Business Ecosystems in Exploration

MINING EDITION 2016

Monitor Deloitte.

PDAC PROSPECTORS & DEVELOPERS ASSOCIATION OF CANADA

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FOREWORD

While innovation is increasingly seen as critical to mining companies globally, questions remain about how to go about it—especially when capital is constrained, human resources are scarce and innovation activities are perceived to be risky and expensive. How can mining companies innovate when they can't afford to do so? In an increasingly networked global economy, it seems that the answer might lie in collaborating with others in a structured way. This study recently conducted by Monitor Deloitte, which is the second in a series of innovation reports, sought to engage and understand the role of business ecosystems in exploration and to identify ways to drive innovation more successfully through them. The study comprised of 22 interviews with senior executives and subject matter experts in mining, with representation from majors, juniors, service companies, industry associations and academia.

The prevailing view? Innovation is key to the survival of the industry. But, individual mining companies generally lack the funding, expertise, and systematic environments necessary to achieve the scale of innovation required today. Ecosystems are a key way in which leading, innovative industries have evolved and through which collaboration has occurred. While some evidence of ecosystems has emerged in exploration, the lack of widespread ecosystems in mining represents a missed opportunity for the mining industry.

Business Ecosystems in Exploration

Mining Edition 2016

A BURNING PLATFORM

The mining and exploration industry is facing difficult times, alongside a confidence crisis in the market. While the industry is accustomed to cyclicality, this "bust" after the preceding "boom" has been exceptionally painful due to the unfortunate confluence of unforeseen shifts in macroeconomic conditions, diminishing capital flows and a short-term focus on value creation.

In the last up-cycle, money came pouring into the exploration market. The markets demanded immediate results from exploration activities, thus much of the effort was placed on known assets i.e. established mining districts. Producing, or once-producing, districts offered quick wins for exploration companies and they were less risky than exploring new frontiers. Much of the drive behind exploration activities during the last super cycle was not necessarily to create mines in terms of finding economic ore bodies, but to create value for option holders in the short term. As commodity prices continued to rise, more money poured into the market and there was an influx of non-technical people running companies. As a result of these colliding forces, more sub-par projects found their way into the market.

When commodity prices began to decline due to slowing global economic growth, sources of capital started drying up and many projects turned out to be bad decisions. The market lost confidence in exploration, both the industry and the people in it, and many investors (i.e., both institutional and especially retail) pulled their capital. As time progressed, quarterly and annual results started to reveal the extent of the damage—billions in write-downs.

Today, the industry still faces the same fundamental challenge that drove trust and confidence in the industry to these low levels—sluggish GDP growth rates in China and the emerging markets are leading to depressed commodity prices. Due to the strength of the US dollar, even gold prices, which tend to do well in uncertain global times, have also been hit.

With so little room to maneuver, mining companies largely acknowledge that innovation could help their companies and the greater industry in these tough times. Interviews for this study revealed that some see innovation as an opportunity; others see it as a necessity. But in either case, there is a sense that they must find a new way to operate, especially since the "old" way got them into this situation. However, the question for many is how? Juniors face barriers since most lack the funding or expertise to continually innovate in isolation. And, in their quest to become ever leaner, the majors have scaled back their R&D budgets and are funding less innovation both internally and externally than ever before. This has put pressure on the service sector to come up with ways to help mining and exploration companies achieve cheaper and better methods to explore. On the one hand, the service sector is well placed to be a source of innovation; however, their success in this endeavor requires collaboration within the industry. Often mistrust exists whereby mining companies see service companies as being wedded to existing technology and service companies see mining companies as being resistant to the adoption of new ideas. To make industry-wide breakthroughs, companies must shift from a "go-it-alone" mentality to one where collaboration is a central tenant. This also requires a cultural change. Companies must realize that shared knowledge and market intelligence tends to favor those that recognize opportunities for change.

IN YOUR OWN WORDS

*"The blunt instruments in your cost-cutting are gone? What's left? **You have to do things differently.**" —Industry Association*

"I would have to put the mining industry about 20 years behind other industries. We are certainly well back of the oil and gas industry in how we innovate" —Junior

*"Everybody is slashing budgets...therefore, innovation is taking a back seat, which is the **exact opposite mentality** that we should be using." —Industry Association*

*"Investing now could lead to **huge competitive advantages.**" —Major*

In the previous report in this series, *Innovation state of play: Mining edition 2015,* we recommended that participants in the mining industry increase their focus on collaboration to overcome these constraints. While some companies have made progress in creating a culture of open innovation—using external resources (through partnerships) to find solutions to complex problems—a more systematic environment is generally needed where collaboration among all types of industry participants can occur, and innovation can thrive.

To minimize or remove the perceived barriers to innovation, mining industry participants would significantly benefit from coming together in a structured manner to discuss, promote and foster innovation. Some collaboration is taking place organically, but on a very small scale. More structure, organization and support are required to help develop major mining innovation hubs—the likes of which would include companies, educational institutions, incubators and the various levels of government. **What's needed, in other words, are highly connected, high performing ecosystems.**

ECOSYSTEMS EMERGED IN THE FIELD OF BIOLOGY – WHAT ARE THEY?

"A localized community of living organisms interacting with each other and their particular environment of air, water, mineral soil, and other elements.

These organisms influence each other, and their terrain; they compete and collaborate, share and create resources, and co-evolve; and they are inevitably subject to external disruptions, to which they adapt together."

- British Botanist, Arthur Tansley

A new paradigm for innovation

This year's report focuses on these ecosystems, which are emerging as the new paradigm for innovation. Ecosystems are defined as **dynamic** and **co-evolving communities of diverse actors** who **create and capture new value** through increasingly productive and sophisticated models of both collaboration and competition. A distinctive characteristic of many ecosystems is that they form to achieve something together that lies beyond the effective scope and capabilities of any individual actor—or even any group of broadly similar actors. At their core, ecosystems are a powerful way of looking at collaboration through which companies can realize increased opportunities for innovation.

Ecosystems have always been found in nature, but until recently they have not been as prevalent in business, especially within the mining sector. In the past few years, four converging forces have paved the way for ecosystems to flourish by eroding the long-standing cultural boundaries and technological constraints that have traditionally shaped the evolution of businesses. These four forces are:

- **New sources of innovation** – Sustainability challenges, demographic shifts and the needs of a new global "middle class" are increasingly driving innovation.

- **Social and cultural shifts** – These changes are occurring everywhere, empowered by an increasingly influential generation of entrepreneurial and impact-oriented "digital natives."

- **Different ways of interacting** – The Internet and social media have altered the ways in which businesses and their customers and employees interact, spawning new organizational forms, business models and approaches to talent engagement.

- **Technological advancement** – Digitization of the economy has already had a tremendous impact, but we are only beginning to witness the sheer scale and scope of its transformative power. The challenge for companies is to avoid becoming data-rich but knowledge poor.

ONE FOR ALL AND ALL FOR ONE

The defining characteristics of an ecosystem

In coming together, an ecosystem typically has these defining characteristics:

1) Diverse — Ecosystems enable and encourage the participation of a diverse range of large and small organizations, and often individuals, who together can create, scale and serve markets beyond the capabilities of any single organization.

2) Distributed —Participating actors interact and co-create in increasingly sophisticated ways by deploying technological tools of connectivity and collaboration that are still evolving. These new networked interactions are hard to coordinate formally in the traditional "top-down" manner.

3) Purposeful — Participants, often including customers, are bonded by some combination of shared interests, purpose and values, which incentivizes them to collectively nurture, sustain and protect the ecosystem as a shared "commons." Everyone contributes, everyone benefits. This enhances the longevity and durability of ecosystems.

Ecosystems work

Business ecosystems are important because they provide a better way to collaborate—and, collaboration has been much more successful in developing breakthrough innovations when compared to an individual or organization working in isolation. A review of 200+ of the most important innovations and scientific breakthroughs from the past 600 years (1400–2010) showed that 85 of them were developed through a small, coordinated team within an organization, while 122 evolved through collective, distributed processes, with a large number of groups working on the same problem.

Business ecosystems are having a profound impact today within many different industries. Most often these ecosystems are led by vendors or by a community, and they can be open (i.e., anyone can join) or closed (i.e., by invitation only).

Just as ecosystems can take on different forms, their goals can differ as well. In broad terms, ecosystems usually focus on either "sharing the pie," where benefits accrue to the organizer and certain participants, or "expanding the pie," where the focus is on creating greater opportunity for all participants. In our experience, high-performing ecosystems that generate greater value tend to be among the latter category. These high-performing ecosystems, which aim to "expand the pie," exhibit certain characteristics. (See Figure 1.)

Figure 1. Characteristics of typical versus high-performing ecosystems.

SHARING THE PIE *Typical ecosystems limit benefits to the organizer and specific participants*		**EXPANDING THE PIE** *High-performing ecosystems focus on – creating increased opportunity*
Low ability to quickly reconfigure (i.e., tightly integrated, lack of standards at the interface)	**Loose Coupling**	High ability to quickly reconfigure (i.e., highly flexible and can meet changing demands)
Centralized control of access to ecosystem; stringent criteria/process	**Access Management**	Decentralized control of access to ecosystem; minimal criteria/easy process
Centralized control; rules and feedback primarily driven by stringent rules	**Behaviour Management**	Decentralized control; rules and feedback primarily participant-influenced and contain feedback loops
Primarily short-term, extrinsic (i.e., monetary, reputation) rewards	**Incentives**	Primarily long-term, intrinsic (i.e., learning and development) rewards
Centralized decision-making, absence of milestones and decision points	**Action Point(S)**	Decentralized planning of milestones and decision points, collective decision-making
Narrow content of participant transactions archived	**Interaction Archive**	Rich content of interactions archived to enable long-term view of ecosystem opportunities

Source: Performance Ecosystems, Deloitte 2012.

The characteristics of high-performing ecosystems are additionally indicative of a general trend among businesses at large. When it comes to innovating, organizations, and indeed entire industries, are moving away from hierarchical, highly structured "militaristic" approaches and toward more "organic" self-organizing and collaborative models. This raises the million—or perhaps billion—dollar question: "Is the mining industry aligned with this shift toward collaborative innovation through business ecosystems?"

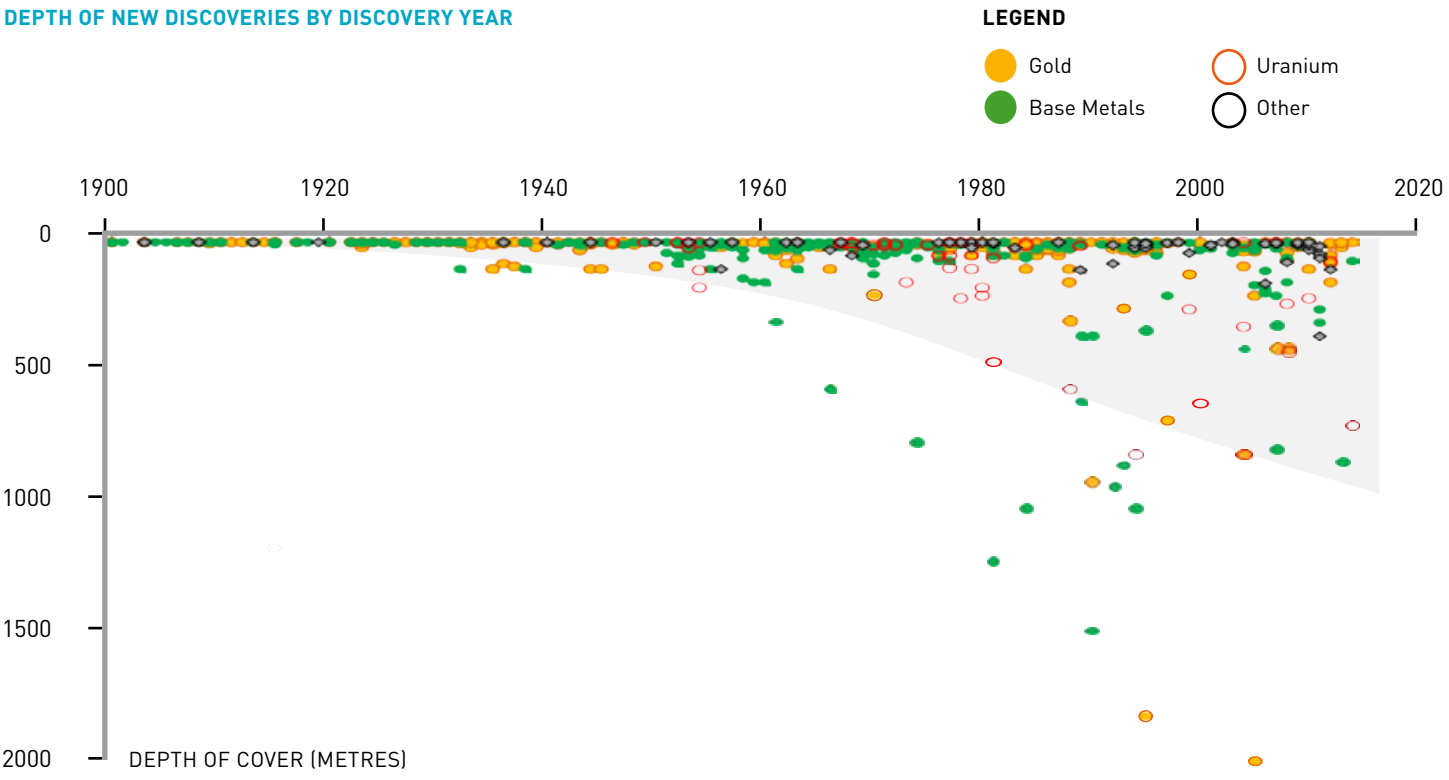
Current state of mining

Within the mining industry, our survey found broad agreement that business ecosystems are the most effective way to drive innovation. And, there are plenty of reasons behind the growing recognition among mining companies that they can no longer go it alone. First of all, there's too much at stake. The mining industry is one of the primary engines of the Canadian economy, contributing $54 billion, or 3.4% of the nation's GDP, in 2013. It employs nearly 400,000 Canadians and it is the largest private sector employer of aboriginal people in Canada.

Furthermore, the industry is facing a series of exploration challenges which could potentially be addressed through the use of ecosystems.

1. **Complex Environment**
   Mining companies face a more complex environment where new discoveries are more technically challenging (See Figure 2), along with more vocal and connected communities.

Figure 2. Depth of New Discoveries by Discovery Year



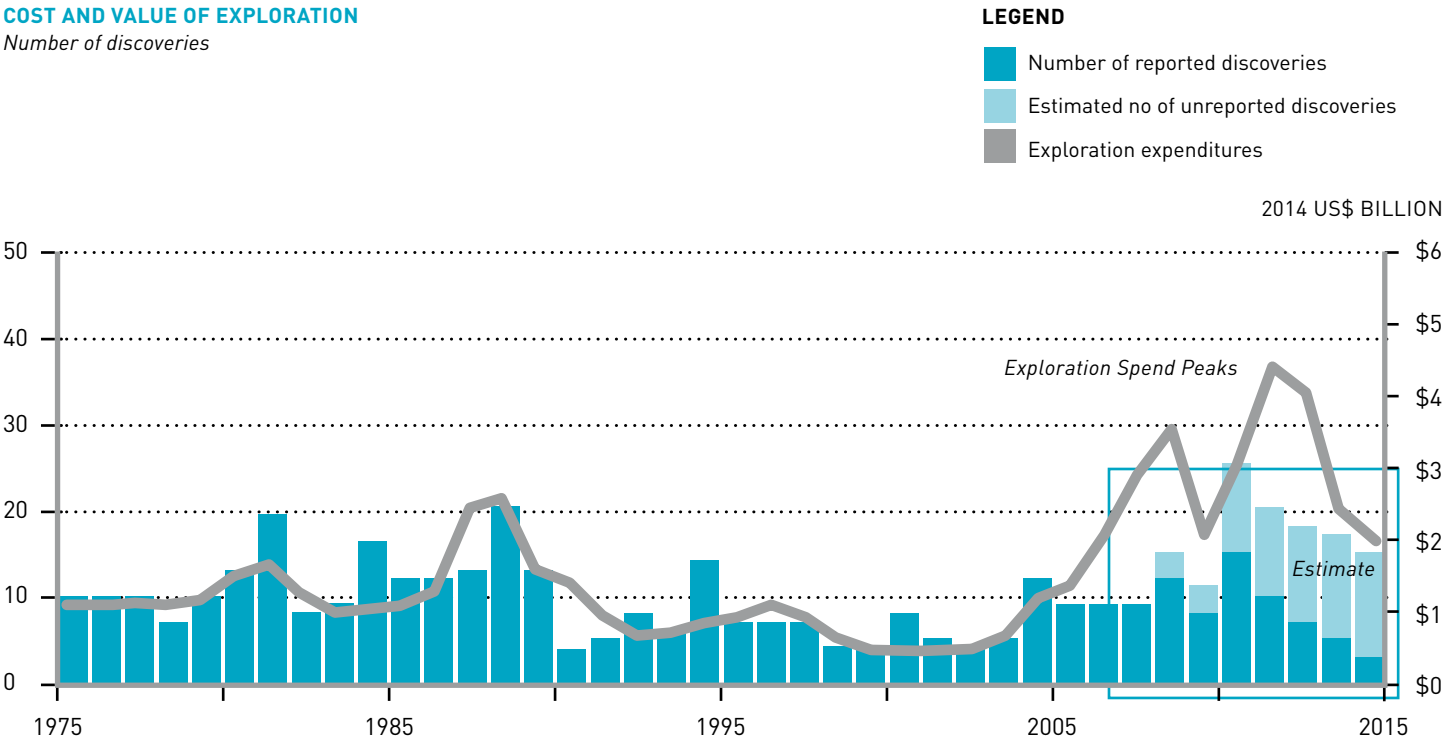
(*Source:* Canada's Discovery Performance and Outlook - Richard Schodde PDAC 2015)

Often, new deposits are not found in isolation, but are part of a larger geological structure. Ecosystems could de-risk projects by working with neighbouring deposits regarding many common operational aspects (technical challenges, community relations and shared costs) as opposed to viewing the neighbouring company as the "competition". Core to this is having a view on what the areas of common interest are, but also where one needs to invest to create real sources of competitive advantage.

2. **Declining exploration budgets**
As described by the interviewed participants, the industry appears to be in a state of contraction, with few companies willing to extend beyond their known comfort zones. A lack of new frontiers and disappointing returns on exploration investments are two big reasons why mining companies are sticking close to home, i.e., they need to do more with less.

For instance, even when exploration budgets were historically high between 2001 and 2011, they did not produce a proportional amount of discoveries.[iii](See Figure 3.) Ecosystems could potentially address this as they are a means to share best practices for exploration, promote shared costs and overcome technical challenges by driving breakthrough innovations.

Figure 3. More money is spent finding fewer discoveries



(*Source:* MinEx Consulting © March 2015)

IN YOUR OWN WORDS

"When prices come down people want to be risk averse—therefore focus on brownfields. There are higher changes of success in known deposits. In this environment, it's about taking care of your assets—lowering costs and finding resources close to existing, operating mines." —Major

"Canadian juniors feel much more comfortable going into a post-conflict zone overseas than exploring in an area like the James Bay lowlands that will require lots of technology. Technology scares them; a war zone doesn't." —Academia

"The world is getting a lot smaller and there are not many new frontiers out there anymore—maybe Antarctica—where we can explore a large tract of unexplored land. We are condemned to search for deposits that are deeper, i.e., don't outcrop or are covered. It makes the exploration process more expensive and risky." —Industry Association

3. **A shortage of skilled labour**
   Amid this challenging environment, mining companies must contend with a growing talent shortage. Historically, majors had robust exploration departments acting as incubators for young geologists. As the industry went through cyclical downturns, these exploration departments were cut, and they were never fully rebuilt, even when prices recovered. This has resulted in "lost generations" who found jobs in other industries—all while the industry was becoming more technical and more data-intensive. The result? As one survey participant observed, "An experienced labor force is going to be one of the big weak links in the coming years." The mobility and accessibility of talent can be addressed through ecosystems.Through technology, firms can connect to groups of seasoned experts from around the world to deal with the actual explorational challenges. The location of talent could increasingly be less of a constraint.

Given the magnitude of these challenges, it will be difficult for individual companies to overcome them on their own. Although more and more companies realize they need to look outward to foster greater collaboration and innovation, there is still a lot of progress to be made. Some collaboration around exploration has been taking place for years, particularly within mining "clusters," regionally focused players, and through industry councils and research groups. A mining cluster, when organized well can be thought of as an ecosystem, is essentially a loose association of geographically and technologically similar organizations, linked by commonalities and complementary capabilities. However, a lack of a national vision to drive collaboration along with disparate provincial and federal regulations often holds back these clusters, thus contributing to escalating costs and diminishing exploration activity.

Our interview subjects acknowledged that ecosystems have already benefitted the mining industry—having produced enough small and large-scale breakthroughs to demonstrate the power of ecosystems and to reinforce the need to collaborate. However, most of these initiatives are narrow in scope, and many rely on informal means of information exchange. In other words, the limited ecosystems that exist within mining today are not reaching their full potential.

IN YOUR OWN WORDS
Mining ecosystems today

"Raison d'être for business ecosystems is to solve big challenges that companies can't solve. CMIC is doing that."
—Industry Association

"Using [the HeroX®] platform, what it allowed us to do is band all the contestants together. And what we're seeing is fantastic multi-talented teams." —Junior

"MDRU is a good example of collaboration in the exploration industry where companies provide information and students spend time studying. The information generated is confidential to the group." —Major

"Explorers love to get together but it's focused very much on a geoscientist view of the world not on a full extractive process view of the world." —Academia

The survey results confirmed that the industry by and large is not capitalizing upon the collaborative platforms that are available today. **Most of our interview subjects said that their companies do not consider themselves as participants in a business ecosystem and they are not formally organized to take advantage of ecosystem benefits.** In fact, many believe significant barriers exist to forming ecosystems that are as robust as those in other industries. Among these barriers, mining companies are unsure of how to make it happen. They don't understand ecosystems, how they apply to them or how they can benefit.

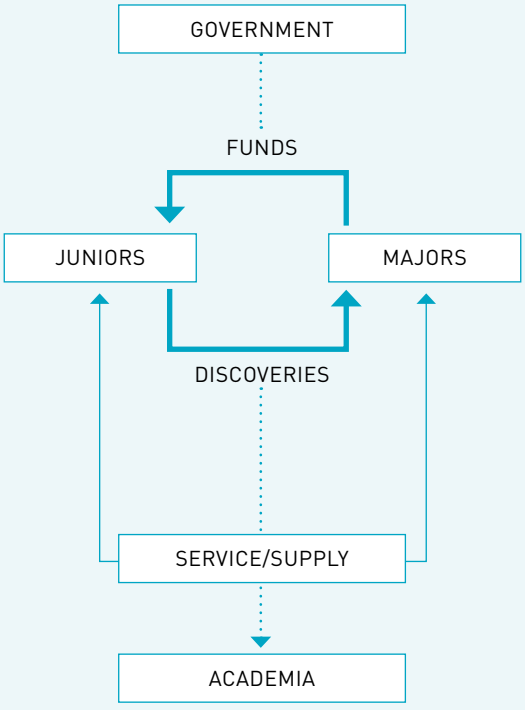
They are also very reluctant to trust each other, since the concept of formalized collaboration is still new and constituents are protective of their intellectual property (IP) and competitive advantage. Corporate culture also poses an obstacle. Mining and exploration companies don't hire or train geologists or geoscientists specifically to operate in an ecosystem. For many companies, the concept of collaboration simply isn't in their DNA. Nor are they equipped from a technological standpoint to share data or make it universally accessible, despite the fact that most organizations have immense amounts of this largely untapped resource.

Figure 4. Perceptions of business ecosystems in mining.

ECOSYSTEM APPROACH TODAY

Most companies in the mining industry do not consider themselves as participants in a business ecosystem and are not formally organized to take advantage of ecosystem benefits

PERCEPTION OF CURRENT EXPLORATION ENVIRONMENT:



BARRIERS TO ORGANIZING ECOSYSTEMS IN EXPLORATION:

COMMUNICATION

"There is not enough cross-pollination between the universities, the government research programs, and industry." — Junior

COMPETITION

"As long as mining companies, see this stuff as purely a competitive advantage to their business practices then its going to stagnate." — Industry Association

AWARENESS

"Most businesses aren't aware of what a business ecosystem is... we don't use or understand them." — Industry Association

INFORMATION

"Collaboration with other companies is very carefully done, You don't want to give your competitor information - you want their property more cheaply." — Major

Innovation building blocks and levers

The reality of exploration is changing in ways that will require some fundamental shifts in thinking. As mining companies grapple with the challenges of a complex environment, declining budgets and a skilled-labor shortage, the sector must catch up to other industries that are already leveraging ecosystems through which they can innovate more effectively. They can address this by getting organized, building trust, skilling up and creating platforms.

GET ORGANIZED

Companies must first get organized since creating a collaborative, innovation-focused environment needs to be done from the inside out. Last year's study identified 12 capability levers (i.e., internal actions) that any organization can emphasize or adjust to foster greater innovation within themselves (See Figure 5.) While all of these levers contribute to building innovation capabilities, there are four areas in which companies must improve in order to help build ecosystems and strengthen their ability to participate in them:

1. **External Connections** — Developing contracts and structures for identifying and leveraging external capabilities, partnerships and solutions.

> *"People don't have the built in tendency to reach out and see what the other guys are doing. That doesn't happen and it's really unfortunate." —Industry Association*
>
> *"We cant think 'oh, good enough.' We always have to ask ourselves is there a better way?" —Service Provider*

2. **Talent Management** — Attracting and deploying those with the right skills at the right time to deliver on open innovation.

> *"There is almost no one in this industry who sees this current climate as an opportunity... few people are proactive about poaching good people or lining up opportunities to take advantage of the cycle." — Academia*
>
> *"Feet in the ground head in the clouds. You need someone 100% dedicated to innovation. You can't have someone who's already overworked by 50% try and think about these issues." —Industry Association*

3. **Innovation Tools** — Implementing specialized protocols, software, techniques, etc. for different methods of open innovation.

4. **External Attraction** — Fostering and incentivizing external resources to participate in innovation efforts on your platforms.

> *"I would emphasize it's not just about the technology. It's really about how you manage and organize that technology to get a positive result." —Academia*
>
> *"The ones who are going to win are the ones who can implement the technology and actually use it" — Junior*

> *"Smaller companies are more incentivized to jump into these things [ecosystems] and more agile and more risk tolerant to see where they go and understand the sharing of value because they're hurting as well." —Industry Association*

Figure 5. Internal capability levers.

BUSINESS ECOSYSTEMS IN EXPLORATION: ADDRESSING THE CHALLENGES

The ability to create a high performing ecosystem as individual companies, is intimately linked to building your internal capabilities to perform in an ecosystem across these 12 levers

APPROACH

1. **Innovation strategy**
   Goals for open innovation and thematic opportunities to pursue
2. **Pipeline and portfolio management**
   How the collection of open innovation initiatives are managed in a pipeline and portfolio
3. **Process**
   How open innovation initiatives move from abstract hypotheses and ideas to launched businesses

ORGANIZATION

4. **Senior leadership**
   How senior leaders engage with open innovation
5. **Governance**
   How and by whom decisions are made
6. **External connections**
   Contracts and structures for identifying and leveraging external capabilities, partnerships, and solutions

RESOURCES &COMPETENCIES

7. **Funding**
   The amount of financial resources devoted and the mechanisms for accessing the funding
8. **Talent management**
   Attracting and deploying those with the right skills at the right time to deliver on open innovation
9. **Innovation tools**
   Specialized protocols, software, techniques, etc. for different methods of open innovation

METRICS & INCENTIVES

10. **Financial and nonfinancial rewards**
    Monetary incentives, formal and informal recognition of contributions to innovation
11. **Innovation metrics**
    Targets and indicators to guide innovation decisions and measure progress
12. **External attraction**
    How you foster and incent external resources to participate in innovating on your platforms

BUILD TRUST

After getting organized and shoring up their internal innovation capabilities, companies need to reach out to fellow industry participants and mutually **build trust** in order to create robust ecosystems capable of solving collective problems. However, this is where many companies hesitate. The tug-of-war between competition and collaboration often gets in the way, with mining companies being inherently risk averse, especially when it comes to disclosing IP. This is changing, however, with some mining companies beginning to push for greater sharing of data, technology and leading practices, but many hurdles remain, especially pertaining to sharing IP throughout the supply chain.

Sharing IP certainly has its risks, but these risks should be balanced against potential rewards. By releasing IP to a broader range of participants, companies can problem-solve in new ways and generate distributed value that goes well beyond what they can create on their own.

Furthermore, ecosystem participants don't need to feel unprotected since they can choose to participate in either an open or a closed ecosystem, with the latter having built-in protections since the IP as well as the risks and rewards are only shared among a select group. Participants in any type of ecosystem can also employ mitigation strategies to help manage the risks. Modular architectures, for instance, allow companies to pick and choose, with great precision, the IP components they contribute to the broader ecosystem and the ones they wish to retain as confidential. A staged approach to releasing IP can also help to manage risk. By beginning with less critical IP, a company can build trust and learn how to stimulate innovation through the ecosystem before releasing more valuable information assets. Indeed, risk can actually be reduced by developing IP through a group, since the funding burden is shared and so too are the rewards. CMIC serves as a good example of this equitable distribution.

SKILL-UP

In addition to building trust, mining companies will need to **skill-up** both to meet the changing needs of exploration today as well as to gain the capabilities necessary to participate in a business ecosystem. This will require important new skills and capabilities, including the design of resilient networks; management of reciprocity-based relationships; adoption of new technologies and driving analytics. Indeed, ecosystems can be an increasingly important way to develop this talent, especially as new and more open models proliferate. Post-secondary institutions, for instance, could provide cross-skill training in conjunction with industry, leveraging the ecosystem to create relevant and up-to-date programming. The ecosystem could also provide a way for companies to borrow the skills they need by inviting freelancers, professors and students to bring new perspectives to industry challenges.

Notably, a business ecosystem requires companies with different cultures, some of whom are competitors, to work together collaboratively. The situation becomes even more complicated considering that a large portion of the companies themselves may be made up of freelancers with their own individual cultures. In this environment, a strong and distinct corporate culture is important not only for attracting talent but also for facilitating interaction within the ecosystem. Productive ecosystems require companies to instill values that benefit the collective as well as the individual, such as collaboration and calculated risk-taking when it comes to technology adoption and innovation. And, these values are defined and embedded into team dynamics through corporate culture.

BUILD PLATFORMS

Finally, to enable truly successful ecosystems, mining exploration data must be digitized and disseminated via platforms that enable the sharing of ideas, while protecting IP. For instance, challenge campaigns could be organized to find solutions to complex programs through demonstrated platforms such as HeroX®, or through privately developed platforms that allow ecosystem members to present their solutions based on value creation. While platforms can take many forms, they must comprise of a governance structure and collaboration protocols, in addition to the core technology, in order to protect IP and address privacy concerns.

Where to go from here

In order to address the pace of change and disruption, the mining industry will need to broaden its collaboration efforts far beyond where they are right now. This means deepening existing connections within the limited ecosystems that exist today as well as expanding these networks to involve more stakeholders, including non-traditional ones. The government, academia, the investment community, the media and local community groups will all likely have roles to play.

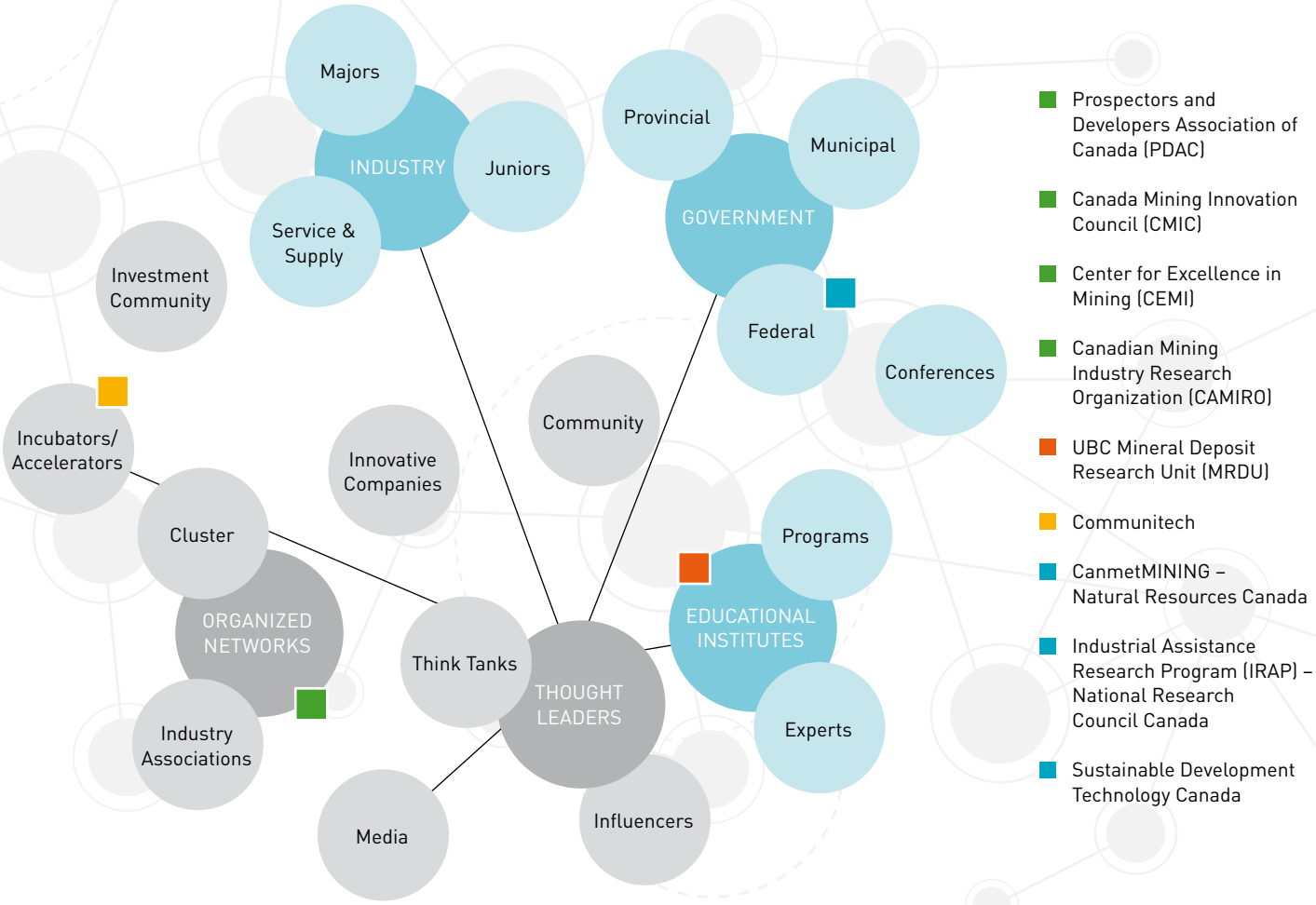
Government is worthy of special mention, since it can do a great deal to enable business ecosystems. The support of federal and provincial governments is important since they have the opportunity to develop strategies for expanding Canada's global market share. For instance, the federal government has spent billions of dollars over the last decade in an effort to fund innovation in Canada, but the country still ranks near the bottom of the OECD countries in the Canadian Chamber of Commerce Innovation Index. This government-led push for innovation involves over 3,000 different funding agencies. This suggests a diffuse, sub-optimal approach to driving step change in specific industries. With the immense financial resources governments have on hand, they will need to have meaningful and far-reaching discussions with the mining industry to best define their role in the ecosystem.

Governments can also play an important role in research and development, as in the US where federal agencies often both fund and participate in the development of large-scale, industry-focused innovations. Government laboratories are particularly important for taking on some of the high-risk innovation activities that are not suitable for academia, startups or small and mid-sized enterprises. Where relevant, federal government labs can also provide a valuable verification service for technology that shows promise, but has yet to undergo standardized testing to validate performance claims.

Figure 6. Expanding the present mining ecosystem.

BUSINESS ECOSYSTEMS IN EXPLORATION: ADDRESSING THE CHALLENGES

To address the pace of change and disruption, integrated external innovation ecosystems need to be broadened beyond traditional members



WE HAVE STARTED, BUT WE NEED TO GET **MUCH BETTER**

With the innovation imperative upon us, a broad, integrated, external business ecosystem is essential. While "ecosystems" are inherently an expansive concept, any individual mining organization can drive them forward by taking a few simple actions. Here are some suggestions of what you can do right now:

- **Collaborate** — Call a meeting with a handful of your major competitors and speak about how you can tackle common problems collaboratively. Run a workshop with your service companies and juniors to collect information on problems that you might solve together. Begin discussions on how you might solve them.
- **Evaluate business ecosystems** — Talk to the leaders of the business ecosystems that exist today to see what their value propositions are and how they could positively impact your business. Reach out to industry organizations for recommendations on innovation groups that are worth contacting.
- **Lobby for support from government** — Have deep and meaningful conversations with industry organizations on the role of government and how you can support them in their lobbying efforts.
- **Explore platforms** — Start co-investing, exploring or creating platforms for sharing ideas; someone has to start, why not you?

CONCLUSION

The pressure upon the mining industry to work together among themselves and with government and academic institutions to solve mutual problems for mutual gain has never been so intense. But, change can come slowly in an industry that has historically been self-reliant when it comes to innovating—and has a long track record of being successful at it, particularly in terms of improving operational performance and driving out costs.

Today, however, time is not on our side. Incremental innovation will likely not be sufficient to address increasingly complex and challenging operating conditions, amid an environment of constrained budgets and limited human resources. Increasingly larger strides will need to be made just to survive, with major breakthroughs required to restore true health and vitality to the sector. Business ecosystems may offer the industry a lifeline. Fears about losing competitive advantage and IP are no longer valid reasons not to grasp it. When the right platforms are in place, innovation within the mining industry comes down to a simple calculation: ecosystems exponentially multiply our brainpower.

IN YOUR OWN WORDS

We don't create the environment for success if we don't work as an ecosystem—as an ecosystem we share the risk and bring in new insights." —Major

The major point to make is that for the mineral industry the business ecosystem approach is the only one that's going to work to solve the long term challenges." —Industry Association

A business ecosystem is a constructed entity to drive and create significant value for all the actors or all the players involved. That's a key piece. You're getting value out of it." —Industry Association

END NOTES

[i] Johnson, Steven, "Where do Good Ideas Come From," 2010.
[ii] Mining Association of Canada, "Facts and Figures of the Canadian Mining Industry," 2014.
[iii] MineEx Consulting, 2015.

ABOUT

MONITOR DELOITTE

To grow with confidence, organizations need to make clear choices about where to play and how to win. And in a world where the pace of change is rapid and sometimes unexpected, leaders need to act nimbly and decisively. Monitor Deloitte strategy consultants employ cutting-edge approaches embedded with deep industry expertise, working with leaders to resolve critical choices, and drive enterprise value.

PDAC

The Prospectors & Developers Association of Canada (PDAC) is the national voice of Canada's mineral exploration and development industry. With a membership of over 8,000, the PDAC's mission is to promote a responsible, vibrant and sustainable Canadian mineral exploration and development sector. The PDAC encourages leading practices in technical, environmental, safety and social performance in Canada and internationally. PDAC is known worldwide for its annual PDAC Convention, regarded as the premier event for mineral industry professionals. The PDAC Convention has attracted over 25,000 people from 125 countries in recent years and will next be held March 6-9, 2016, in Toronto. Please visit www.pdac.ca.

CANADA MINING INNOVATION COUNCIL

The Canada Mining Innovation Council (CMIC) is a national non-profit organization that coordinates and develops research development and innovation (RDI) projects and programs in response to life of mine challenges defined by its industry members. These 80 plus members include mineral exploration and mining companies and their service providers, working together towards common solutions to common challenges. This allows for shared financial and technology adoption risk, faster development of solutions and wider spread benefits. Challenges are defined and prioritized, and programs developed by CMIC technical groups. CMIC technical groups are led by Canadian company vice presidents and populated by leading industry experts in the fields of mineral exploration, extraction, processing, mine waste management and energy. Please visit http://www.cmic-ccim.org

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