improve human talent. It is becoming obvious that many of our existing structures are inadequate to deal with the complexities of a digitally interconnected world.

Today there are a growing number of prescriptive solutions pushed under the moniker of the *future of work*. Many of these are detailed recipes or based on some new technology that will supposedly save the day. As a student of history, I doubt these claims. People can never be more efficient than machines. All we can do is be more curious, more creative, and more empathetic.

We need to design our workplace structures and systems so that open collaboration can help each and every worker make critical decisions. In this volume I have discussed several ways of implementing network learning, as well as various methods for organizational engineering. Our biggest challenge, as my Internet Time Alliance colleague Charles Jennings notes, is to *imagine the different*.

Once again, I would like to thank Christopher Mackay for his assistance in putting this volume together and creating the graphics which accompany it.

Connected Curiosity

If you knock out exuberance, you knock out curiosity, and curiosity is the single most important attribute in a world that requires continuous learning and unlearning just to keep up.

—Knocking the Exuberance Out of Employees,
Kathy Sierra, *Creating Passionate Users*, 2006-10-06¹

We are only as good as our networks. Our decisions reflect the diversity of our networks. Complex problems usually do not have simple solutions but require a deep understanding of the context. So how can we understand the complexity of social networks? Empathy puts us in other people's shoes. We try to understand their perspective. Because we need to rely on our networks for work and learning, empathy is a requisite perspective for the network era. Empathy means engaging with others. The ability to connect with a diversity of people is the human potential of the Internet.

As Lilia Efimova understood the two-way challenge of PKM with blogs in 2004, today we have to deal with the dual-edged sword of a network mediated world.

To a great extent PKM [personal knowledge management] is about shifting responsibility for learning and knowledge sharing from a company to individuals and this is the greatest challenge for both sides. ... Creativity, learning or desire to help others cannot be controlled, so knowledge workers need to be intrinsically motivated to deliver quality results. In

¹ http://headrush.typepad.com/creating_passionate_users/2006/10/knocking_the_ex.html

this case “command and control” management methods are not likely to work ... Taking responsibility for own work and learning is a challenge for knowledge workers as well. Taking these responsibilities requires attitude shift and initiative, as well as developing personal KM knowledge and skills.

—Lilia Efimova, *Mathemagenic*, 2004-05-11²

Our close-knit social groups will not provide us with the diversity of knowledge we need to navigate the complexities of our networked world. Simple solutions, or worse, those based on our emotions, will fail us. Most of our established institutions are not helping us address complex challenges such as climate change and global refugees. Our markets are singularly focused on short-term profit at the expense of human communities and the environment. Can our social networks help us address these issues?

Technology and culture writer, Nicholas Carr, says that our increasing use of social media platforms does not help us think, and is taking away time for solitary reflection.

Mr. Carr observed that, for decades, Rodin’s 1902 sculpture The Thinker epitomized the highest form of contemplation: a figure with an imposing physique staring abstractly downward, hunched over to block out distraction, frozen because it’s a statue, of course, but also

² <http://blog.mathemagenic.com/2004/05/11.html#a1198>

because deep thinkers need time and don't fidget. It's hard to imagine a postmodern update called The Tweeter being quite so inspirational.

—The End of Reflection, Teddy Wayne, *New York Times*, 2016-06-11³

But is reflection solely the realm of sitting and thinking on one's own? Or does reflection require the ebb and flow of conversations and making meaning through discourse? If it is the latter, then a platform like Twitter can be a place to make sense of our complex world by engaging with others. Time for silent reflection is undoubtedly beneficial, but can it enable us to understand other opinions and new ideas, or will it lead to narrow egocentric thinking instead?

For example, B.J. May used Twitter to see the world beyond a workplace that he described as, “*All men, all heterosexual, all white*”. He followed Marco Rogers' advice to use “*Twitter as a way to understand viewpoints that diverge from your own*”. B.J. May found and subscribed to opposing and diverging points of view on Twitter, following for at least 30 days. He listened with an intention to understand things outside his own experience. He did not criticize. He learned by empathizing with those who were quite different from people in his own community. At the end of this experiment May decided to make these behaviours permanent.

Every one of my opinions on the issues at hand had been challenged, and most had shifted or matured in some way. More importantly, however, was this: The exercise had taught me how

³ <http://www.nytimes.com/2016/06/12/fashion/internet-technology-phones-introspection.html>

to approach a contrary opinion with patience and respect, with curiosity and an intent to learn, with kindness and humanity."

—How 26 Tweets Broke My Bubble, B.J. May, *Medium*, 2016-01-18⁴

Would B.J. May have been able to learn as much through solitary reflection? His reflection was directly linked to his engagement with others, often fully so. It hurt to learn. He learned socially. While we still need time for reflection, even more so we need experiences to reflect upon. This makes our learning personal: felt in our gut. Real learning is not abstract.

B.J. May mentioned the need to approach a contrary opinion with curiosity. Some people seem to be naturally curious. Others work at it, while some just lack interest in learning. You can notice this when traveling. Some people can describe many aspects of their local vicinity while others don't know anything about why certain features exist. They say that the most interesting people are those who are interested in others.

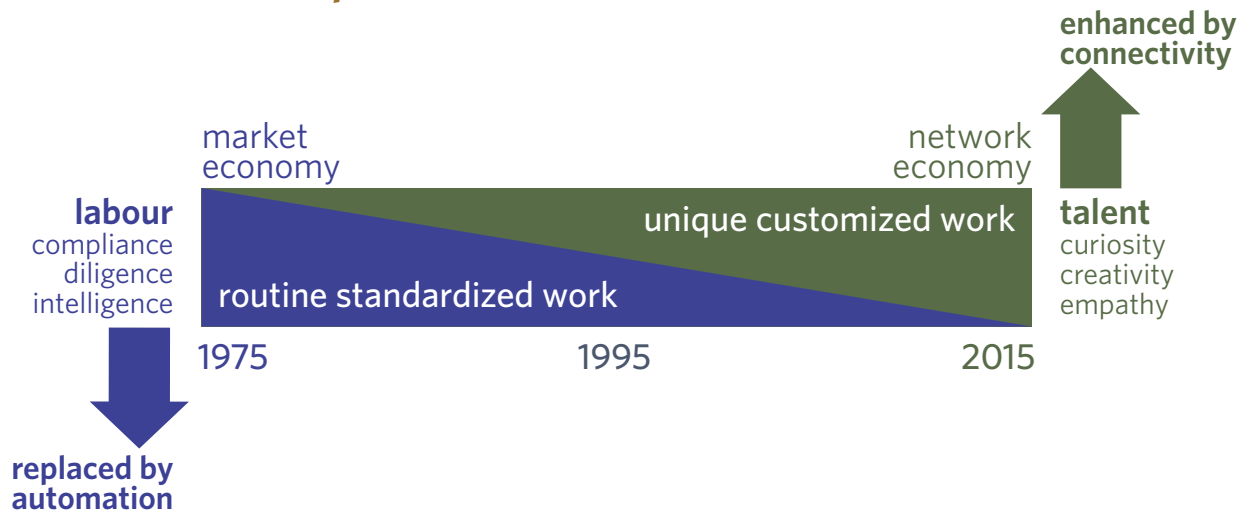
The primary work skills of the previous century, what I call *Labour*, can be summed up as: compliance, diligence, and intelligence. These skills were needed for routine work and standardized jobs. Much of this type of work is getting automated by machines and software.

The new skills required to live in a world dominated by networks and non-routine work requires *Talent*: curiosity, creativity, and empathy. This type of work is increasing as we get more connected across geographical and cultural boundaries. The core skill is curiosity. Curiosity about ideas can improve creativity. Curiosity about people can improve empathy, through understanding others. We cannot

⁴ <https://medium.com/@bjmay/how-26-tweets-broke-my-filter-bubble-88c1527517f3>

be empathetic for others unless we are first curious about them. We cannot be creative unless we are first curious to learn new ideas.

The network era shift



We see a lot of discussion about digital skills and future of work skills, but the basic skill required to navigate the network era is curiosity. It should be nurtured and supported in our schools, but often is not. Standardized curriculum dulls curiosity. Standardized work reduces creativity. Standardized communities have little empathy for those who are different. If we want to change the world, be curious. If we want to make the world a better place, promote curiosity in all aspects of learning and work.

Individuals need to step up. Individuals connected through active and engaged social networks can be the force for positive change in our society. This requires not just skills, but empathy for others. We learn about other people by engaging with them. The technology is available. We just need the will. It is time to *unecho* our collective chambers.

Organizing Principles

Capitalism today is the ultimate expression of a market dominated society, where money is made from nothing, as financial traders manipulate stocks, currencies, and whatever else they can. Its final growth spurt was enabled by ubiquitous fossil fuels so that supply chains could take advantage of either cheap goods or cheap labour due to the human inequalities on our planet. But the age of oil is ending, and markets are being replaced by networks as the dominant organizing model. Nafeez Ahmed recently stated that the end of capitalism is inevitable.

At the core of this radical re-wiring is a transformation of the human relationship with nature: moving away from top-down modes of political and economic organization, to participatory models of grassroots self-governance, localized sustainable agriculture, and equity in access to economic production.

—Beyond Extinction, Nafeez Ahmed, *Medium*, 2015-07-28⁵

One theory that has informed my own work is David Ronfeldt's TIMN⁶ (Tribes-Institutions-Markets-Networks) Theory showing that all four of these forms will co-exist as we enter the next evolution of society, but networks will dominate. This explanatory theory shows what has happened as we have previously transitioned from one dominant organizing form to the next and is a good starting point to discuss what we can do about it.

⁵ <https://medium.com/insurge-intelligence/beyond-extinction-12daed1bc851>

⁶ <http://twotheories.blogspot.com/>

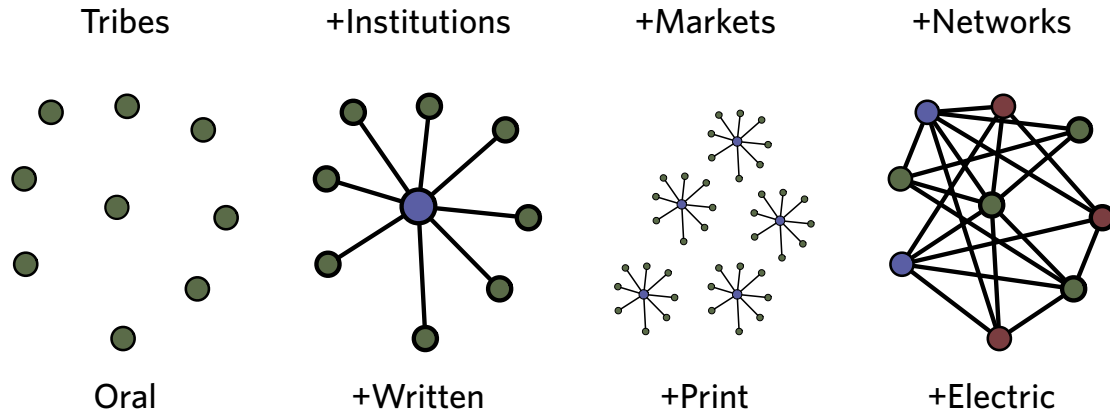
The TIMN model shows how civilization grew from a collection of tribes, added institutions, and later developed markets, as the dominant form of organization. These aligned with revolutions in communications: from oral, to written, to print. The network era began with the advent of electric communications, though it is by no means completely established. As with previous shifts of this magnitude, there is a tendency in parts of society to retreat to the old ways.

In tribal organizations, influence often comes through kinship. It still does with certain royal families. In institutions, power is exerted through the hierarchy. It is positional. Even today, in a market-dominated society, many people accept that they are their institutional job title, and feel naked without it. But those who exercise power through markets can often throw off their job titles and not worry about their formal qualifications, as long as they deliver the goods (and services).

As we shift to a network-dominated society, we do not lose tribal, institutional, and market organizational forms. However, their relationships between each other will change. For instance, a person with strong network influence, with perhaps millions of followers on a social media platform, can exert power through reputation, while still remaining inside an institution. But the power relationship between that person and the institution will change. This type of influence is no longer the sole realm of celebrities in a broadcast world, as many more of us can have influence beyond our institutions in a network society. Power is shifting.

The T+I+M+N Era

Based on TIMN model by David Ronfeldt



Subsidiarity

There are three important organizing principles that can give us a common starting point from which to build new organizations for a network society. The first is the principle of subsidiarity, which is: *“that social and political issues should be dealt with at the most immediate (or local) level that is consistent with their resolution”*.⁷

Subsidiarity is a stated, though perhaps not always followed, principle of the European Union.

Under the principle of subsidiarity, in areas which do not fall within its exclusive competence, the Union shall act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States, either at central level or at regional

⁷ <https://en.wikipedia.org/wiki/Subsidiarity>

and local level, but can rather, by reason of the scale or effects of the proposed action, be better achieved at Union level.

—EU Declarations⁸

Subsidiarity can be a founding organizational principle for democratic society in the network era. It enables community-level cooperation to counter older, and still strong, competitive market forces, in order to meet local needs within a global context. It enables organizations to let those with the best knowledge of complex social situations to act upon them. Governments only need to act if local objectives cannot be achieved by the community. Executives only need to support those doing the work, not tell them how to do it. The solutions to many of our problems are in our networks: local and global.

Wirearchy

Given the high-level of principle of subsidiarity, organizations can adopt the next level principle of Jon Husband's wirearchy⁹: "a dynamic flow of power and authority, based on information, trust, credibility, and a focus on results, enabled by interconnected technology and people". Wirearchy clarifies how people can work together in a networked democracy. A dynamic flow of power and authority supports the principle of subsidiarity. The succinct definition of wirearchy is immediately understood and easy to convey to others.

⁸ https://en.wikisource.org/wiki/Consolidated_protocols,_annexes_and_declarations_attached_to_the_treaties_of_the_European_Union/Declarations#46._Declaration_on_Article_5.283.29_of_the_Protocol_on_the_Schengen_acquis_integrated_into_the_framework_of_the_European_Union

⁹ <http://www.wirearchy.com/>

Network Management

My Principle of Network Management, adapted and amended from the last century's Principles of Scientific Management put forth by F.W. Taylor in 1911 which informed much management thinking, is more specific on how work can be done in wirearchical organizations which adhere to subsidiarity.

The Principle of Network Management is that: *It is only through innovative and contextual methods, the self-selection of the most appropriate tools and work conditions, and willing cooperation that more creative work can be fostered. The duty of being transparent in our work and sharing our knowledge rests with all workers, especially management.*

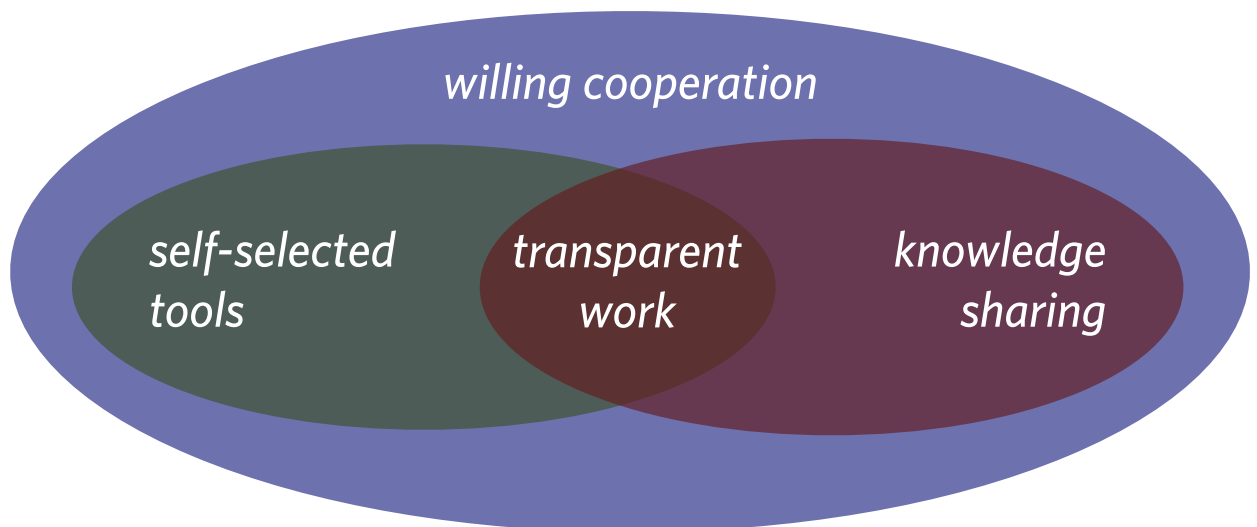
Here are the constituent parts of the principle of network management.

1. *innovative & contextual methods = in the network era work and jobs cannot be standardized, which means first getting rid of job descriptions and individual performance appraisals and shifting to simpler ways to organize for complexity.*
2. *self-selection of tools = moving away from standardized enterprise tools toward an open platform in which workers, many of which are part-time or contracted, can use their own tools in order to be knowledge artisans.*
3. *willing cooperation = lessening the emphasis on teamwork and collaboration and encouraging wider cooperation.*
4. *duty of being transparent = shifting from need to know to need to share especially for those with leadership responsibilities, who must understand that in the network era, management is a role, not a career. Transparency is*

probably the biggest challenge for organizations today, and it can start with salary transparency.

5. *sharing our knowledge = changing the environment so that sharing one's knowledge does not put that person in a weaker organizational position. An effective knowledge worker is an engaged individual with the freedom to act. Rewarding the organization (network) is better than rewarding the individual, but only if people feel empowered and can be actively engaged in decision-making. Intrinsic, not extrinsic, motivation is necessary for complex and creative work.*

The Principle of Network Management



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Implementing the Principle of Network Management

In the network era, each organization needs to build its own unique human operating model based on the three general principles, within its specific complex context, which only it can understand. There are no cookie cutters to organize for complexity.

Improve Insights — Traditional management often focuses on reducing errors, but it is insight that drives innovation. Managers must loosen the filters through which information and knowledge pass in the organization and increase the organizational willpower to act on these insights. Encouraging ongoing small experiments to probe the complexity requires an attitude of perpetual beta.

Provide Learning Experiences — Managers are vital for workers' performance improvement, but only if they provide opportunities for experiential learning with constructive feedback, new projects, and new skills.

Focus on the *Why of Work* — Current compensation systems ignore the data on human motivation. Extrinsic rewards only work for simple physical tasks and increased monetary rewards can actually be detrimental to performance, especially with creative work. The keys to motivation at work are for each person to have a sense of Autonomy, Competence, and Relatedness, based on Deci & Ryan's *self-determination theory*.¹⁰ Autonomy and Competence are relatively straight forward concepts and need no further explaining. Relatedness "*is the universal want to interact, be connected to, and experience caring for others*". This is the social aspect of work which we all seek but is often blocked by organizational barriers.

¹⁰ <http://selfdeterminationtheory.org/>

Help the Network Make Better Decisions — Managers should see themselves as servant leaders. Managers must actively listen, continuously question the changing work context, help to see patterns and make sense of them, and then suggest new practices and build consensus with networked workers.

Be Knowledge Managers — Managers need to practice and encourage personal knowledge mastery (PKM) throughout the network. PKM¹¹ is a set of processes, individually constructed, to help each of us make sense of our world, work more effectively, and contribute to society. PKM means that all workers are in control of their professional development.

Be an Example — Social networks shine a spotlight on dysfunctional managers. Cooperative behaviours require an example and that example must come from those in management positions. While there may be a role for good managers in networks, there likely will not be much of a future for directive bosses.

Distributed Authority — Coupled with a willingness to experiment, distributed authority is needed to ensure the organization stays connected to its outside environment. People at the outer edges of the organization often can see the environment more clearly than those at the centre. This aligns with the principle of subsidiarity.

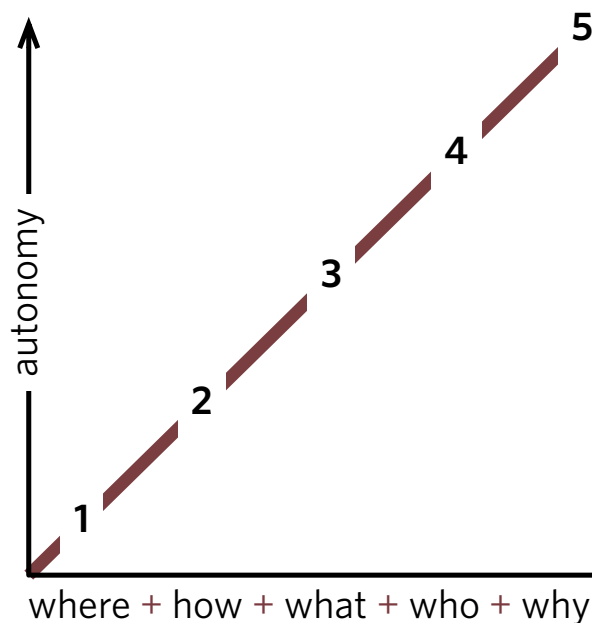
¹¹ <http://jarche.com/pkm/>

Self-governance

What is autonomy in the workplace? Employees are given different degrees of autonomy in terms of the decisions they are allowed to make within the confines of organizational power. Today, discretion for action is often accorded by virtue of one's place in the hierarchy. Usually the higher one goes, the more autonomy one has.

One way to look at autonomy is the type of action people are allowed to take without permission. The self-governance maturity model shows five levels of autonomy:

Self-governance maturity model



1. Where you work
2. + How you get things done
3. + What you work on
4. + Who you will work with
5. + Why you do the work in the first place

Each one builds on the other, so that people need to be able to decide for themselves where to work before they can be auton-

omous in how they work. The constraints of space and place must be released in order to find the best ways to get work done, such as the selection of the appropriate tools.

Once people can decide where and how they work, they can make informed decisions on what they will work on, as nurses at Buurtzorg do. Buurtzorg, which employs 9,000 people, was founded by Jos de Blok.¹² This Dutch company has only 50 administrators but is rated high by patients and employees, continues to grow, and is exposing its model to the USA. This ten-year old company has limited hierarchy and nurses manage themselves in teams of about twelve. For most of their work, the teams are autonomous.

Given this autonomy, workers can then decide who they work with, as employees at Semco do. Past-CEO Ricardo Semler¹³ states that Semco *“staff determine when they need a leader, and then choose their own bosses in a process akin to courtship”*. Not only do they choose who they work with, they choose who they work for.

Finally, when business strategy is informed by the emergent activities of all employees with their customers and environment, the *why* of work truly reflects the organization and is not imposed on the people doing the work. This is full autonomy, aligned with the principle of networked management. Those in charge of organizations today must realize that they cannot manage a network, only influence through their interactions.

12 Jos de Blok describing Buurtzorg (video): <https://vimeo.com/114773750>

13 Ricardo Semler describing the Semco model (video): http://www.ted.com/talks/ricardo_semler_radical_wisdom_for_a_company_a_school_a_life

Self-organization

If we as a society think it is important that citizens are engaged, people are passionate about their work, and that we all contribute to making a better world, then we need to enable self-organization. Central planning and hierarchical decision-making are just too slow and ineffective, especially for complex situations involving lots of people. In my network learning model, discussed later, people constantly navigate between social networks, communities of practice, and work teams. Personal knowledge mastery is the individual discipline that can enable this, while working out loud is how groups stay in touch and learn. It all hinges on individuals taking control of their learning, and organizations giving up control.

Self-organization is a major challenge for people who constantly have been told what to learn at school and later what to do at work. What I call perpetual beta is the attitude to adopt new models and ideas, but being ready to discard them when presented with better models, new evidence, or changing conditions. A key part of this is getting rid of our comfortable old ideas.

Self-organizing teams are much more flexible than hierarchical ones, but they require active and engaged members. One cannot cede control to the boss, because everyone is responsible for the boss they chose. Like democracy, self-organized teams are hard work. But they are best to deal with complexity. Hierarchies work well when information flows mostly in one direction: down. They are good for command and control. They are handy to get things done in small groups. But hierarchies are rather useless to create, innovate, or change.

In the network era the unity of hierarchical teams is counter-productive, as it shuts off opportunities for serendipity and innovation. We are moving into a post-job economy, and work is becoming much more multifaceted than a

simplistic model of *Homo Economicus* can address. Many of us who do not have jobs are already working in self-organized teams. Organizations can look to these edge cases to see the future. Hierarchies will become temporary arrangements to get things done. The future of work is hierarchies in perpetual beta.

Mediated Expertise

We are the Media

As we shift from a market-dominated to a network-dominated society, we do not lose our previous tribal, institutional, and market organizational forms. However, their relationships between each other changes. For example, print-based media now operate at electric speed increasing the urge to feel immediate outrage for events not directly connected to us. Short-form social media writing platforms like Twitter push the printed word to its limit and in so doing, reverse it to a new form of orality. A tweet is ephemeral and soon forgotten, like a quick spoken comment.

We have lived in technology-mediated societies for millennia. Every technology, from the pen to the computer, has had an influence on the society that has adopted it. Marshall McLuhan's *Laws of Media*¹⁴ put forth that every medium (technology) has four distinct effects on people who use it.

1. It extends a human property (the car extends the foot);
2. It obsolesces the previous medium by turning it into a sport or an form of art (the automobile turns horses and carriages into sports);
3. It retrieves a much older medium that was obsolesced before (the automobile brings back the shining armour of the knight);
4. It flips or reverses its properties into the opposite effect when pushed to its limits (the automobile, when there are too many of them, create traffic jams, that is total paralysis)

¹⁴ https://en.wikipedia.org/wiki/Tetrad_of_media_effects

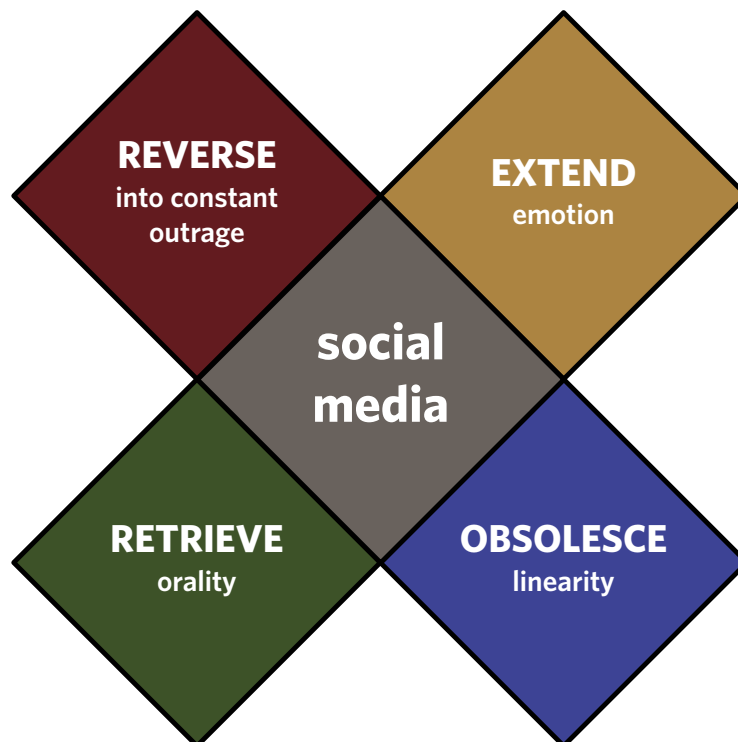
Social media can extend the emotion of our words, while obsolescing the linearity of long-form writing, and make this type of writing a luxury. They can retrieve the immediacy of oral communication, with the caution that this can quickly reverse into constant outrage. This is a danger when our existing institutions have lost much of their authority with the public.

When the prevailing mood is anti-elite and anti-authority, trust in big institutions, including the media, begins to crumble.

—How technology disrupted the truth, Katherine Viner, editor-in-chief Guardian News & Media, 2016-07-12¹⁵

The printed word

McLuhan's Media Tetrad



Understanding the effects of pervasive networks like social media is an essential literacy today. Each citizen has to be informed through active engagement in a digitally-mediated society. But it seems that generally we don't trust experts.

15 <https://www.theguardian.com/media/2016/jul/12/how-technology-disrupted-the-truth>

Maybe your friends and family aren't experts ... but they surely have your best interests at heart, and that is why they are nearly as trusted on this topic as scientists, despite their lack of expertise.

So here we have a partial answer to why experts aren't trusted. They aren't trusted by people who feel alienated from them. My reading of this study would be that it isn't that we live in a post-fact political climate. Rather it is that attempts to take facts out of their social context won't work.

—Why don't we trust the experts? Tom Stafford, 2016-07-04¹⁶

If we have a tendency to not trust appointed or credentialed experts, we have to consciously develop expert networks that we do trust. This requires effort, such as the discipline of personal knowledge mastery. In the long run our professional social networks can make our sense-making much easier. But these take time to develop as we establish new relationships, develop empathy, and build trust. A diverse social network, with sources of deep knowledge can be our insurance of better understanding of complex issues. Without personal knowledge networks, we are at the whim of whatever current outrage is flowing through the social media platforms.

We trust people we know. We can get to know people through social media, if we listen and take the time. B.J. May experienced *"Twitter as a way to understand viewpoints that diverge from your own"*. For the most part, our close-knit social groups cannot give us the diversity of knowledge we need to navigate the complexities of our networked world. Simple solutions, or those that comfort our emotions, will fail us. Generally, people no longer trust our established

¹⁶ <http://www.tomstafford.staff.shef.ac.uk/?p=447>

institutions today. But complex challenges such as climate change and terrorism will continue to confront us. This is a challenge for each of us. Writer and academic Tobias Stone observes from a historical perspective that most people live in a *time bubble*,¹⁷ not seeing the timelines of connections that influence society in the present.

1. "They are only looking at the present, not the past or future
2. They are only looking immediately around them, not at how events connect globally
3. Most people don't read, think, challenge, or hear opposing views."

At the same time as digital media platforms dominate our social interactions, market forces continue to strive for monopolies, as that is how capital markets are designed. Platform capitalism is the ability of a network to enable easy commercial transactions that previously had many middlemen and gatekeepers. Buyers of services get convenience, while sellers get a larger market. The spoils go to the owner of the platform, receiving a percentage of revenues. Most of these platforms are created when regulations and oligopolies make these transactions difficult by traditional means. Platform capitalism initially disrupts a sector that is poorly served.

PayPal is an example of facilitating small financial transactions between parties in different countries because the banks were terrible at it. PayPal facilitates small businesses to engage in e-commerce. Uber is disrupting taxi monopolies. Uber enables car owners to make some extra money and eases payment for passengers. AirBNB is taking on the hotel industry and its practices. Airbnb provides an easy way to rent out extra space in your home by connecting you to a global market.

¹⁷ <https://medium.com/@theonlytoby/history-tells-us-what-will-happen-next-with-brexit-trump-a3fef154714>

At some point, network effects kick in. This is the hope of the investors in these platform companies. Once they dominate a sector, it is almost impossible for a competitor to compete directly. Facebook has achieved this for social networking, Amazon dominates online retail sales, and Google controls online advertising. The wealth that is created for the users pales in comparison to the value for the platform owners. Once the platform capitalists achieve dominance, they act like an old-fashioned 19th century industrial monopolist.

Platform capitalism requires four contributing factors, which when combined, create a perfect opportunity for what is often called *uberization* of almost any industry.

1. A platform: a mobile application delivered through an oligopoly like iTunes or Google Play.
2. A critical mass of users: upwardly mobile knowledge workers, especially those in Silicon Valley or the tech sector.
3. Desperate service providers: people with no ability to organize due to weak or non-existing trade unions in their field, who see opportunities for better cash flow.
4. Lack of regulations and oversight: bureaucracies that either cannot keep up with technology advances, or political leadership that condones poor working conditions in the name of progress.

Individuals connected through active and engaged social networks are the only force for positive change in our society. The networked citizen requires not just digital skills, but empathy for others, cultivated through trusting relationships. We can only understand people by engaging with them. Social media give us the chance to connect. Not engaging with fellow citizens could mean that society

reverses into tribalism while also manipulated by inadequately prepared institutions and market forces intent on pushing platform capitalism.

a progressive agenda turns on the recognition that every single human being is creative. And that developing economic & social structure to harness the full creativity of each is the key to creating real meaning & purpose

—Richard Florida, Twitter, 2016-02-16¹⁸

We are all Learning Experts

In an era where work is learning, and learning is the work, are experts needed to manage learning in the workplace? Hierarchies and experts have a symbiotic relationship. Without hierarchies, no authority can tell us who is the expert. Without hierarchies, we have to find our own experts. This of course takes a lot more effort. It's not easy to find all the experts we need on our own.

The Cluetrain Manifesto stated in 1999 that hyperlinks subvert hierarchy. Hyperlinks are one manifestation of a network society. They provide multiple ways to communicate, not just up and down the chain of command. But without hierarchy we need to find expertise on our own. This means engaging with knowledge networks because we are no longer told what to think and do. Therefore, the greatest knowledge asset becomes our network. In a network society, individual expertise is replaced by cooperative expertise. We are seeing workplace where everyone is simultaneously connected, mobile, and global, while conversely contractual, part-time, and local. With this instability in work relationships, taking control of learning is becoming an imperative.

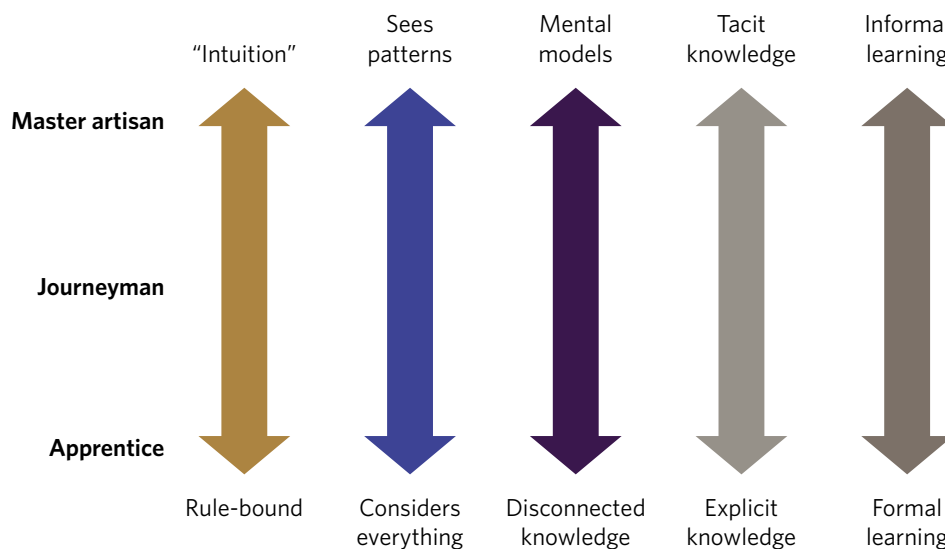
¹⁸ <http://jarche.com/2016/02/network-era-economic-shift/>

If individual expertise is diminishing in power and reach, so is individual ability to get anything done. Without direction from above we need to set our own direction with the help of our networks. We not only have to share knowledge with our work teams but also engage in communities of practice to experiment in how we work, as well as gain awareness from our professional social networks.

The network era is subverting the hierarchies of markets and institutions. Direction emerges from our networks, but slowly and indirectly. Only by engaging our networks can we learn from them. As professionals in the network era, not engaging in communities and networks leaves us at a significant disadvantage. When work is learning, and learning is the work, personal knowledge mastery becomes a core skill. As shown in Tom Gram's¹⁹ model below, developing expertise takes deliberate practice. As we all become the experts, we are all responsible for our learning.

Deliberate Practice

Based on an image by Tom Gram



¹⁹ <https://performancedesign.wordpress.com/2013/03/08/practice-and-the-development-of-expertise-part-1/>

Cognitive Apprenticeship

In the traditional apprenticeship model, novices learned under the tutelage of a master, but for the most part were assisted by journeymen, who were qualified in their trade but not yet masters. The amount of formal education in this model was usually around ten percent.

The journeyman license certifies that the craftsman has met the requirements of time in the field (usually a minimum of 8,000 hours) and time in an approved classroom setting (usually 700 hours).²⁰

A cursory look at several Canadian trades programs confirm this general ratio of 10% education to 90% field experience. The 70:20:10 model²¹ is based on observations that generally, people learn 70% of what they need to do their job from experience. About 20% is learned from exposure to new tasks or environments. Only 10% is learned from formal education. While these numbers are not firm, they provide a rule of thumb, especially for resource allocation to support learning at work. Basically, more resources are needed to support learning while working, and fewer for formal courses.

When looking at the 70:20:10 model (Experience, Exposure, Education) the 10% formal education component is easy to understand, as is the 70% experience component. Convincing management of the usefulness of this model is not difficult. Less obvious is what makes up the 20% exposure component. Given the

²⁰ <https://en.wikipedia.org/wiki/Journeyman>

²¹ <http://702010institute.com/>

dominance of knowledge work in the modern workplace, *the cognitive apprenticeship model*²² provides some insight. It includes six methods:

- *Modelling*
- *Coaching*
- *Scaffolding*
- *Articulation*
- *Reflection*
- *Exploration*

While cognitive apprenticeship was originally designed for teachers working with students in a formal setting, it can be used in the workplace as well. In organizations where experts may be significantly more advanced in their skills than novices, there is a role for a knowledge journeyman. This person's role would be to provide the six components of cognitive apprenticeship, and be a bridge between the experts and novices. Too often experts forget how they learned the basics and find it difficult to coach novices. Novices need the support of sense-makers as companions on their journey to mastery.

In many organizations, formal instruction is provided for basic skills or compliance training. But the path to expertise is not made clear. Appointing journeymen to provide the 20% exposure is a way to recognize the importance of learning as a part of work. Supporting these journeymen in how to be good coaches can be the role of the Learning & Development department. This is not course production or delivery. It is helping organizational knowledge grow.

²² https://en.wikipedia.org/wiki/Cognitive_apprenticeship

The foundational method, of six main components described for cognitive apprenticeship, is modelling. Exposure can be provided by modelling behaviours, and does not require any formal instructional programs. When we teach through modelling behaviour, the learner is in control, whereas teaching by shaping behaviour (training) means the instructor is in control.

Shaping worked when our environment was complicated, but it is now complex. As knowledge expands and new information is constantly added, no one has the base knowledge to do all the shaping. In our digitally networked world, modelling how to learn and work is a better strategy than shaping on a predefined curriculum. However it is still necessary for each person to spend time on articulation, reflection, and exploration. Developing mastery requires deliberate practice over time.

Hierarchies & Leadership

The job was the way we redistributed wealth, making capitalists pay for the means of production and in return creating a middle class that could pay for mass produced goods. That period is almost over, as witnessed by 54 million self-employed Americans. The job is a social construct that has outlived its usefulness. Freelancing may be a replacement but often lacks a safety net, and many of the self-employed become pawns of the platform capitalist monopolies. We are entering a post-job economy. Our careers will be shorter as our lives get longer. Companies and institutions are no longer the stable source of employment they once were, as even the Fortune 500 companies now have an average lifespan of 20 years, as opposed to 60 years in 1960.

Consider that almost all of our institutions and many of our laws are based on the notion of the job as the normal mode of working life. Schools prepare us for jobs. Politicians campaign on job creation. Labour laws are based on the employer-employee relationship. What happens when having a job is not the norm? In the USA today, half of all jobs are at a high risk of automation. These will soon disappear and new jobs are not being created at the same rate.

The decrease in salaried employment is a key factor that will change the nature of work teams. As long as people have jobs, we will have hierarchical teams. The job is premised on the assumption that people can fit into existing teams like cogs in a machine and that team members can be easily replaced.

We already have other ways of organizing work. Orchestras are not teams, and neither are jazz ensembles. There may be teamwork on a theatre production but the cast is not a team. It is more like a social network. Hierarchical teams are what we get when we use the blunt stick of economic consequences as the

prime motivator. In a creative economy, the unity of hierarchical teams can be counter-productive, as it shuts off opportunities for serendipity and innovation. In complex, networked economies, workers need more autonomy to be curious, creative, and empathetic.

Hierarchical teams, with someone in charge, collaborate to get work done. In networks, people have to cooperate to accomplish objectives.

...collaboration means working together. That's why you see it in market economies. markets are based on quantity and mass.

cooperation means sharing. That's why you see it in networks. In networks, the nature of the connection is important; it is not simply about quantity and mass ...

You and I are in a network — but we do not collaborate (we do not align ourselves to the same goal, subscribe to the same vision statement, etc), we cooperate

—Stephen Downes²³

Cooperation makes more sense as the term to describe working together in a networked and non-directed relationship. This is an important distinction from collaboration. For example, Jérôme Delacroix²⁴ also sees cooperation as the suitable term for what we do in networks. Jérôme explains why his site is called *Coopératique* and not *Collaboratique* — collaboration happens around some kind

23 Personal conversation with Stephen Downes (2009) <http://downes.ca/>

24 <http://www.cooperatique.com/2009/cooperation-ou-collaboration/>

of plan or structure, while cooperation presumes the freedom of individuals to join and participate. Cooperation, not collaboration, is a driver of creativity. It is difficult to be creative while collaborating, because the objective has already been established.

Work in networks requires different skills than in directed hierarchies.

Cooperation is a foundational behaviour for effectively working in networks, and it's in networks where most of us, and our children, will be working. Cooperation presumes the freedom of individuals to join and participate. People in a network cannot be told what to do, only influenced by their peers. If they don't like you, they won't connect.

In a hierarchy you only have to please your boss. In a network you have to be seen as having some value, though not the same value, by many others.

Organizations need to be open, transparent, and diverse to thrive in networks.

Enabling people to cooperate gives organizations the flexibility they will need to engage with complexity.

Working with Complexity

Environment, Problem Type, Situation*	Optimal Work Practices	Optimal Interaction & Communication Method
Simple ¹	Best Practices	Coordination
Complicated ²	Good Practices	Collaboration
Complex ³	Emergent Practices	Cooperation
Chaotic ⁴	Novel Practices	Action

1: Can usually be addressed by standardized procedures

2: Can be addressed through work practices & assisted by software

3: Requires greater human involvement and sharing implicit knowledge

4: A state to be avoided, or a crisis to be immediately addressed

* Based on Cynefin Framework

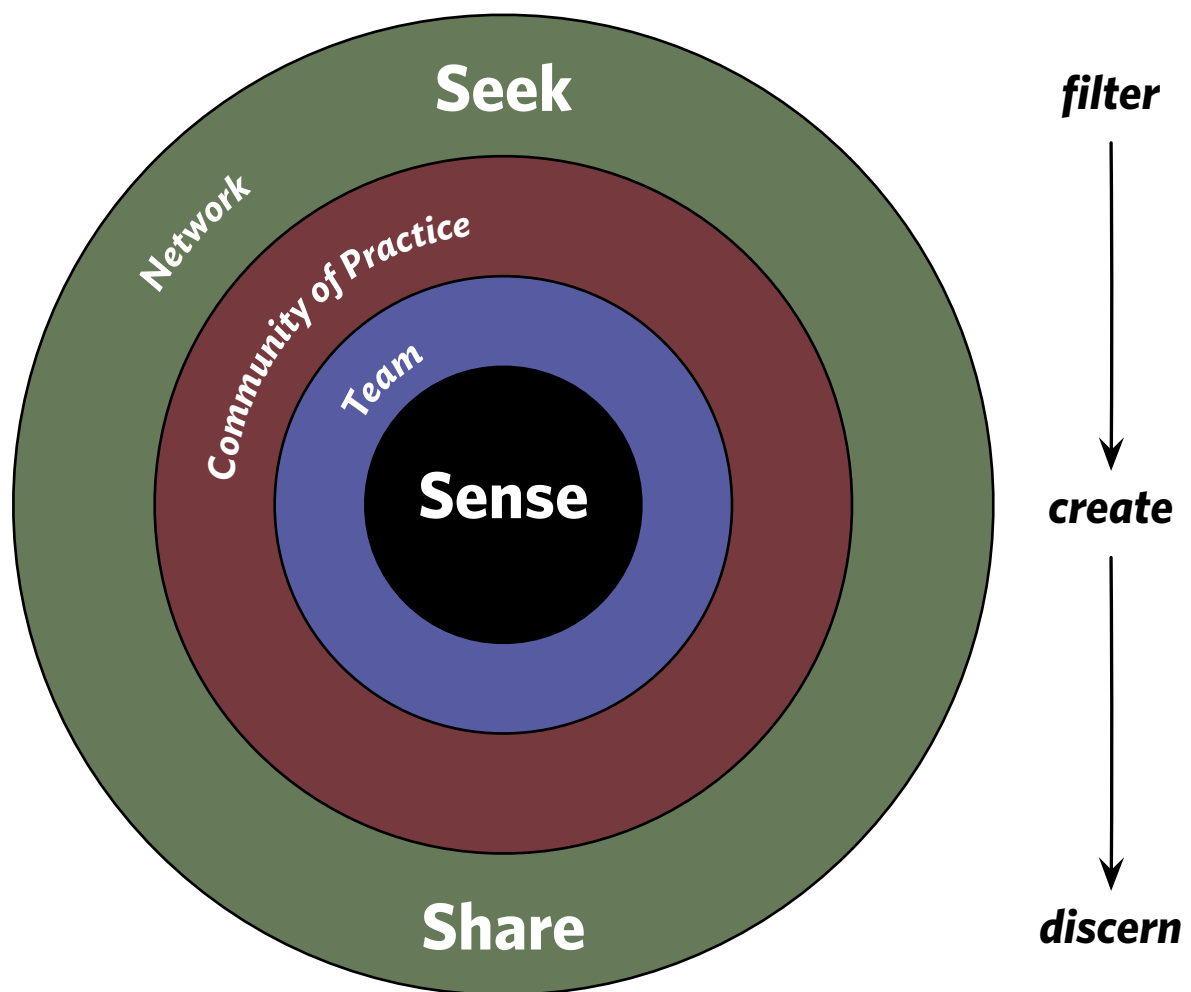
If all you have is a hammer, then every problem looks like a nail. If all you know is hierarchical leadership by virtue of one's position, then all solutions appear to be in the hands of the CEO. Today, the great man theory of leadership is outdated, just as the divine right of kings was two centuries ago. We don't need better leaders. We need organizations and structures that let all people cooperate and collaborate on their terms. Positional leadership is a master-servant, parent-child, teacher-student, employer-employee relationship. It puts too much power in the hands of individuals and blocks human networks from realizing their potential.

In the network era, leadership is helping the network make better decisions. The future as proposed by much current leadership literature is about becoming a better leader, but it's really about all of us becoming better people. This starts by creating more human organizational structures: ones that enable self-governance. Leadership is an emergent property of a network in balance. Depending on one person to always be the leader will only dumb-down the entire network.

Managing Knowledge

The Personal Knowledge Mastery (PKM) model of *Seek > Sense > Share* is focused on helping individuals work better in teams, and contribute to professional communities by developing and engaging their social networks to continuously learn. This approach has been used in several organizations. Today, it is critical to take control of your own learning and build a professional network. Engaging with other people, especially those different from us, is the key to making sense of information.

Personal Knowledge Mastery: Seek > Sense > Share



One reason the PKM framework is getting attention now is because work in the network era is changing the nature of the job. PKM requires that individuals take more responsibility for their learning, and that organizations give up some control. Automation is removing routine work from people's jobs, leaving only non-standardized and more complex work. In this network economy that is driven by creativity, people have to not only stay current but create unique ways of operating and connecting.

The discipline of PKM helps to ensure that we remain connected to our human networks in order to maintain our curiosity and develop empathy for others. It is only by empathizing that we can truly understand the relationships in our social networks. Machines can analyze, but only humans can feel. The network economy is seeing the rise of knowledge artisans, who create new meaning through cooperation and building value with their peers.

Our basic approach to education is obsolete in an age of pervasive networks. Developing a standardized curriculum is completely inadequate to prepare for non-routine work and complex problem solving. One person, or group of experts, cannot decide that some minuscule percentage of knowledge is what we should teach everyone. Courses are like stock that is out of date as soon as it is published, while implicit knowledge is like flow, that requires constant interactions to make sense. There are no cookie-cutter recipes for non-routine or complex work. Each person and organization has to find a unique path by seeking out information, making sense of it, and sharing it.

Engaging through PKM is a journey. I currently offer a 60-day online program to give participants time to start new habits, but even this may not be long enough. I have often described PKM as the layers of an onion. While the simple framework of *Seek > Sense > Share* is on the outside, there are many layers beneath

it. For example, there are different ways to curate information, multiple tools available, and a variety of ways to express oneself. PKM is easy to understand, but like learning a language, takes time to become fluent. And like a language, PKM changes the way we think over time.

One challenge with implementing PKM in an organization is managing expectations for immediate results. Everyone develops their skills at their own pace and it is often not until they have an *ah-ha* moment that things click. It is best to start by developing seeking and sharing habits. Sense-making takes more time and this can develop after the initial network learning habits are put in place. Implementing PKMastery in an organization will usually take a minimum of six months of concerted effort, and often several setbacks.

Each person needs to develop seek, sense, share habits that work for their particular context. PKM is different for everyone, which is why any singular technology or approach will fail in the long run. I have collected a number of examples of PKM in practice, but these are descriptive, not prescriptive. The key lesson is that you will not know what works for you until you try. I suggest that people should try to share something every day. It's a good way to start, and time will tell if you want to do it more or less frequently. Again, empathy is important. Think of what others might need or find useful. Look back to when you were learning something new, and ask what might have been helpful.

Today we have almost too many machine filters to help us seek information. These filters, algorithms and heuristics, can help discover new information but many of these are gamed by either the operators selling sponsored content, or users gaming the system. People are better information filters but only if in aggregate they provide a requisite variety of knowledge, experience, and perspective. We need to get outside of our knowledge bubbles and echo-chambers to

build our knowledge networks. Tim Kastle,²⁵ a writer on discipline of innovation, has identified three types of human filtering:

1. Naive filtering — asking the person closest to you, or the first to mind, for advice.
2. Expert filtering — finding the recognized expert on a subject, often with credentials from a recognized authority.
3. Network filtering — developing a network of experts with differing perspectives on an issue or in a field.

For important issues, such as our professions, networked experts are essential. Developing these network filters takes time. But once these networks have been developed, they become part of the value we bring to a team, an organization, or a community. Today, we are only as effective as our knowledge networks. Building networks through cooperation, which is freely sharing without expectations of direct reciprocity, builds trust. In trusted networks, knowledge flows faster.

Group KM

While PKM is an essential discipline, especially for knowledge artisans, practicing it is not going to get work done. PKM is primarily a framework to facilitate learning in networks through cooperation. In order to collaborate, more structure is necessary, as well as agreed-upon rules for sharing knowledge. Group Knowledge Management (KM) takes PKM to the next level: getting things done.

Group KM involves narrating your work, so that others in the group know what is happening, even when separated by time and space. Group KM focuses on teams and projects sharing their work to ensure as much common understanding as

²⁵ <http://timkastle.org/blog/2010/04/five-forms-of-filtering/>

possible. One critical component of work narration is the capture of how exceptions are handled in order to get this information to anyone who may need it in the future. Unique problems should arise once and then be addressed. A description of how the problem was handled is recorded and made available for future reference, so that emergent practices are developed. This is how work is learning, and learning is the work.

Group KM requires some type of social sharing platform, but many options are available (e.g. Slack, Jive, Yammer) and most companies today have a social tool in-house. It is the group's responsibility to curate exceptions in a format that is accessible to all. Some exceptions can even become rules: in perpetual Beta, of course.

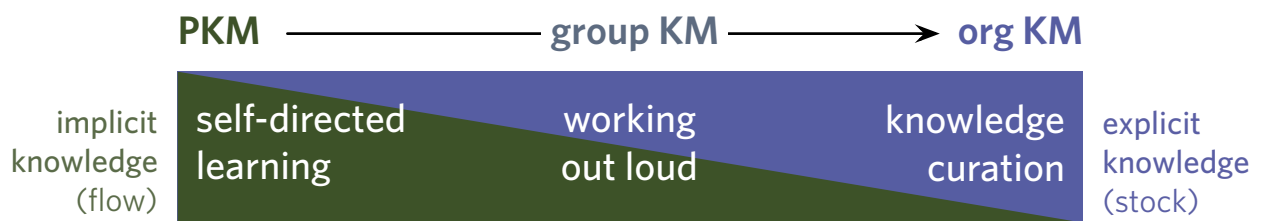
Capturing exceptions should be practiced by groups, and then the process can be shared through the enterprise. Establishing a decision memory practice — why we made a certain decision and not another — is a simple way to start. It does require some solid direction on capturing and sharing these decision processes though. Group KM promotes groups to make decisions given the knowledge they have at the time, but subsequently learning from each decision. In addition, by creating safe-to-fail experiments, they should try out new ways of working, with minimal investment or risk.

Group KM practices ensure that what is learned is shared and codified as much as possible. Leveraging what individuals learn through their own practices of PKM, and combined with groups sharing their work and learning, organizational KM is then a matter of curating what is happening in the enterprise. This is a bottom-up model, ensuring knowledge flow, not a directed top-down approach wrongly assuming that existing stocks of knowledge are unchanging and immutable.

Group KM does not require that everyone work in the same way though. There are many roles that can be done.

- *Creators of knowledge artifacts, such as diagrams, articles, and explanations.*
- *Critics who examine issues from multiple perspectives and guard against group-think.*
- *Connectors link people and ideas together, weaving triangles of knowledge flows to make the network more resilient.*

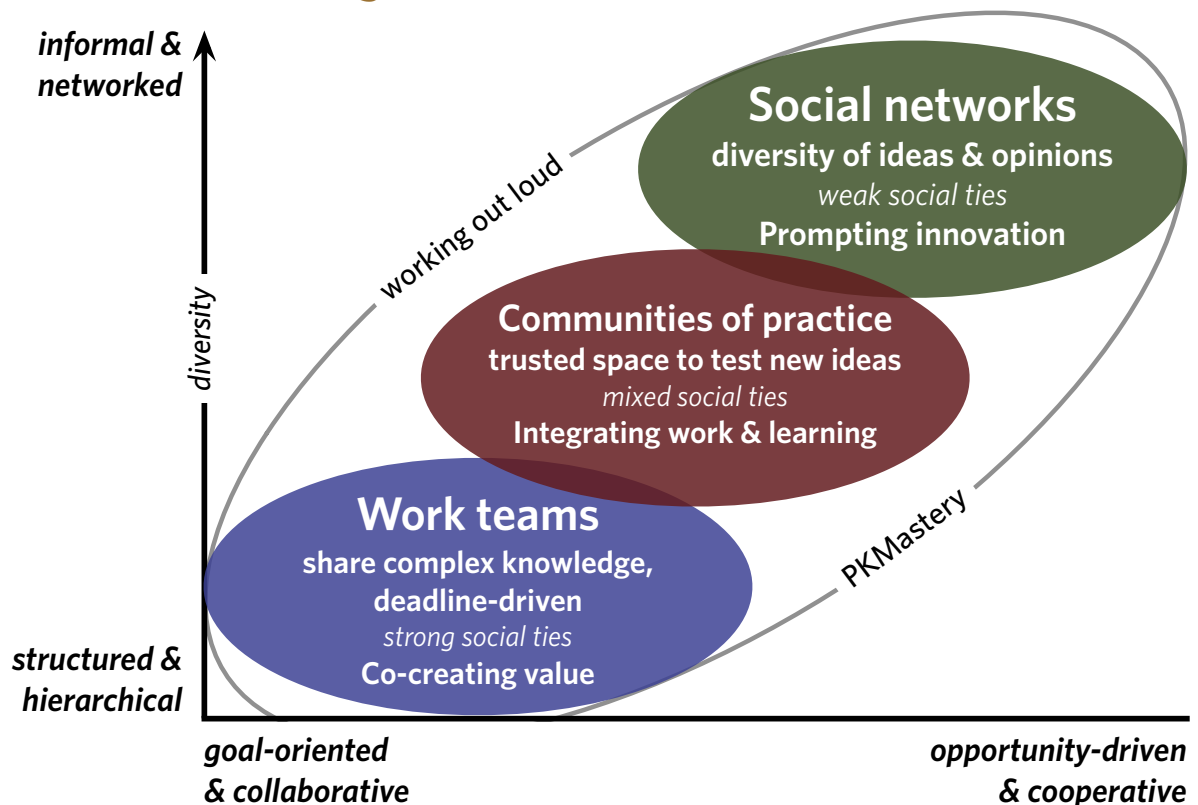
Making organizational knowledge explicit



The Network Learning Model

Today, individuals need to master the ability to negotiate social networks, communities of practice, and teams doing complex or creative work. Personal knowledge mastery is the individual skill, while working out loud helps groups stay in close contact with the work flow. Everyone needs to be adept at cooperating in the openness of social networks in order to be open to possible innovative ideas. At the same time these workers have to be focused on co-creating value at work. They also need to find a trusted middle ground to test new ideas. Communities of practice become a business necessity and a professional development imperative. This is the network learning model.

The Network Learning Model



The Network Learning Model describes how knowledge can flow between professional networks, communities of practice, and work teams. It shows that it is necessary to connect all three in order to ensure a diversity of ideas and perspectives, as well as safe places to test these, in order to support increasingly complex collaborative work tasks. An essential component of this is ensuring individuals develop the discipline of personal knowledge mastery.

In the network era, developing the skills of a master artisan in every field of work will be critical for success. While getting work done collaboratively will continue to be of importance in all organizations, it will not be enough. New ideas will have to come from our professional networks in order to keep pace with innovation and change in our fields.

More importantly, a safe place is needed to connect these new ideas to the work to be done. The need for communities of practice will continue to grow as knowledge artisans look for places to integrate their work and learning in a trusted space. As the gig economy dominates, communities of practice can bring some stability to our professional development. These are owned by the practitioners themselves, not an association and not an organization. You know you are in a real community of practice when it changes your practice.

The essence of the network learning model is that knowledge flows between individuals engaged in doing work and sharing with their communities and social networks. In the model I show that working out loud comes from our work, while PKMastery is how individuals take control of their professional development. Implementing the network learning model has many facets.

Experience

We learn from our experiences. As much as 70%, indicate some models. Therefore it is important to share our work as we do it. We are sharing with trusted colleagues, but it is often implicit and difficult to describe knowledge, so we need ongoing conversations to ensure understanding as we deal with complex issues. The lessons we learn from our work can be shared later and in context with our communities of practice. Some general lessons can then be shared more widely in our social networks. For example, I have learned much from my clients, but I only share general lessons on my blog.

Ideas

We get new ideas from people who are most different from us. Social networks provide a fertile environment to share ideas. But we need a safer place to test ideas, so we turn to our trusted communities of practice (note that if you are not a member of at least one community of practice, you are missing a critical aspect of any profession). Once these ideas have been tested, at least in principle, work teams have the opportunity to incorporate them.

Opinions

Social networks also enable us to find new opinions, perhaps quite different from ours. Instead of getting into a heated debate with someone we do not know, we can discuss and debate these opinions in a safe environment, among trusted colleagues in a community of practice. While we are at work, we make our opinions clear, so that those we are trusted to work with understand from where we are coming. We may not agree, but we understand, because we have work to do.

Relationships

In social networks we can find new relationships, especially people who may not share our background or culture. These people can help give us a diversity of perspectives. In our communities of practice, we can develop stronger social ties as we test out our ideas and opinions in a trusting environment that is not an echo-chamber. While we work with those with whom we have strong social ties we need to take time to reinforce these relationships through social contact, listening, and empathizing. All relationships are human. The notion that *it's just business* is for another age.

Models

I share many of my working models on my blog, with many social networks. But these ideas were first developed with my trusted colleagues, such as the coherent organization model, developed with my Internet Time Alliance colleagues. These models were further tested by my clients, many who have adopted them.

Value

Value is what we exchange when we work. I give my time, labour, or something tangible in return for some other value. Our social networks can show us how value networks work, if we take the time and effort to examine them. I have changed some of my practices by seeing how others offer their professional services. These new services can be tested *among friends* as pilot projects to see

how they work. For example, I have conducted several pilot projects with my Internet Time Alliance colleagues over the years. The objective of working with others is to co-create value, each person bringing something of value and then delivering something of greater value. This is how work should be done in the network era — connecting networks, communities, and teams.

	Work Teams	Communities of Practice	Social Networks
Experience	Share Your Work	Discuss Lessons in Context	Share General Lessons
Ideas	Incorporate Ideas	Test Ideas	Share Ideas
Opinions	Make Opinions Clear	Discuss & Debate Opinions	Connect to Diverse Opinions
Relationships	Reinforce Social Ties	Develop Social Ties	Find New Social Ties
Models	Test New Models	Develop New Models	Share Working Models
Value	Co-create Value	Test New Value Creation	Explore Value Networks

A Network-centric Perspective

The three overlapping circles of the network learning model — social networks, communities of practice, work teams — have been described by Patti Anklam²⁶ as three network types — connectivity, alignment, productivity. This makes sense, because in social networks we mostly connect, while in communities of practice we strive to find alignment between ideas and practice, and in our work teams we produce something of value. Patti goes on to describe the key tasks for *network builders*.

²⁶ <http://www.pattianklam.com/2016/08/knowledge-in-the-network/>

Connectivity Network (social network): “Weaving — Helping people make connections, increase ease of sharing information”

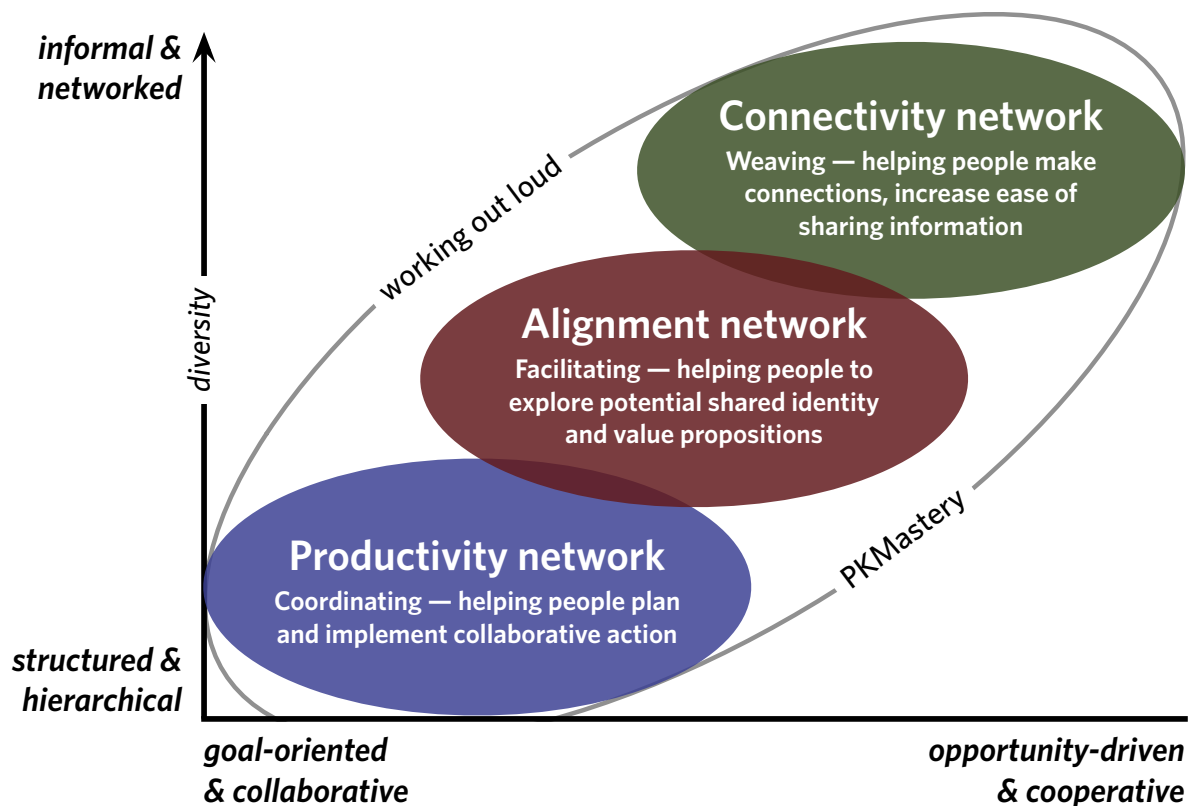
Alignment Network (community of practice): “Facilitating — helping people to explore potential shared identity and value propositions”

Productivity Network (work team): “Coordinating — helping people plan and implement collaborative action”

Perceiving all three of these spaces as networks reinforces the principle that we cannot manage networks, only influence through our interactions.

Network-centric work & learning

Inspired by Patti Anklam



The Triple Operating System

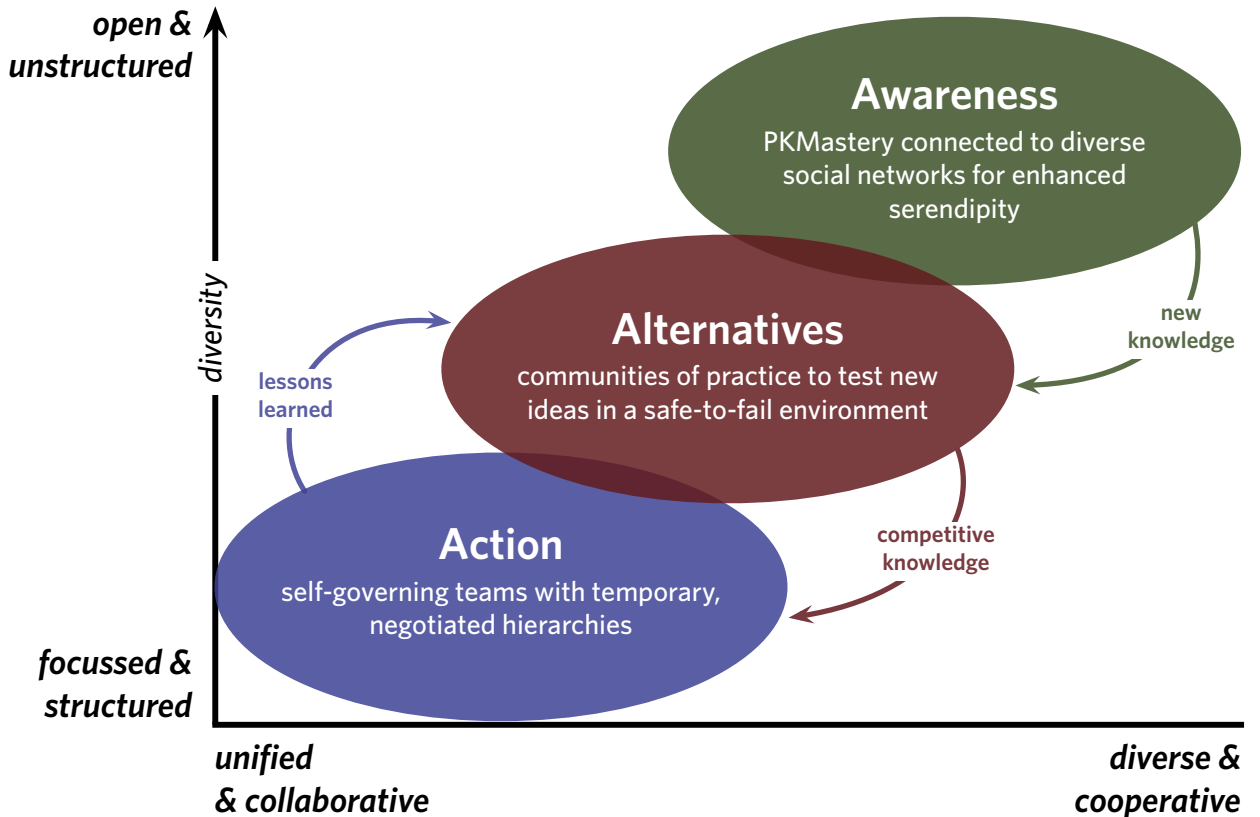
The triple operating system looks at network learning from the organizational perspective. Systems and practices need to be put in place so that workers can practice PKM while at work. This ensures awareness of the external environment. Workers also require communities of practice (alignment networks) so they can examine multiple alternatives in emerging practices or determine how to deal with changing situations. Given a higher degree of awareness, and a greater number of viable alternatives, the organization can take action in a more coherent manner, taking into account the complex nature of the network era.

A triple operating system aligns work and learning and has a network perspective. It is based on three interrelated processes, first proposed by Valdis Krebs:²⁷ Awareness, Alternatives, Action. My perspective is that people in organizations cannot take appropriate action unless they have systems in place to consider alternatives, and are aware of the complex environments in which they operate. While the network learning model looks at knowledge flow from the individual's point of view, the triple operating system is how an organization can enable continuous learning.

²⁷ <http://orgnet.com/>

Triple Operating System

AAA inspired by Valdis Krebs



Awareness of New Knowledge

Social Networks/Connectivity Network — The primary perspective in social networks should be empathetic. Human networks connect through empathy. From this perspective of trying to understand others, our actions in these networks should be driven by curiosity. We should constantly look for the new and different. In return we contribute to our networks through cooperation, sharing freely, with no expectation of direct compensation. It is from these serendipitous encounters that we are exposed to new knowledge.

Alternatives to create Competitive Knowledge

Communities of Practice/Alignment Network — As we become aware of new knowledge, we need to test it out, but not take ourselves too seriously at this point. Playfulness, cleverness, and exploration constitute essential parts of creativity. But creativity requires an ongoing commitment. We cannot merely take creative time. It has to be part of our working flow. David Williamson Shaffer says that we need to make space for conversations in order to be creative, “Creativity is a conversation — a tension — between individuals working on individual problems and the professional communities they belong to”. Organizations need to nurture and support communities of practice, to let alternatives be discussed away from the confines of the established hierarchy. Organizations cannot control communities but they need their competitive knowledge to inform organizational actions. Communities of practice are cooperative in nature, as membership is voluntary. Here members can work collaboratively on experiments and side projects that may not fit in with their paid work. Communities filter knowledge from social networks and work teams, fuelled by new knowledge and providing competitive knowledge.

Action: Leading to Lessons Learned

Work Teams/Productivity Network — In work teams, a primary perspective is one of sharing. This is where working out loud is essential. As we take action, we need to know what others are doing so we can work in concert. Working out loud is one way of connecting to others. Connecting people and ideas in the context of taking action is how work gets done in the network era. This is informed collaboration, between self-governing individuals who have agreed upon temporary hierarchies in order to get work done. This reflects the principle of wirearchy as *“a dynamic two-way flow of power and authority based on knowledge, trust, and credibility...”*

	Action: Leading to Lessons Learned	Alternatives to Create Competitive Knowledge	Awareness of New Knowledge
Primary Perspective	Sharing	Playful & Creative	Empathetic
Core Behaviour	Connecting	Experimenting	Curiosity
Interpersonal Connections	Collaborative	Cooperative & Collaborative	Cooperative

End Note

What is new in this emerging network era is how much information on any topic or event we can access if we want. Information is abundant and our social connections are prolific. Many of us are overwhelmed, especially from the constant outrage on social media. It would be comforting to let our existing institutional hierarchies and market authorities look after things for us. But this would mean giving up on the democratic values many of us grew up with, even though we may have taken them for granted.

The inconvenient truth is that our institutions do not have the answers. They were all designed for a different era. Our markets, designed to capitalize on gaps and weaknesses, are already focused on creating digital platform monopolies, so that the rest of us may become nothing more than users and renters of space. These capitalists are no different than the robber barons of the 19th century. For instance, in this digital age many of us no longer own anything. When we die, everything that we have rented — our music, our lodgings, our software — no longer belongs to us. Even our identities, like email addresses and usernames, disappear. We become consumers, but not owners. Is digital indentured servitude our collective dystopic future?

Questioning existing hierarchies is necessary to create the wirearchies of the future where there will be shared power and authority based on mutual trust. The dominant organizational model needs to shift on the continuum, away from hierarchy, toward networks. Reverting to old-style, simple hierarchies removes us from our obligation as citizens to build a better networked organizational model for society.

The new model must be one in which tribes (families), institutions, and markets co-exist under the dominant umbrella of networks. Giving up our influence in a network society, by trusting institutional or market hierarchies, is an abrogation of our democratic responsibilities. In the network era, we are the media and we are the experts, whether we like it or not.

All models are flawed, but some are useful.

—George Box, Statistician, 1919–2013

>

Colophon

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