IMPLICATIONS FOR PRACTITIONERS

Innovation and learning organisations: a practitioner's view

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Introduction

In keeping with the theme of this Special Section – "New and Unusual Perspectives [. . .]", we have decided to depart from the more conventional genre of papers written by, and predominantly, for, academics, and to ask *a practitioner* about their views on the link between LO/OL and Innovation – in essence, the intention was to solicit a practitioner's viewpoint alongside the academic papers in the Special Section, providing insight into what people that are working with concepts we are writing about think with regards to their practical side. To make this point as free from biases as possible, we have deliberately kept the brief quite open: we are interested in what you think about the LO/OL/Innovation link. No further questions were asked.

Our industry contributor is Norman Wijker, Chief Technology Officer at ARC Aerosystems, a British SME specialising in design and manufacture of small vertical take-off and landing (VTOL) aircraft. Norman, leading ARC Aerosystems' design process and personally involved in much of it himself, has decades of previous experience in innovation in aerospace and hi-end sailing boat design gained with organisations ranging from SMEs to the largest multinationals, as well as top sailing teams.

The practitioner's view

Thinking about the question – whether there is a link between LO/OL and Innovation, and what it is – the answer, at least to the first part, seems obvious at first: yes of course, there is a link. In the highly innovative sectors I have worked in throughout my career, innovation is a core capability; therefore, to remain competitive, organisations need to be able to learn how to innovate in new and emerging ways, in response to, or in anticipation of, the changes in the context such as market conditions or technological developments. The "what" is more complicated; and even the "whether", on second thought, is not that straightforward either.

If you ask someone in the business world about their thoughts on Learning Organisation, chances are it will be Senge they will have heard about. But my first impression when I read The Fifth Discipline was that it is not the full picture, and building a learning organization in the real-world sense requires a lot more than that; it requires other matters to be taken into

The Learning Organization
Vol. 30 No. 1, 2023
pp. 93-100

0969-6474
DOI 10.1108/TLO-07-2022-286

account, such as motivation, leadership, management, complexity and so on, and they are not separate entities; they are a system; ironically, the biggest part that's missing from Senge is system thinking *about* LO, not system thinking *as part of* it.

Moreover, particular elements of the model seem somewhat limited in how Senge looks at them. Personal Mastery, at least among the intrinsically motivated people I am working with, seems an inherent human desire; you only need to get your team to want to master *the right things*. Shared Vision is a leadership element, which comes in various guises – transactional vs transformational etc., as well as in many leadership styles – think Trump vs Obama – and it's much more complicated than simply creating a vision; it is also about how this vision is embedded throughout the organisation, and put into action. Mental Models, to me, are about how we *create*, and there is a lot we don't understand about it; I shall get back to it. Team Learning should also include individual vs team creativity, not just learning as acquiring new skills and knowledge, or adopting new routines – or, perhaps, learning shouldn't be understood so narrowly. And then Systems Thinking [. . .] The real-life complexity is nearly infinite, and one self-contradictory thing about Senge is that he looks at systems as things unto themselves, in isolation; whereas in real life you need to think of a system, and then look at how it interfaces with a larger system, and so on. There are infinite layers in this onion, so it is a question of how we manage complexity, which, again, cross-links to Mental Models.

As a whole, if "learning" is taken to include Innovation, especially the radical side of it, Senge's model seems to pick and mix a few key elements, leaving aside some others, such as the source and the process of new ideas; as such, it doesn't pave the way to understanding what the link between OL and Innovation is.

Let me illustrate how innovation and learning can come about with an example of one of our current designs, Q-Starling. We have been working on a different project, our then-envisaged flagship we called e-Starling. We reached the ½ scale prototype stage; it was roughly as big as a passenger car, and could in principle carry people. But it wasn't meant to be a marketable *product*; its main purpose was research, trying and testing various concepts and ideas – i.e. the creation and acquisition of knowledge. However,*** we then started to realise that it had potential to become a successful *product*, albeit with some financial, business, technical and regulatory constraints, outbalanced by a few reasons why it could be a good idea, including the amount of investment it has already consumed. By commercialising the half-sized aircraft instead of the full model, we could gain more insight into manned VTOL flight; it would test the certification process for such aircraft; and it would be easier to complete successfully than the larger version, thus decreasing the risk, serving as a stepping stone towards the intended "full-sized" version and providing a revenue stream to support it, whilst building brand awareness and investor confidence.

So, the Board decided that we should try to commercialise what was originally intended as a demonstrator model, a giant – and very sophisticated – RC aeroplane, by making major tweaks to it to transform it into a small passenger aircraft. I, however, decided to start designing it from scratch rather than adapting an existing model to carrying people.

This experience made me ask the question of where the new ideas come from. The Innovation literature I have read seems to equate innovation with new knowledge creation, jumping straight into Nonaka's SECI spiral, and moving on. But what about "blue sky" thinking, ideas that are not, at least on the surface, a combination of some pre-existing elements? One could argue that some initial premises – such as laws of physics – are, indeed, a pre-requisite, and are "combined" with whatever follows, but imagination and blue-sky creativity that don't fit anywhere on the SECI spiral also play a role; and an important one at that. Indeed, being an aircraft designer with decades of experience, I can safely say I have a good knowledge of the fundamentals: I have a decent understanding of how the air flows over a shape, how drag (air resistance) appears and how lift is created. An idea violating any of that would be simply unworkable; thus, the “eureka moments” don’t just come out of nowhere; they have to have a solid foundation in the fundamental principles of aerodynamics and other laws of Nature, and I believe these are the precursors of the creative stage. But once the key governing principles are defined, what’s next? Once again, where do new ideas come from?

I think SECI model is overly analytical, effectively meaning that to create new knowledge (assuming that this can be equated with new ideas, which is debatable in itself), you need to gather your Lego pieces, tell others what you’ve got, borrow a few bits that are missing – things you don’t know – and then you can build something new out of it. But it is a very bottom-up approach; it starts from individual bits, and leaves little to no space for a holistic, systemic approach starting from an overall concept, and gradually working out the detail.

Taking up the leadership role in the development process for the new airplane, I started with our first design which had lots of rotors, and complicated structures. However, my thought process was governed by one key principle behind my design philosophy: the age-old aircraft design adage, “KISS: Keep It Simple, Stupid”; or as Antoine de Saint-Exupéry once apparently said, “Perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away”. To me, this talks of efficiency and elegance of design; it is about finding the most efficient path through the forest of complexity, finding solutions that are all mutually supporting so that the whole is bigger than the sum of the parts.

Applying this to the design in question, I reduced the number of rotors down to two, one either side within the wings; although I am embarrassed to admit I did not take it as far as I could have, to just one; it was suggested by a team member, and I later realised it could work.

This “reductionist” approach created a lot of tangible benefits. It drove down parts count and complexity, and it also allowed us to build a smaller wing for the same size of the rotor; some other elements could also be done differently – in a much more simple, elegant way – and it created a neat structural solution. Thus, it was the process of *shedding* the elements of the design off rather than combining existing ones in a new way. It was only “combination” in the sense that the starting design was combined with the principle of simplifying it as much as possible; but I think it’s stretching the concept of “combination” a bit too far.

Next, came the problem of forward propulsion. Our aircraft are taking off like helicopters, and cruising like conventional airplanes; the take-off rotors are driven by electric motors which are powered by a turbo-generator in the fuselage. But finding a way of making the plane go forward was a separate challenge.

The first idea was to use another set of electric motors, with propellers, on the sides of the aeroplane around the tail area, but it simply looked too messy. Removing them would make the plane look like a jet, clean and elegant, in line with Saint-Exupéry’s principle, and this visual cue gave rise to another idea: so why not make it a jet then? In aircraft terms, the difference between a jet and a propeller aeroplane is about as big as that between a horse-driven cart, and a car with an internal combustion engine, and the idea didn’t come out of combining people’s knowledge; it was precipitated, simply, but the appearance of the aeroplane with engines removed.

In other words, it was a major new direction for the process to take; but the problem was *how*. The turbo-generator, although effectively a turbojet engine, wouldn’t on its own create enough forward thrust to drive the aeroplane forward; its primary purpose was to generate electricity for the take-off. On larger aircraft, big fans – effectively, very high-speed propellers called “bypass fans” – are used at the front of the engines to do it, but they are incompatible with the electricity-generating mode; and we needed both. The simple solution was to design a system with bypass fans becoming operational only during cruising, and the engine in purely electricity-generation mode during take-off. This might sound like a fairly obvious solution, but it isn’t something that typical commercial jet engines have; and the simplicity is where the beauty of this solution lies. This became our working concept.

The point it illustrates is that even if the combination of knowledge did take place, it was knowledge of fundamentally different kinds, not just “bits that various people knew”. I came up with the overall idea, the direction for the process as a whole, and the thinking behind it was conceptual, aesthetic even; aimed at determining the key principles behind it, not the technical details. It was holistic and systemic, and required creativity and radical ideation. However, I am not an electrical engineer or a propeller designer, and the fresh idea on its own would remain just that: an idea. It had to be operationalised, and this is where our specialists came in, checking the engineering feasibility of the concept, its viability from the manufacturing point of view, developing the actual technical design etc. This – what I call the “sizing” phase – is a simply unavoidable part of the design process, yet it is fundamentally different from the ideation stage. It is very highly specialised, requires in-depth expert knowledge, and above all, it is highly analytic rather than synthetic.

Thus, the process of coming up with a radically new yet workable design, from my perspective, has three parts to it. A solid understanding of the fundamental premises – laws of physics, basic engineering principles and so on – is required. Without it the “new ideas” can easily be chimeras; but its role is more about helping the designer to determine which areas in the design space are a clear no-go, rather than to feed into the SECI process, to be shared, etc. It helps channel and concentrate the ideation process towards practicable solutions – or, if gone wrong, can stifle it, creating excessive path-dependency. Then there is the ideation process, which is largely a black box; as far as I know, we don’t understand it virtually at all. This is the artistic, aesthetic, holistic, qualitative process, even if within the boundaries defined by the fundamentals; it can – and often is – governed by principles such as simplicity and elegance; and this is where radically new ideas come from. And then there is the process of technical design and engineering, which is complicated and very highly specialised, but at the same time, straightforward in the sense that it is something that aircraft engineers have been doing well for decades.

The challenge here is that the three elements are not “stages”; the process is not linear (nor spiral-shaped, for that matter), and there is constant back-and-forth interplay between the fundamental principles, the holistic conceptual ideation and technical design; a sort of a tripartite ying-yang, the Holy Trinity of Innovation. For the process to be capable of creating something radically new, one needs all three elements, and the interaction between them needs to be fluid.

However, getting back to the question I have been asked to ponder over – the link between LO/OL and Innovation – it can be easily seen that it can be a challenge in the organizational context of larger corporations. You come against the rigidity and the fragmentation dictated by the hierarchies, structures, rules, procedures and project management methodologies such as PRINCEII; relinquishing them is an unwelcome idea, just like encouraging the creative “generalists” in their holistic thinking, since it feels like letting go of control and power.

In some major aerospace corporations I have worked for, a lot of rhetoric is centered around Innovation, but the focus is always on *team* creativity, as it is understood by the management – i.e. comparatively large number of people working separately on highly specialised design tasks, with the innovative whole product expected to come out of it somewhere down the line. There also is a very strong focus on formalising and “improving” the process of it; essentially, this means trying to apply Lean to creativity, trying to speed innovation and creativity up, verging on becoming an “innovation production line” in a very Taylorist sense. But I have always found it too hard to convince the top management that other ways could be better – it made me wonder many times whether we spoke different languages. A lot of this was because they were part of a hierarchical organisation, so there are deeply ingrained in structures, lines of communication, budgets and deadlines, and totally uncomfortable with chaotic processes. None had heard of Senge.

Complexity is really the driver; it is what systems thinking is all about. Complexity is the crux of the challenge, but I think the issue is when the level of complexity goes above what one person or more specifically, one human brain can cope with; then we have to get into finding different solutions. One solution is to share that creativity across a larger team, but not in the mechanistic way I have described in the paragraph above – it really needs to be something combining the technical expertise, which comes by default in the sector, an overall vision (Team Vision perhaps?), and systems thinking, which is not something that can be seen above at the individual level, nor, possibly at the team’s one either. To begin with, for these things to take place, you need to keep the team small and flat, otherwise work, communication, and creativity will start breaking down, fragmenting into elements too far detached from one another and thus losing the systemic nature.

A good practice I am aware of used by some major aircraft manufacturers is to have a very small team of “technical fellows” working on a project, and yes, they are experts in a particular area each, and have individual tasks – after all, there’s only so many people you can have in front of a CAD screen - but in the main they are generalists, in that their knowledge spreads beyond their own specialisations, allowing them to have the overall vision of the process and the product as systems. In my first example it wasn’t like this at all; I would be hard pressed to name any core team that coordinates the design process. One could describe the former example as a left-brain organisation, mechanistic and rigid, just like a production line, capable of producing a significant amount of output – innovation - but of the incremental kind; exploitation rather than exploration, single-loop learning. The latter is a right-brain organisation, holistic, somewhat chaotic, not the most efficient as far as the volume of output is concerned, but more capable of radical innovation and double-loop learning.

But then there is the contextual challenge. While the “right brain” type of environment seems the way to go in principle if one wants radical innovation, real-life organizations still operate in a very tight set of constraints. They still need to make a profit, so budgets and costs aren’t going anywhere. They still need to deliver to the customer on time, so it can’t be an open-ended process. In case if safety is involved, i.e. in sectors such as aerospace, pharmaceuticals or nuclear energy, it imposes a lot of certification requirements. This is only natural; of course there will always be constraints, or the engineers could be off designing the latest tech bra technology with no tangible outcomes in sight. Yet it is also important to be critical about them, to keep validating what those explicit and tacit boundaries are, pushing them. However, such behaviour is usually perceived as “rebellious”, “unconventional”, “eccentric” even, and it is usually discouraged in the corporate world; ironically, often under the guise of “good teamwork” or “good leadership”, both, in reality, meaning compliance with the rules, procedures, structures, culture, leadership competencies and whatever else.

But even if a healthy dose of chaos could be acceptable, there is still the challenge of innovating on such immensely complex products as a jumbo jet; it is physically impossible to have all creative work done by one person, so we do have deal with collective creativity. I am, however, unsure as to where and what is the transition between the individual creativity – or a collection of individual creativities – and a collective one. If you take an orchestra as an analogy, the conductor may be brilliant, but without first class musicians, it all means nothing; or the other way around, a bunch of great musicians in one room won't necessarily play a symphony well – or will they? It is not unheard of great music to come out of jam sessions – unconducted, self-led, un-prearranged, chaotic in the organisational sense of the word.

I think there is a parallel here with my point above regarding creative *teams* being *small*. Collectively creating a new music piece through the process of live, real-time improvisation might be possible for a quartet, but hardly so for a full orchestra; there, coordination is needed, and here comes the conductor. Effectively, we are talking about the complexity of the process and the product reaching a certain point whereby creative chaos loses the "creative" bit, and becomes just "chaos", or perhaps falls into the known paths, possibly working well as far as improving the familiar is concerned, but incapable of creating anything completely new. But where *is* this threshold – how do you find it? Can it be moved? May it *need* to be moved? It may have to be: with a typical jet consisting of literally several million individual parts, it can hardly be the product designed by a mere handful of people. Yet how do we avoid it becoming a performance where every individual plays their part very well, perhaps even in sync with those next to them, but what comes out is still clearly Mozart?

It is, therefore, almost impossible to have a one-size-fits-all solution, but it is also clear that in many cases, organisations fail to recognise the benefits of doing things differently, often because it means relinquishing control.

Overall, I think, there is still some way for us to develop the understanding of the link. It seems to be the consensus that innovating without learning is impossible, and an innovative organisation has to be a learning one, but conflating the two concepts isn't necessarily productive. After all, an individual or a company can learn from others, without creating new ideas of their own, perhaps combining – exploiting – existing bits of knowledge in a SECI fashion. The creation if *entirely* new knowledge, ideas, designs, etc., however, takes us beyond what Senge and Nonaka are dealing with; both seem to be more attuned to single-loop learning; learning how to create new things out of a bucketful of Lego blocks, but not creating new blocks and radically new designs built out of them.

Furthermore, even if someone came up with a model or a theory explaining individual and collective creativity, and capable of dealing with complexity, chaos and what, in my experience, requires holistic, systemic thinking, implementing it in a real-world corporation would face an enormous amount of organisational challenges – rigidity, power structures, hierarchies and so on. I do firmly believe that the "right-brain" organisations are more capable of double-loop learning and radical innovation, but they are almost entirely out of sync with the currently prevalent ways corporations are run.

Discussion

The contribution above raises a few interesting points.

One is that our understanding of creativity as a starting point for innovation (Amabile, 1997) is, indeed, limited. First of all, there is a disconnection in the literature between the two matters, although Amabile's view is widely accepted. The relationship between them is still poorly understood (Çokpekin & Knudsen, 2012), and the two are still treated independently in the literature (Litchfield, Ford, & Gentry, 2015).

Moreover, our previous research dedicated to Radical Innovation in high-performance boat design (Bogolyubov, Simeonova, Wijker, & Easterby-Smith, 2017) has, indeed, highlighted that "creativity" is most often equated with "knowledge creation", and it's only one step from there to Nonaka and Takeuchi's model (Nonaka & Takeuchi, 1995 – e.g. Popadiuk & Choo, 2006; Liao, Fei, & Liu, 2008; Donate & de Pablo, 2015). It seems to have become a go-to way out of trying to explain *how* coming up with new ideas actually happens, despite the fact that some researchers (Peschl & Fundneider, 2014) have openly challenged this conflation of innovation with new knowledge creation. Norman's example of how SECI models doesn't seem to explain the evidence very well, also challenges it; perhaps there is a need for a better model that would not only truly treat creativity as an integral part of the innovation process, but would also provide a better understanding of new *ideas* creation than SECI does.

Furthermore, if we define "collective creativity" as a process resulting in creating a design that has to rely on the input from a number of people – e.g. due to its complexity – it brings forth further questions. The aforementioned project (Bogolyubov et al., 2017) has found evidence – supporting Norman's example – that collective creativity requires knowledge contributions of entirely different kinds that couldn't be said to be simply "combined". Invariably across a number of design teams, the concept creation was done by a very small number of people; often just one or two of them. The next stage was to develop a technically feasible design, and this is performed by a wider circle of experts; and the last stage is the production design – i.e. to put it simply, figuring out how to make it. This, in turn, involves an even wider group of *different* experts. In other words, knowledge from the previous stage is *developed* into knowledge of a fundamentally different scope, and then handed over rather than internalised. Even if we accepted that each stage follows the SECI model in its own right – although further evidence would be required to say this with any certainty – it is quite clear that at the collective level, the spiral breaks down in a number of ways. For example, at the end of the process, with a new design successfully developed and ready for production, the originator may still have no knowledge of the manufacturing process; yet it is an integral part of the development process.

The last point of interest arising from Norman's contribution is that of the team roles: that of the "generalists" who may also be experts in their own fields, that play a role of an integrator, and do the systems thinking. In essence, the "generalist-expert" role matches the idea of a T-shaped expert; someone possessing T-shaped knowledge. The concept itself is hardly new, introduced in Hansen, Nohria, & Tierney (1999), and widely researched since. We are, however, talking about T-shaped knowledge at the *collective* level: teams combining an adequate amount of expertise with a capability to have a systemic view; and the two do not necessarily have to be combined in every individual; they can be distinct roles. Some research has been done regarding the team-level T-shaped knowledge (Barile, Franco, Nota, & Saviano, 2012), but further research is needed.

It could be concluded, therefore, that the key message to be gleaned from this industry perspective is the need to understand the matters of creativity, new knowledge creation and their links to innovation at the collective level, and within the context of real-life companies that pose a number of organisational challenges.

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