UNLOCKING PRODUCTIVITY

The Human Capital Supply Chain

THE Productivity Project ———

The Productivity Project is a collaboration of a multidisciplinary team of experts from academia, industry, and policy. Together, they address a pivotal question: **How can human capital drive Canada's productivity?**

Series 1: Productivity and People delivers actionable insights through six research studies. For additional information on future publications, please visit ProductivityProject.ca

ACLMR

MOUNT ROYAL UNIVERSITY
Institute for Community Prosperity

CANADAWEST FOUNDATION

LearningCITY

PRODUCTIVITY AND PEOPLE

Economic, social, and cultural dynamics—driven by rapid technological advancements and globalization—are profoundly reshaping regional economies. A region's competitive advantage is no longer dictated by its access to natural resources; instead, it's rooted in the productivity of its labour force.

Today, labour market productivity is anchored in individuals who can navigate uncertainty and adapt seamlessly. Adaptation, at its core, is the ability to learn, unlearn, and relearn.

> *Today, labour market productivity is anchored in individuals who can navigate uncertainty and adapt seamlessly.*

AUTHOR TEAM

Dr. David Finch, *Mount Royal University*

Dr. Nadège Levallet, *University of Maine*

Dr. Irina Dovbischuk, *Mount Royal University*

Janet Lane, *Canada West Foundation*

Jeff Griffiths, *Canada West Foundation*

Dr. Stephen Murgatroyd, *University of Alberta*

Dr. Sharon McIntyre, *New Cottage Industries*

Project Manager: Alexandra Swiston

Report Design: Sarah Thomson

Copy Editor: Jarica Kritsky

CONTENTS

FIGURES & TABLES

FIGURES

TABLES

EXECUTIVE SUMMARY

THE CHALLENGE

Historically, regional competitive advantage stemmed from natural resources, such as minerals and access to trading routes.[1] However, in recent decades, the competitive advantage in many regions has transitioned from reliance on natural resources to measures of productivity.

Productivity measures the ability to produce more output with fewer inputs. Productivity is fundamentally rooted in optimizing its human capital—its labour force. Today's labour market, demands individuals who thrive in uncertainty and possess the capacity to adapt to dynamic demands. Adaptation is the capacity to learn, unlearn, and relearn.

However, Canada's learning system remains entrenched in its 19th-century industrial roots, contributing to fragmentation, inertia, and systemic inefficiencies. Moreover, increased economic volatility has led to conditions in which no single stakeholder, whether a government, learning provider, employer, or credentialing body, can unilaterally overcome these structural challenges. The result is an increasing gap between labour market supply and demand.

THE REGIONAL OPEN LOOP NETWORK

FORESIGHT
PLANNING

VALUE
CREATION

BASE
HUMAN CAPITAL

ROLN
HQ

HUMAN CAPITAL
SUPPLY

LEARNING &
DEVELOPMENT

---

1   The definition of a "region" is highly contextual. In this report it can be applied to communities, metropolitan areas, provinces or states, countries, or continents.

THE OPPORTUNITY

Over the past three decades, with the rapid expansion of global trade, supply chains have been reinvented from hierarchical and linear systems to agile, decentralized networks, emphasizing modular, just-in-time systems. These networks enabled rapid response and adjustment to changing market conditions.

Building on the principles of modern supply chain networks, we conceptualize a regional human capital supply chain deemed—the Regional Open Loop Network (ROLN). ROLN is a collaborative open loop network with diverse stakeholders, including individuals, learning providers, employers, credentialing bodies, and policymakers.

At the heart of ROLN is the capacity to efficiently develop the competencies and capabilities demanded by real-time labour market conditions. Like open loop supply chains, a modern human capital supply chain will benefit from the coordination and synchronization of all stakeholders' efforts. The figure below incorporates six dimensions of ROLN.

> At the heart of Regional Open Loop Network is the capacity to efficiently develop the competencies and capabilities demanded by real-time labour market conditions.

Foresight Planning

System-level foresight planning is the foundation of ROLN, providing a disciplined approach to proactive regional resource allocation. In the past two decades, foresight planning has emerged as a framework for managing uncertainty and risk. Foresight planning systematically maps future scenarios, interventions, and outcomes. For ROLN, this includes modelling factors such as economic conditions, demographics, technological disruptions, industry trends, trade, and policy changes.

Base Human Capital

Base human capital is individuals' foundational knowledge, skills, experiences, and attributes, which enable them to participate effectively in the workforce and society. These include intellectual, personality, and physical resources developed through early childhood education, health, socialization, and life experiences.

Learning and Development

Researchers recognize that learning is highly dynamic and can take infinite forms, from traditional classroom learning to lived experiences. Building on the principles of open innovation, open learning recognizes that learning providers, employers, policymakers, and individuals must collaborate to maximize learning outcomes.

Open learning encompasses diverse learning experiences beyond traditional classroom settings, including options for employment, volunteerism, artistic endeavours, athletic participation, and engagement with asynchronous resources such as books or podcasts. This approach fosters a more inclusive understanding of learning, acknowledging the diverse modalities and environments through which human capital can be developed. In ROLN, open learning is clustered into three forms: (1) certified learning, (2) non-certified learning, and (3) informal learning.

Human Capital Supply

Human capital supply is the output produced by the learning and development activities. We cluster competencies into (1) Enabling competencies and (2) Task-specific competencies. In addition, the learning activities play a significant role in developing an individual's personal and professional networks, which accrue to an individual in the form of social capital.

Enabling Competencies

Enabling competencies are foundational to an individual's adaptive capacity and apply an individual's intelligence and personality resources. These resources are not context-specific and, therefore, are applicable in diverse situations. Evidence shows that enabling competencies are critical to employability. Researchers commonly identify enabling competencies across problem-solving, collaboration, communication, core literacies, and self-regulation.

Task-specific Competencies

Task-specific competencies are the relevant knowledge, skills, values, experience, and abilities needed to complete a specific job. Task-specific competencies incorporate functional competencies (e.g., computer programming), sectoral competencies (e.g., expertise in an industry), or organization-level competencies (e.g., start-up expertise).

Social Capital

Social capital encompasses the tangible and intangible value derived from networks of relationships—both strong ties (e.g., family, close friends) and weak ties (e.g., acquaintances, professional contacts)—that collectively bind individuals to their communities and broader society. These networks facilitate trust, reciprocity, and access to resources, enabling collective action and individual opportunity. While close relationships provide emotional support, weaker or more diverse connections often bridge social divides, exposing individuals to new ideas, resources, and pathways beyond their immediate comfort zones.

Value Creation

ROLN is optimized to deliver value. Following the guidance of the Organisation for Economic Cooperation and Development's (OECD) Better Life Index and the New Zealand Government's Living Standards Framework. ROLN defines value creation as multidimensional,incorporating four perspectives: (1) Economic, (2) Social, (3) Personal, and (4) Ecological. ROLN establishes regional key performance indicators for each dimension and optimizes human capital development and deployment to deliver on these goals.

ROLN HQ

The overarching goal of ROLN is to foster collaboration and eliminate silos, ultimately facilitating the acceleration of innovations to unlock the full capacity of a regional human capital ecosystem. To do so, we propose establishing an independent ROLN backbone organization (ROLN HQ) to coordinate ROLN. Backbone organizations are independent entities designated to oversee the essential operations needed for ecosystem collaboration. Backbone organizations help by providing the structure and resources for diverse stakeholders to identify shared priorities, which are crucial to the partnership's success. The ROLN HQ should be staffed by supply chain secondments that bring in individuals with expertise from diverse contexts. The ROLN HQ would be responsible for five coordination mechanisms: (1) Establishing a shared vision, (2) Empowering learners, (3) Optimizing knowledge sharing, (4) Facilitating a common competency taxonomy, (5) Defining harmonized metrics, and (6) commitment to continuous learning.

WHERE TO START

The greatest challenge facing economic regions lies not in external factors but in our embedded practices and cultures, which influence mindsets and behaviours. Therefore, the most practical path forward is to break ROLN down into small steps. For example, ROLN is founded on collaboration and trust among ecosystem partners. Therefore, developing these relationships will be the foundation of a sustainable human capital ecosystem.

THE CHALLENGE

HUMAN CAPITAL AND THE EIGHT FORCES

Like many resources, human capital's nature and value are highly contextual and can be understood across three distinct levels, as illustrated in Figure 1.

Individual Level: At the individual level, human capital represents the economic and social value derived from a person's competencies and capabilities, encompassing knowledge, skills, experiences and attributes that empower them to achieve their objectives.

Regional Labour Market Level: The regional labour market human capital reflects the broader pool of human capital. Here, the value of specific competencies is determined by supply and demand.[2]

Organizational Level: Organizational human capital is the collective capabilities of employees that enable a company to meet its strategic goals and generate a return on its human capital investments.

The relationship between human capital and geography has long been recognized. Historically, regional economic growth was driven by proximity to scarce natural resources, such as timber, oil, or iron ore, as well as access to trade routes and navigable waterways, which facilitated commodity extraction, manufacturing, and commerce. However, in recent decades, the foundation of competitive advantage has shifted. Today, a region's ability to cultivate and leverage human capital is paramount. The dramatic change in corporate valuation underscores this transformation: in 1975, tangible assets accounted for 83% of the S&P 500's

FIGURE 1: REGIONAL HUMAN CAPITAL

value, but by 2020, intangible assets—primarily driven by human capital outcomes like intellectual property—comprised 91 percent (Figure 2).[3]

Moreover, research indicates that human capital is strongly associated with factors essential to regional economic development, including labour productivity, innovation, technology adoption, market valuation, and competitiveness. Studies suggest that the geographic clustering of human capital fosters the adoption of new knowledge through effective information diffusion, spillovers, shared learning, experimentation, and social embeddedness.[4]

FIGURE 2: EVOLVING VALUE

INTANGIBLE VALUE   TANGIBLE VALUE

---
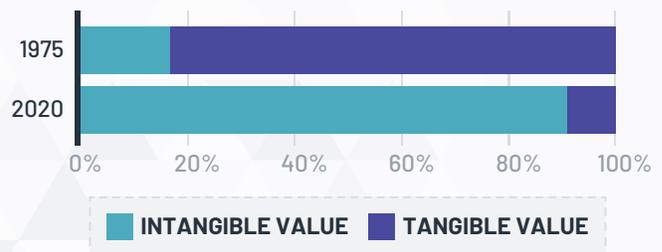
2   From Arora, 2023.

3   From Government of Ontario, 2020.

4   For further information, refer to studies on the relationship of factors to regional economic development, Kotsantonis & Serafeim, 2020 or Azar, 2020. For labour productivity (Osiobe, 2019), innovation (Gruzina et al., 2021), technology adoption (Che & Zhang, 2018), market valuation (Pelinescu, 2015), competitiveness (Amir, 2024), information diffusion

Human Capital Stakeholders

A business ecosystem is a dynamic network of interconnected stakeholders collaborating to create and deliver shared value. Ecosystems emphasize co-creation and interdependence, generating incremental value beyond what individual stakeholders can achieve. As per Figure 3, the regional human capital ecosystem incorporates five core stakeholders:

Individuals: Incorporating all residents of the region. They engage in the labour market by developing competencies through certified, non-certified, and informal learning pathways, and then apply those competencies in the workforce

Learning Providers: Incorporating all individuals and organizations accountable for delivering certified, non-certified, and informal learning within a region.

Credentialing Bodies: Incorporating all organizations that assess, verify, and acknowledge the qualifications and competencies of individuals within a specific profession or field.[5]

Policymakers: Incorporating all levels of government with jurisdictional responsibility in the region, including local, municipal, provincial, state, national, or federal.

Employers: Incorporating all employers, business and professional associations from the region. They engage in the labour market by hiring and developing staff.

> Human capital is strongly associated with factors essential to regional economic development.

FIGURE 3: REGIONAL HUMAN CAPITAL ECOSYSTEM

THE HUMAN CAPITAL ECOSYSTEM
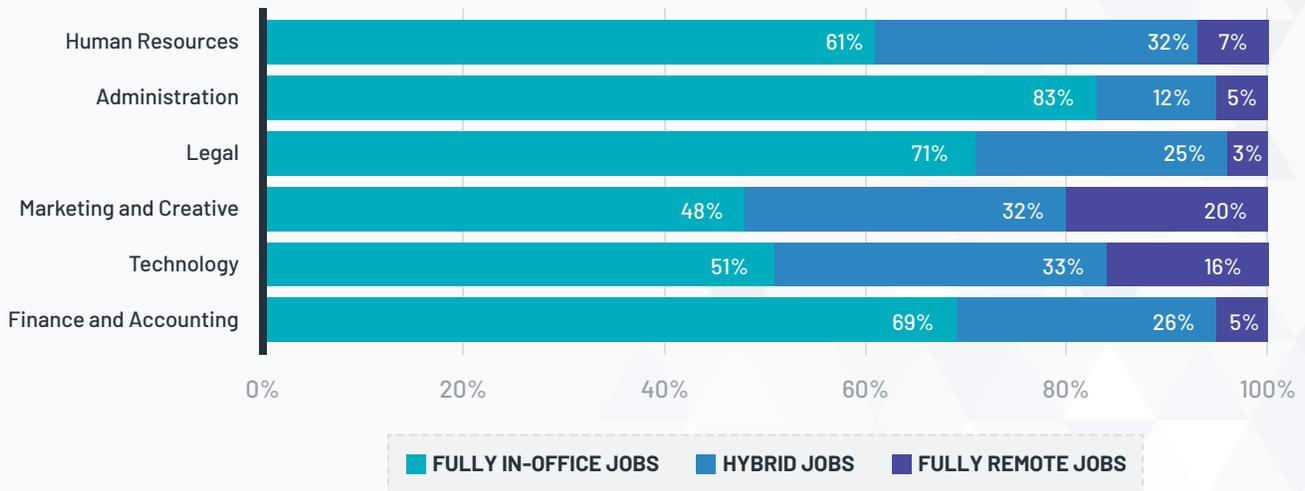
- INDIVIDUALS
- LEARNING PROVIDERS
- CREDENTIALING BODIES
- POLICYMAKERS
- EMPLOYERS

(Guastella & Timpano, 2016). However, researchers highlight the unprecedented volatility confronting organizations (Di Battista et al., 2025), sectors (Wang et al., 2022), and labour markets (Autor, 2022).

5   From American National Standards Institute ANSI. n.d.

FIGURE 4: GEOGRAPHY AND OCCUPATIONS

Occupation	Fully In-Office Jobs	Hybrid Jobs	Fully Remote Jobs
Human Resources	61%	32%	7%
Administration	83%	12%	5%
Legal	71%	25%	3%
Marketing and Creative	48%	32%	20%
Technology	51%	33%	16%
Finance and Accounting	69%	26%	5%

■ FULLY IN-OFFICE JOBS ■ HYBRID JOBS ■ FULLY REMOTE JOBS

Does Place Still Matter?

The COVID-19 pandemic accelerated remote work, creating the perception of a borderless labour market. Yet data from Canada and the U.S. confirm that human capital remains deeply tied to geography. A study of 22,000 Canadian job postings found that 89% of roles were location-dependent, with only 11% fully remote—a trend further detailed in Figure 4 by occupation category.[6] Similarly, just 1.6 percent of Canadian employees reside outside their employer's province. In the U.S., the share of workers living 80+ kilometres from their workplace saw a sevenfold increase between 2019 and 2023.

> While the future of work remains uncertain, the interdependence of labour markets and geography will persist.

Yet, this group still represents only 5.5 percent of employees and is disproportionately high-income.[7]

While the future of work remains uncertain, the interdependence of labour markets and geography will persist. Consistent with this, the Global Talent Competitive Index now identifies cities and regions as central players in shaping talent competitiveness.[8]

---

6   From Robert Half, 2025.

7   From Akan et al., 2024.

8   For further information on geography and labour, following COVID-19, refer to Statistics Canada, 2024; Lanvin & Monteiro. 2023.

The Coming Storm

In the first report of this series, *The Coming Storm: The Eight Forces Reshaping Regional Labour Markets*, we examined how the convergence of eight macro-level forces is redefining local labour markets (Figure 5). These forces—spanning automation, extended working lives, and the rise of contingent labour—are driving profound shifts in workforce dynamics. Our analysis concluded that to remain competitive, economic regions must fundamentally rethink how they develop and deploy human capital in this rapidly evolving landscape.

The challenges of today's labour markets mirror the VUCA framework—volatility, uncertainty, complexity, and ambiguity—first introduced by the U.S. Army War College in 1987 to describe the unpredictable nature of multilateral decision-making. Just as VUCA demands adaptability in military strategy, it now underscores the need for agile regional labour markets. Yet few regions have built the responsive systems required to navigate these growing demands. At the heart of this challenge lie the eight forces driving disruption across global labour markets.

FIGURE 5: THE EIGHT FORCES RESHAPING LABOUR MARKETS

TALENT SCARCITY

CONTINGENT LABOUR

THE ROLE OF PLACE

RISK MANAGEMENT

IMPACT ON **LABOUR MARKET**

DECLINING TRUST

FROM JOBS TO COMPETENCIES

AUTOMATION

THE 50-YEAR WORKING LIFE

THE OPPORTUNITY

THE EVOLUTION OF SUPPLY CHAINS

The Evolution of Supply Chains: From Linear to Agile Networks

A supply chain is the backbone of commerce, transforming raw materials into finished goods and delivering them to market. While supply chains have existed for millennia, the Industrial Revolution marked a turning point, enabling large-scale production and global distribution through railways and shipping. The 20th century brought even greater efficiencies with innovations like containerized shipping, enterprise resource planning (ERP) systems, and air freight.

Today, logistics clusters—geographic hubs where transportation, warehousing, and distribution converge—are reshaping supply chain dynamics. By co-locating, businesses gain shared infrastructure, a skilled workforce, and collaboration opportunities with universities, consultancies, and research centres. These clusters drive productivity, foster innovation, and strengthen supply chain resilience.[9]

From Linear Chains to Adaptive Networks

Traditional supply chains follow a linear model (Figure 6): suppliers → manufacturers → distributors → retailers → customers, supported by flows of goods, information, and payments. However, in the past two decades, globalization, digital transformation, and disruptions like COVID-19 have exposed the fragility of this approach.

To thrive in an era of volatility, businesses are adopting agile supply chain models—leveraging just-in-time systems, modular production, and strategic outsourcing. The Association for Supply Chain Management (ASCM) now depicts supply chains as continuous-loop networks (Figure 7), emphasizing cyclical improvement, adaptability, and real-time optimization.[10]

> A supply chain is the backbone of commerce, transforming raw materials into finished goods and delivering them to market.

FIGURE 6: LEGACY COMMERCIAL SUPPLY CHAIN

INFORMATION FLOW

SUPPLIERS — MANUFACTURING (Raw Material Inventory | Processing | Finished Products Inventory) — DISTRIBUTION / RETAIL — CUSTOMERS

MATERIAL FLOW

---
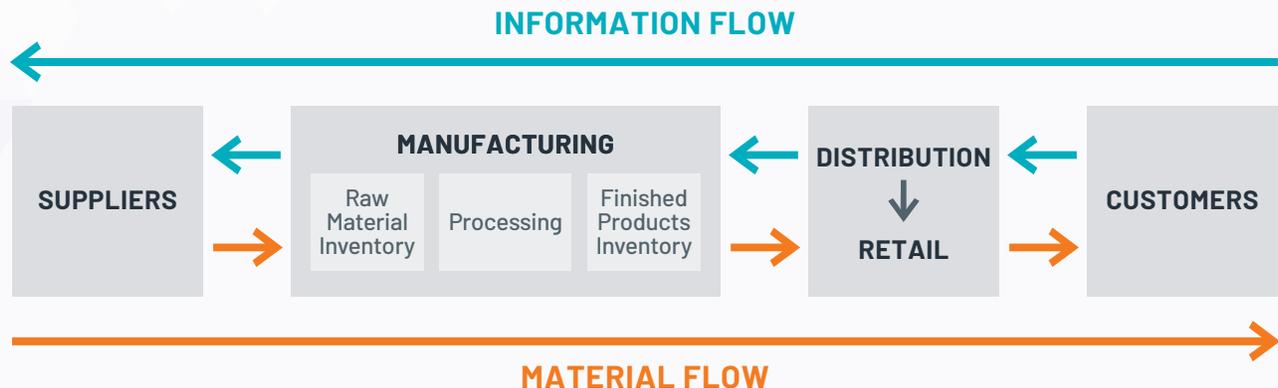
9   From Sheffi (2012).
10   From the Association of Supply Chain Management, 2022.

Technology-Driven Supply Chain Transformation

Technology is rapidly reshaping supply chains, enabling greater agility, efficiency, and resilience. The Internet of Things (IoT) facilitates real-time inventory tracking, while AI-powered analytics enhance demand forecasting and dynamic rerouting in response to disruptions. Blockchain further strengthens traceability and security across the supply network. Together, these innovations create interconnected, data-driven ecosystems capable of anticipating and mitigating market volatility.
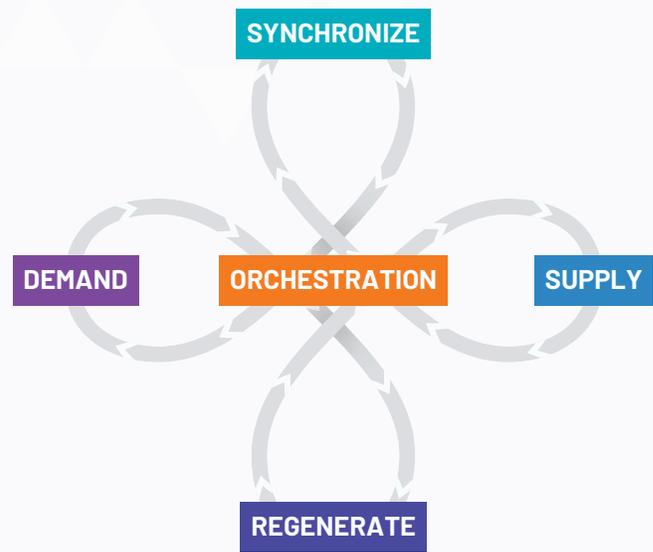
This shift toward data-centric decision-making allows organizations to harness predictive analytics, revealing critical insights into consumer behaviour, operational inefficiencies, and demand fluctuations. By leveraging these insights, businesses can optimize inventory management, reduce lead times, and align production with rapidly shifting market conditions—key competitive advantages in today's uncertain landscape.[11]

From Linear Chains to Collaborative Networks

Modern supply chains are evolving beyond traditional linear models into open loop, collaborative networks. Leading companies like Apple and Tesla exemplify this shift, integrating open innovation and cross-industry partnerships to drive efficiency and innovation. These ecosystems foster knowledge-sharing and value co-creation, enabling organizations to tap into external expertise and accelerate growth. Beyond operational improvements, these networks enhance intangible asset value, as companies that effectively integrate these interconnected systems gain a strategic edge.[12]

In the next section, we will apply these supply chain transformation principles to conceptualize a regional human capital supply chain and explore how similar strategies can optimize talent development and workforce agility.

---

11 For further information on the impact of technology on supply chains, refer to studies by Christopher & Holweg 2017; Wang & Hu, 2020; Wang et al., 2016.

12 From Chesbrough, 2017.

FIGURE 7: AN OPEN LOOP SUPPLY CHAIN NETWORK

Source: Association of Supply Chain Management, 2022.

A REGIONAL HUMAN CAPITAL SUPPLY CHAIN

The principles of open loop supply chain networks provide a proven framework that can be transformed to optimize regional talent development and deployment. Building on this model, we propose the Regional Open Loop Network (ROLN) - a collaborative human capital supply chain designed to dynamically align competency development with evolving labour market demands.

Today's labour markets face accelerating volatility, where shifting competency requirements routinely outpace traditional learning and training systems. In this environment, neither governments, educational institutions, nor individual employers possess sufficient resources to bridge these gaps effectively alone. Mirroring the evolution of modern supply chains, ROLN represents a responsive, stakeholder-driven model that applies supply chain optimization principles to human capital development. By establishing shared tracking of system-level supply and demand data, ROLN creates a closed-loop feedback system where workforce competencies continuously adapt to economic needs. This approach reduces competency mismatches while enhancing regional economic resilience and competitiveness.

Today's labour markets face accelerating volatility, where shifting competency requirements routinely outpace traditional learning and training systems.

The ROLN framework (Figure 8) incorporates six critical dimensions that enable this dynamic synchronization:

1. Foresight Planning
2. Base Human Capital
3. Learning and Development
4. Human Capital Supply
5. Value Creation
6. ROLN HQ

FIGURE 8: THE REGIONAL OPEN LOOP NETWORK

FORESIGHT PLANNING

VALUE CREATION

BASE HUMAN CAPITAL

ROLN HQ

HUMAN CAPITAL SUPPLY

LEARNING & DEVELOPMENT

DIMENSION 1
FORESIGHT PLANNING

Over the past 20 years, foresight planning has become a critical tool for managing uncertainty. It helps organizations like ROLN proactively prepare for future risks and opportunities by analyzing economic trends, workforce shifts, technological advancements, industry changes, trade policies, and regulatory impacts.

ROLN's approach focuses on two key forecasts: workforce optimization (ensuring the right competencies for future jobs) and resource allocation (strategically investing in regional growth). By using system-level foresight planning, ROLN makes data-driven decisions to stay ahead of challenges and drive long-term success.[13]

Human Capital Optimization

1. *Base human capital supply*: What is the current regional human capital supply?
2. *Human capital demand*: What is the future human capital demand forecast?
3. *Human capital optimization*: What is the gap between base regional human capital supply and demand?

Learning Resource Optimization

1. *Base learning system supply*: What is the current learning resource supply?
2. *Learning resource demand*: What is the future learning resource demand forecast?
3. *Learning resource optimization*: What is the gap between the base learning system supply and the forecasted demand for development resources?

---

13   For further information on foresight planning, refer to Peter & Jarratt, 2015; Rezapour et al., 011; For the impact of technology, refer to Acemoglu & Restrepo, 2019.

BASE HUMAN CAPITAL

As defined by the OECD, base human capital is the foundational knowledge, skills, experiences and attributes that individuals possess, enabling them to participate effectively in the workforce and society. It includes core competencies developed through early childhood education, health, socialization, and life experiences. [14]

> Base human capital is the foundational knowledge, skills, experiences and attributes that individuals possess, enabling them to participate effectively in the workforce and society.

Personality Resources

Personality resources include emotional stability, openness to experience (e.g. independence, intellectual curiosity, imagination), extraversion, agreeableness, and conscientiousness (e.g. goal-driven, dependability, organization). These resources are perceived as relatively stable but have the potential to be refined and developed. [15]

Intellectual Resources

Intellectual resources power strategic decision-making through advanced cognitive and meta-cognitive capabilities. These competencies—analysis, synthesis, and judgment—enable leaders to solve complex problems and drive innovation.

Cognitive strengths include critical thinking, decision-making, and problem-solving, sharpened by learning from experience. Self-evaluation further enhances these abilities by identifying improvement opportunities.

Meta-cognition adds deeper value through deliberate self-reflection. Understanding one's cognitive strengths and limitations allows for more effective knowledge application. Together, these capabilities create a competitive advantage in today's dynamic business landscape. [16]

Physical Resources

These are the physical attributes of an individual essential for completing a defined task, such as strength or stamina. The demand for these attributes can vary widely depending on the nature of the task.

---

14   From OECD, 2001. The well-being of nations: The role of human and social capital. OECD Publishing. https://doi.org/10.1787/9789264189515-e Base human capital differs from an individual's innate abilities. Base human capital includes core competencies developed through early education, health, socialization, and life experiences. In contrast, innate abilities are the raw physical, cognitive, and personality resources an individual is born with but has not developed into human capital. For additional background on innate ability, refer to Heckman et al. (2006) or Cunha et al (2007).

15   For further information on the role of personality, refer to studies by Finch et al. (2016) and Bleidorn et al. (2022).

16   For further information on intellectual resources, refer to studies by Halpern (1998) and Reid & Anderson (2012).

DIMENSION 3
LEARNING AND DEVELOPMENT

The learning and development landscape today remains heavily influenced by public institutions, such as school boards and public post-secondary education systems, designed to prioritize control, efficiency, and economies of scale. Since their emergence in the nineteenth century, these institutions have played a pivotal role in shaping society. Yet, as labour markets grow increasingly volatile and competency demands evolve at an unprecedented pace, researchers, employers, credentialing bodies, and policymakers are acknowledging the limitations of this legacy model. This growing recognition has ignited critical discussions about how to realign learning systems with the dynamic needs of today's workforce.

Contemporary research underscores that learning is a fluid and multifaceted process, taking shape in countless ways—from classrooms to experiential and self-directed learning. Drawing on the principles of open innovation, the concept of open learning emphasizes collaboration among learning providers, employers, policymakers, and individuals to optimize outcomes. In this model, diverse stakeholders operate within an interconnected ecosystem, fostering adaptability and responsiveness to labour market shifts.[17]

The industrial, closed institutional model of learning can be likened to a ladder—a rigid, linear progression through predefined educational milestones. In contrast, open learning resembles a climbing wall, offering learners a spectrum of pathways tailored to their unique goals and circumstances. This approach expands the definition of learning to include not only certified learning but also employment experiences, volunteer work, artistic pursuits, athletic engagement, and self-directed learning through books, podcasts, and other asynchronous resources. By embracing this broader perspective, open learning cultivates a more inclusive and flexible framework for human capital development.

Within this system, learning opportunities can be categorized into three key forms: certified learning, non-certified learning, and informal learning. Together, these clusters provide individuals with a vast and adaptable range of pathways to develop the competencies that support their personal and professional goals.[18]

> **Open learning resembles a climbing wall, offering learners a spectrum of pathways tailored to their unique goals and circumstances.**

---

17 For further information on the evolution of learning, refer to Borgos, 2023; Murgatroyd, 2024; KPMG, 2022; Krishnan, 2020; Luksha, 2018; Madgavkar, 2023; Robinson, K., & Aronica, 2015.

18 Herein, we adopt the definition of learning as behaviour adaptation triggered by regular interaction with external stimuli over time. Behaviour adaption includes observable physical and cognitive behaviour.

Certified Learning

Certified learning incorporates structured and organized training, education, or professional development experiences provided through an educational institution, workplace, or professional accrediting body. It is organization-bound and time-bound, resulting in formal certification by a formal organization, professional body, or sanctioned certifying agency. This report clusters certified learning into four sub-categories (primary, secondary and post-secondary education, and professional certification).[19]

Non-Certified Learning

Non-certified learning incorporates organized or systematic learning, training, or professional development activities from various organizations, community organizations, or training agencies. This form of learning requires registration but does not result in an accreditation. The service provider, independent of a government or a professional body, may award individual certificates.

Informal Learning

Informal learning incorporates diverse lived experiences and unstructured learning resources. These include paid and volunteer experiences, and the incalculable forms of self-directed learning, such as LinkedIn learning, free-to-learn MOOCs, or instructional videos widely available on YouTube and Vimeo. A study found that approximately 90 percent of Canadian adults receive 10-15 hours of informal learning weekly.[20]

FIGURE 9: THE OPEN LEARNING SYSTEM

---

19   For further information on certified and non-certified learning taxonomies refer to the reports by Powley & Childs, 2005 UNESCO, 2015; UNESCO Institute for Statistics, 2012.

20   From Kolb & Kolb, 2005.

HUMAN CAPITAL SUPPLY

The outcome of human capital development is the development of competencies—the knowledge, skills, experiences and attributes that enable individuals to complete a task. We cluster competencies into two types: (1) enabling competencies and (2) task-specific competencies. Refer to Figure 10 for a breakdown of a study completed in Calgary for the competency demand by sector.

Enabling Competencies

Enabling competencies are foundational to an individual's adaptive capacity and apply to an individual's intellectual and personality resources. These resources are not context-specific and can be used across diverse situations. Evidence shows that enabling competencies are critical to employability. Researchers commonly include problem-solving, collaboration, communication, core literacies, self-regulation, and others in enabling competencies.[21] Due to their transferable nature, research consistently shows that the demand for enabling competencies exceeds task-specific competencies.[22]

Task-Specific Competencies

Task-specific competencies are the relevant knowledge, skills, values, experience, and abilities needed to complete a specific job. Task-specific competencies incorporate functional competencies (e.g., computer programming), sectoral competencies (e.g., expertise in an industry), or organization-level competencies (e.g., start-up expertise).

Functional Competencies

Functional competencies are required to complete a specific role (e.g. accountant, project manager, chef, nurse, software developer). These competencies can often be adapted and applied across different sectors. Like enabling competencies, the value of functional competencies is horizontal, as they run across the economy, providing maximum agility to people and organizations.[23] Sector-specific contexts may influence functional competencies ranging from management and operations to marketing to accounting.

Functional competencies are often contextualized for a specific sector. For example, marketing in financial services may require exact knowledge of the financial services market, IT support, and detailed knowledge of systems architecture and program functionality. One Canadian study found that the demand for functional competencies was between three and seven times greater than for sectoral competencies.[24]

Sectoral Competencies

Sectoral competencies are the unique contextual knowledge or competencies needed to complete a specific role within a defined sector. For example, a sector may have unique regulatory, legal, or historical contexts that influence a functional role (e.g. an accountant in oil and gas may require specialized knowledge compared to an accountant in the financial services sector). The challenge here is the highly contextual nature of sub-sectors within an industry. For instance, oil and gas comprise dozens of specialized sub-sectors, starting with upstream, midstream, and downstream— each stream involves unique competencies and mindsets. Additional specialization is tied to exploration, drilling, transportation, refining, and distribution within these sub-sectors.

---

21   For further information on enabling competencies refer to studies by Finch et al., 2023 Chamorro-Premuzic et al., 2010 Finch et al., 2013; Elhussein et al., 2023.

22   From Finch et al. 2013b and Finch et al., 2023.

23   For further information on functional competencies refer to studies by Parry & Jackling, 2015.

24   From the Calgary Learning System Audit available from https://www.learningcity.ca/s/Policy-Report-Calgary-Learning-System-Audit-2022.pdf
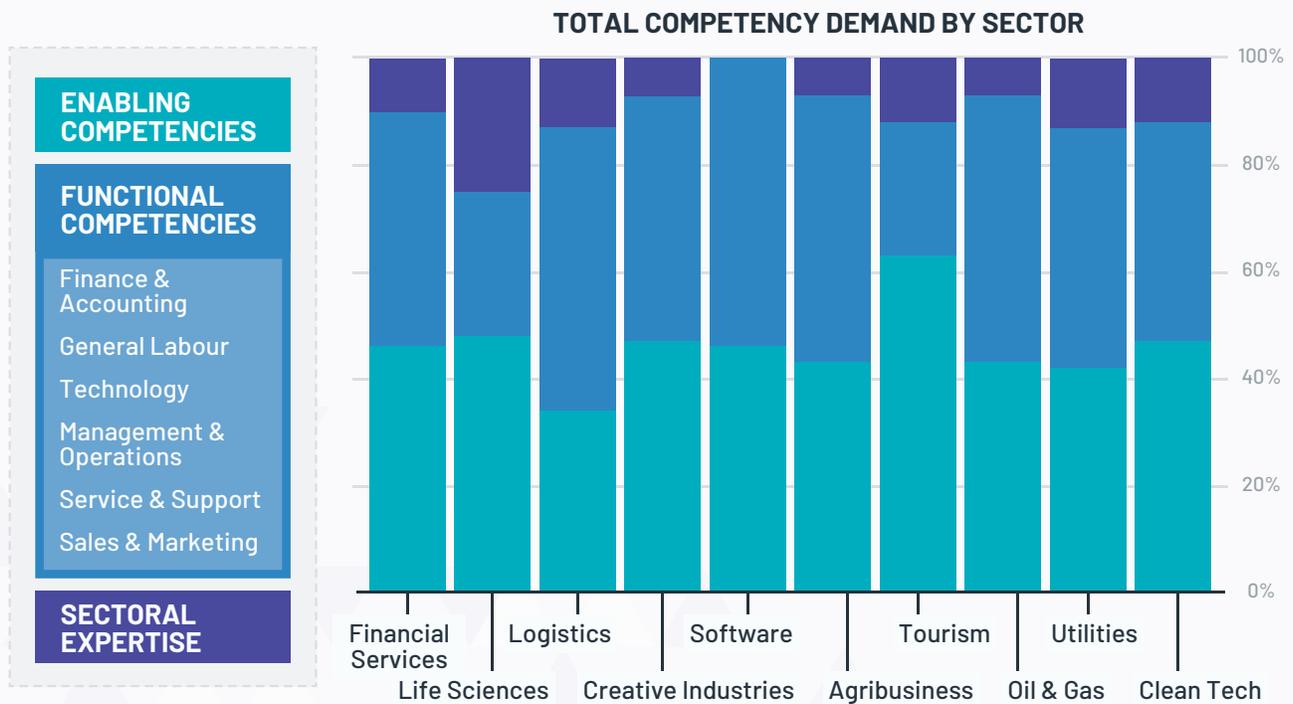
Organizational Competencies

Like industry sector context, an organization's context may influence the types of competencies required. Organizational context may include size, ownership structure, product and service scope, and geographic reach. For example, the competencies needed for a sales manager in a start-up technology company may be vastly different from those required for a sales manager in a technology company with 50,000 employees operating in 100 countries.

Social Capital

Social capital encompasses the tangible and intangible value derived from networks of relationships—both strong ties (e.g., family, close friends) and weak ties (e.g., acquaintances, professional contacts)—that collectively bind individuals to their communities and broader society.[25] These networks facilitate trust, reciprocity, and access to resources, enabling collective action and individual opportunity. While close relationships provide emotional support, weaker or more diverse connections often bridge social divides, exposing individuals to new ideas, resources, and pathways beyond their immediate comfort zones.

FIGURE 10: COMPETENCY DEMAND

TOTAL COMPETENCY DEMAND BY SECTOR

ENABLING COMPETENCIES

FUNCTIONAL COMPETENCIES
- Finance & Accounting
- General Labour
- Technology
- Management & Operations
- Service & Support
- Sales & Marketing

SECTORAL EXPERTISE

Financial Services · Logistics · Software · Tourism · Utilities

Life Sciences · Creative Industries · Agribusiness · Oil & Gas · Clean Tech
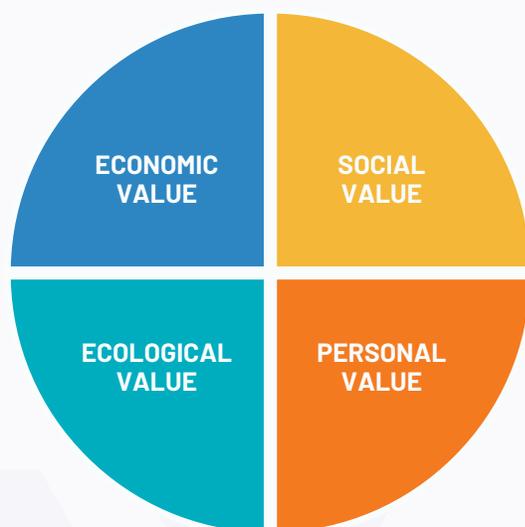
---

25   Refer to Lin, 2017.

VALUE CREATION

Value creation considers the impact of human capital at three distinct levels: individual, organizational, and community (e.g. city, country). For decades, researchers have explored effective methodologies to quantify this value. While traditional approaches often focus narrowly on economic measures, contemporary frameworks recognize that value creation extends to encompass broader dimensions of value.

Multidimensional frameworks developed by diverse groups, including the OECD and the New Zealand Government, mark a significant advancement in how societies conceptualize and measure value. By integrating economic, social, personal, and ecological indicators, these approaches provide a more complete picture of multidimensional value. They acknowledge that while economic value remains important, it must be balanced with other forms of value creation. As countries grapple with complex challenges, these comprehensive frameworks guide the allocation of resources to maximize productivity and drive social and economic prosperity.

FIGURE 11: MULTI-DIMENSIONAL VALUE

Economic Value

The economic dimension is the foundation of traditional value measurement, though contemporary approaches have significantly expanded its scope. GDP remains a crucial starting point, but modern frameworks incorporate measures of income inequality, including economic insecurity, housing affordability, and intergenerational wealth.[26]

Social Value

Social outcomes represent the connective tissue that binds communities together. The OECD measures multiple aspects of social value, including trust in institutions and fellow citizens. Current data reveals concerning trends, with only 40 percent of people across OECD countries reporting trust in their national governments.[27] Social connections and civic participation serve as additional critical indicators, as they correlate strongly with both individual life satisfaction and community resilience.

Safety represents another vital component of social value. New Zealand's approach examines both objective crime statistics and subjective feelings of security, recognizing that perception often matters as much as reality in shaping lived experience. The framework also evaluates the sense of belonging and experiences of discrimination, capturing how inclusive societies foster stronger social bonds. These measures gain particular importance in diverse societies, where social cohesion requires deliberate nurturing across cultural divides.

---

26   King et al., 2018.
27   OECD, 2022b.

Personal Value

At the individual level, value measurement focuses on human capabilities and potential. The OECD framework examines educational attainment and competency development, recognizing these as fundamental to personal growth and economic participation. Health outcomes feature prominently, with metrics extending beyond physical health to include mental value and life satisfaction. New Zealand's approach incorporates cultural identity and spiritual value, particularly important for indigenous populations and multicultural societies.

These personal dimensions interact powerfully with other value aspects. For instance, strong social connections can enhance mental health, while economic stability enables greater investment in education and personal development. The frameworks acknowledge these interconnections through composite indicators that reveal how different life domains interact and influence one another. This systems perspective helps policymakers avoid siloed thinking when designing interventions.

Ecological Value

The ecological dimension represents the most significant evolution in value measurement. Both the OECD and New Zealand Living Standard frameworks recognize that environmental sustainability forms the essential precondition for all other forms of prosperity. Key indicators include air and water quality, biodiversity levels, and greenhouse gas emissions. New Zealand's approach places particular emphasis on indigenous environmental knowledge and sustainable land-use practices.

These ecological measures reflect a growing understanding that human value cannot be sustained on a planet that is degraded. The frameworks incorporate both current environmental conditions and forward-looking indicators of sustainability, recognizing that true prosperity must extend to future generations. This long-term perspective represents a fundamental shift from traditional economic measurement, which often overlooks environmental externalities.

Table 1 shows sample measures across each of the four dimensions. This table illustrates the potential for human capital outcome measures to be aggregated from the individual to the organization to the labour market level.

DIMENSION 6
ROLN HQ

ROLN's mission is to maximize the regional human capital ecosystem's capacity by synchronizing network resources to drive innovation. To achieve this, we propose establishing an independent ROLN backbone organization (the ROLN HQ) to oversee coordination efforts.

In collective impact frameworks, particularly in community development, backbone organizations serve as independent entities that facilitate collaboration across ecosystems. They provide the necessary structure, resources, and leadership to align diverse stakeholders around shared priorities, which are critical to partnership success.

Specifically, ecosystem backbone organizations educate stakeholders on key initiatives, foster trust and collaboration, facilitate challenging discussions, support members' efforts, and empower stakeholders to act as change agents.

The ROLN HQ should be governed by a board representing key stakeholders and staffed through secondments from ROLN partners. This ensures expertise from across the ecosystem, including learning providers, employers, credentialing bodies, and policymakers.[28]

To strengthen collaboration, the ROLN HQ will leverage six core mechanisms: shared vision, to align stakeholders around common goals; empowerment, enabling members to take ownership of initiatives; knowledge sharing, facilitating the exchange of insights and best practices; common taxonomy, standardizing terminology for clarity; harmonized measurement, establishing consistent metrics for success; and a commitment to continuous learning, encouraging adaptability and improvement.

A compelling shared vision emerges from trust, balanced relationships, mutual risk-sharing, and reciprocal value.
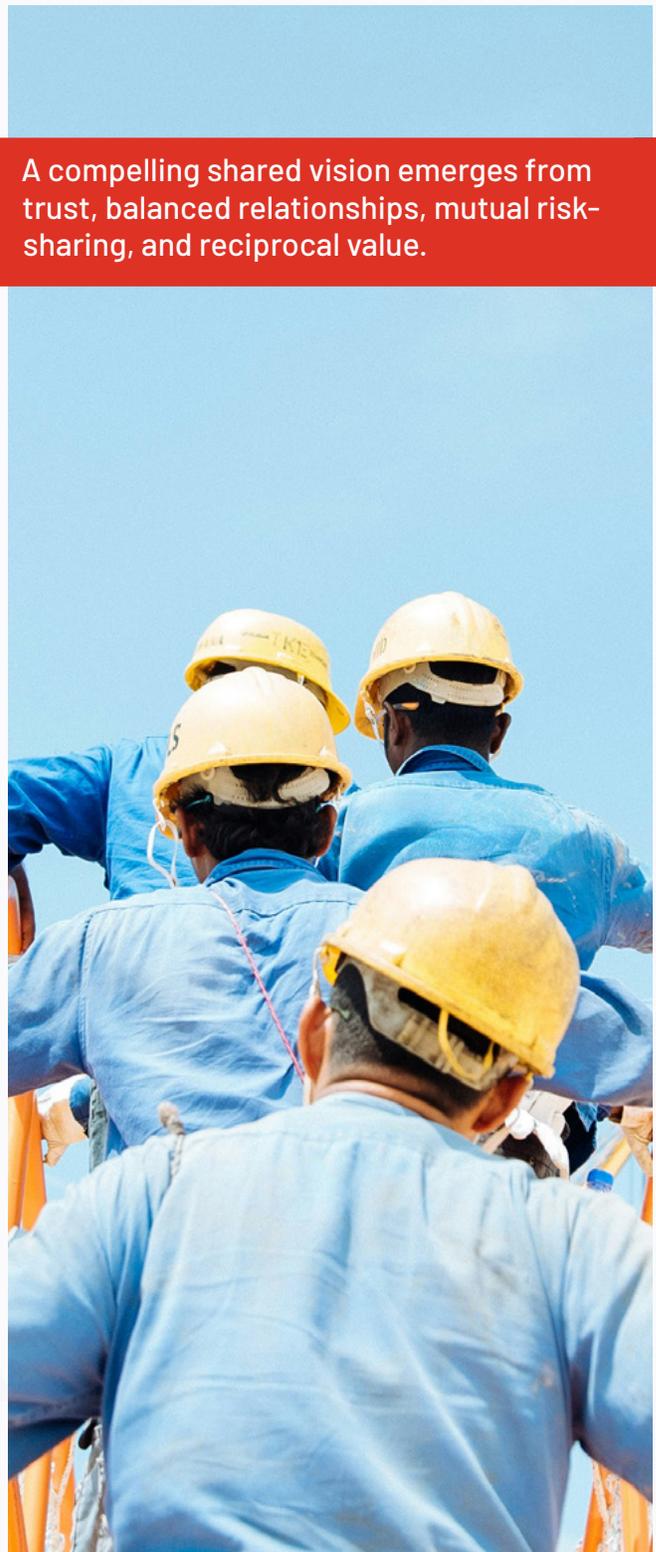
28   For further information on the role of coordination, refer to DuBow, 2018; Sirmon et al. 2011; Teece, 2018; Barney et al., 2021; Hitt et al., 2011; Sheffi, 2012; Saccani, 2023.

MECHANISM 1: COMMITMENT TO A SHARED VISION

Modern supply chain networks depend on more than operational efficiency—they require alignment among all partners. A shared vision serves as the critical foundation for this alignment, representing a collectively defined future state that all participants commit to creating together.

Unlike imposed mandates, a compelling shared vision emerges from trust, balanced relationships, mutual risk-sharing, and reciprocal value. It harmonizes diverse partner objectives into a unified direction while preserving each organization's unique priorities. Most importantly, it creates organic motivation for partners to dedicate resources and sustain commitment to collective goals.

While essential, a shared vision alone cannot ensure lasting collaboration. Network partners must also establish clear strategic guidelines, including boundary rules to define scope, priority rules to focus efforts, timing rules to synchronize actions, process rules to streamline operations, and evaluation rules to measure progress.

This dual alignment—on both the inspirational vision and the practical rules of engagement—enables supply chain networks to move beyond temporary cooperation to achieve enduring, transformative results. The most successful networks combine this strategic clarity with the support of a dedicated backbone organization to maintain momentum and adapt to changing conditions. By implementing this approach, modern supply chains can transition from loose collections of partners to truly integrated, value-driven ecosystems.

Lacking a common taxonomy has become a substantial barrier to managing human capital.

MECHANISM 2: EMPOWERMENT

The legacy education-to-employment pipeline was built on rigid hierarchies and centralized control. ROLN disrupts this model by embracing open innovation, fundamentally redefining the roles of all stakeholders in the human capital supply chain.

Under this new paradigm, learners transition from passive recipients to designers and owners of their learning pathways. They gain the agency to define personalized learning goals and curate dynamic learning pathways tailored to their aspirations.

Employers shift from mere talent consumers to full partners in this human capital ecosystem. Their role expands to include co-creating learning content, participating in competency assessment, and making targeted investments in human capital development. Policymakers and learning providers move beyond traditional command-and-control functions. Instead, they adopt roles as ecosystem facilitators, social investors, and collaborative partners, working alongside other stakeholders to build a more responsive and effective learning infrastructure.

This represents more than incremental improvement - it's a complete transformation of how a region unlocks human potential. By distributing agency and fostering co-creation, ROLN creates an adaptive, demand-driven system that aligns learning with the evolving needs of the workforce and economy. The result is an open learning system that is more dynamic, more equitable, and better equipped to meet the challenges of tomorrow's labour market.

MECHANISM 3: COMMITMENT TO KNOWLEDGE SHARING

ROLN depends on open and efficient knowledge sharing across the supply chain network. Effective knowledge-sharing diffuses knowledge across a network, generating incremental knowledge. However, knowledge sharing depends on two factors: (1) partners being open to sharing knowledge across the network; and (2) efficient channels for facilitating this knowledge sharing.[29]

MECHANISM 4: A COMMON TAXONOMY

A consistent taxonomy and associated definitions are among the most significant barriers facing supply chain network professionals. Similarly, lacking a common taxonomy has become a substantial barrier to managing human capital. For example, there is no commonly adopted label for enabling competencies. One study of competency models identified that each enabling competency (e.g. problem-solving, verbal communication) had an average of twelve different names (or labels).

Competencies are the currency of the labour market, so a common competency taxonomy and associated definitions are essential for operationalizing every dimension of ROLN, from identifying market demand to developing resources to delivering competency outcomes.[30]

MECHANISM 5: HARMONIZED MEASUREMENT

One of the most significant risks facing employers is verifying an individual's development and competencies. However, today's competency quality assurance mechanisms are primarily a patchwork of ad hoc proxies. ROLN embeds consistent competency quality assurance mechanisms, including common competency assessment and verification. Quality assurance mechanisms depend on harmonized competency measurement across supply chain network partners. All partners commit to collectively exploiting new and shared knowledge that drives continuous improvement. Moreover, by establishing a common taxonomy and harmonized measurement, ROLN enables advanced demand forecasting to guide resource allocation.[31]

---

29   For further information on knowledge sharing, refer to studies by Dovbischuk, 2022 Schotter et al., 2017 Brannen & Thomas, 2010.
30   For further information on a common taxonomy, refer to studies by Stek & Schiele, 2021; Finch et al. 2020.
31   For further information on harmonized measurement, refer to studies by Pedulla, 2020; Noe, 2020.

TABLE 1: SAMPLE MULTI-LEVEL OUTCOME MEASURES

REGIONAL	ORGANIZATIONAL	INDIVIDUAL
ECONOMIC OUTCOME MEASURES		
% of labour force employed	Full-time Equivalent (FTEs)	Employment status
Aggregated after-tax median income	Income dispersion	After-tax income
Aggregated % of income allocated to shelter	N/A	% of income allocated to shelter
PERSONAL OUTCOME MEASURES		
Aggregated health outcomes	Absenteeism for health reasons	Individual health outcomes
Aggregated perceived sense of purpose	Perceived sense of purpose of employees	Perceived sense of purpose
Aggregated % of adults (18+) active in learning activities in the past 12 months	Employees have been active in learning activities in the past 12 months	Active in learning activities in the past 12 months
Aggregated literacy rate	Literacy rate	Literacy level
SOCIAL OUTCOME MEASURES		
Aggregated perceived social isolation	Perceived social isolation of employees	Perceived social isolation
Aggregated perceived overall quality of life	Perceived overall quality of life of employees	Perceived overall quality of life
The aggregated perception is that the region is welcoming and inclusive	The perception that the workplace is welcoming and inclusive	The perception is that the region and workplace are welcoming and inclusive
Aggregated property crime	Workplace safety data	Perceived personal safety
ECOLOGICAL OUTCOME MEASURES		
Aggregated ecological footprint	Ecological footprint of the organization	Individual ecological footprint
Aggregated primary access to a transit network	% of labour force who use public transportation as the primary mode	Access to a transit network
Aggregated proximity to parks and open spaces	Proximity of workplace to parks and open spaces	Proximity to parks and open spaces

THE EVOLVING ROLE OF STAKEHOLDERS IN ROLN

A network of stakeholders, including individuals, learning providers, employers, credentialing bodies, and policymakers, contributes to developing and deploying human capital. Below, we profile the evolving role of stakeholders in ROLN.

INDIVIDUAL

Current Role

Learning Ladder: Social conditioning plays a significant role in establishing learning as a key stage in life. Individuals are conditioned to pursue credentials that will secure future employment.

Systemic Inequities: The legacy learning system amplifies social systemic inequities.

Pursue Jobs: Social conditioning creates a goal of pursuing a job and building a career.

Future Role

Continuous Learning: Adaptive capacity empowers continuous learning. This model empowers individuals to map personalized development pathways aligned with their personal and professional goals.

Adaptive Capacity: Adaptive capacity is a foundational competency as employers prioritize candidates with flexibility, resilience, and the capacity to thrive in uncertain situations.

Unlock Potential: The unbundled open learning model unlocks labour force potential by removing systemic inequities.

LEARNING PROVIDER

Current Role

Industrial Education: The legacy learning and labour market model remains deeply rooted in a 19th-century industrial education framework that ties learning to age. Life expectancy has doubled significantly since 1900, leading to an extended working life.

Inflexible System: The legacy learning system remains occupation-centric, developing and identifying competencies anchored to an occupation. This results in a rigid labour market with both competency surpluses and shortages.

Lack of Agility: Existing certified learning systems do not possess the agility to adapt to dynamic needs.

Future Role

Open Learning: Open learning unlocks the potential of a complete learning system. The unbundling of learning pathways and assessment establishes a transparent, harmonized, technology-enabled open recognition system which embeds competency assessment.

Prioritizing Adaptive Capacity: Adaptive capacity is a foundational system competency, especially in K-12. This prioritizes developing the capacity to learn, unlearn, and relearn.

Task-Specific Competencies: Open learning incentivizes the expansion of innovative specialized learning providers to facilitate the continuous development of task-specific competencies.

CREDENTIALING BODY

Current Role

Industrial Education: Credentialing remains government-centric and anchored to the industrial learning ladder.

Occupation Centric: The current credentialing system remains occupation-centric.

Fragmentation and Legitimacy: Market pressures lead to the mass fragmentation of micro-credentials, each with decreasing perceived legitimacy by employers. This, in turn, incentivizes employers to use proxies to manage risk.

Future Role

Automation and Assessment: Automation increases the efficiency and rigour of competency assessment, removing a significant barrier to scaling and creating a path for harmonized open recognition. This unlocks the capacity of non-certified and informal learning pathways and individuals in the labour market with highly valued competencies but no associated credentials. The result is a labour market that shifts from credentials to competencies.

🏛 POLICYMAKERS

Current Role

Inertia: Policymakers recognize that the current learning system is not delivering on emerging demands, but the scope of the changes and political risk contribute only to incremental changes.

Economics: The continued incremental changes to the industrial model led to an unsustainable business model. Attempts to pursue alternative revenue streams (e.g., international students) increased risk and diluted outcomes.

Systemic Inequities: The existing learning paradigm reinforces systemic inequities in the labour market.

Contingent Labour: The rapid rise of contingent labour has led to a lag in policy expansion, exposing some labour market segments.

Task-Specific Prioritization: Policymakers prioritize task-specific competencies because they can deliver immediate economic value and short-term political wins.

Future Role

Open Learning: Introduce open learning to unlock the potential of the entire learning system. The unbundling of learning pathways and establishing a transparent, harmonized, blockchain-enabled open recognition system embedding competency assessment.

Continuous Learning Funding: The introduction of open learning shifts funding from institutions to individuals through continuous learning accounts. This funding empowers individuals to invest in their unique learning pathways. The increased learning pathway competition reduces budget pressures.

Prioritizing Adaptive Capacity: Policymakers prioritize adaptive capacity as a foundational system competency, especially from K-12. This prioritizes developing the capacity to learn, unlearn, and relearn.

Task-Specific Competencies: Open learning policies incentivize the expansion of innovative specialized learning providers to facilitate the continuous development of task-specific competencies.

Unlock Potential: The open learning model unlocks labour force potential by removing systemic inequities.

Contingent Labour: Policymakers introduce policies to support contingent labour while maximizing the flexibility that individuals and employers seek.

🏠 EMPLOYER

Current Role

Competency Mismatch: Growing competency mismatch intensifies talent competition.

Proxy Dependent: Recruitment is a risk management exercise. Firms have adopted various proxies to manage this risk, ranging from amplifying demand for credentials to professional references.

Systemic Bias: In practice, these proxies play little role in managing risk; however, they play a significant role in deepening systemic labour market biases and suppressing opportunities.

Task-Specific Prioritization: Many employers prioritize task-specific competencies because they can deliver immediate economic value to an organization. Hence, organizations hire specific jobs (e.g., accountant), and these individuals could maintain a relatively linear occupation-centric pathway.

Professional Development: Most professional development is limited to larger organizations with training budgets. Smaller firms, representing 75 percent of the labour market, underinvest because it is perceived as a cost out of fear of incentivizing employee churn.

Future Role

Adaptive Prioritization: Adaptive capacity has become a foundational competency for many employers, as employers prioritize candidates with flexibility, resilience, and the capacity to thrive in a VUCA future.

Adaptive Roles: Firms shift from conventional job structures to emphasizing more flexible, boundary-spanning roles. Shift from forecasting jobs to forecasting competency supply and demand.

Competency Verification: Risk management plays a critical role in the recruitment process, but open learning establishes a blockchain-enabled open recognition system, including a harmonized standard for visual tokens with a rich, defined metadata structure. This allows employers to have transparent access to evidence and demonstrate relevant competence.

Employers Adapt: Employers develop highly flexible and fluid on- and off-ramps for staff to support ongoing development.

THE PATH FORWARD

A region's competitive advantage has shifted from being close to natural resources to its ability to develop and utilize human capital, which is reflected in its labour market. However, labour markets worldwide are currently facing increased volatility and uncertainty, leading to a growing disconnect between the supply and demand for competencies.

This report introduces ROLN, a conceptual human capital supply chain. ROLN is envisioned as a collaborative and open network that includes various stakeholders, such as individuals, learning providers, employers, credentialing bodies, and policymakers. The biggest challenge for economic regions is not external factors, but rather the ingrained rules, routines, practices, and cultures that shape mindsets and behaviours. Consequently, the most significant risk to an economic region is inertia.

To address this, the most effective approach is to break ROLN down into manageable steps. For instance, ROLN is based on collaboration and trust. Given the fragmented nature of the current human capital ecosystem, many key stakeholders may lack existing relationships. For example, few employers have connections with local K-12 school systems or non-certified learning providers. Building these relationships is crucial for creating a sustainable ecosystem.

As a first step, we recommend that a region establish an ROLN feasibility task force that lasts for 12 months. This task force could be hosted by the regional economic development agency or the Chamber of Commerce. It should include representatives from across the ecosystem, such as learning providers, employers, credentialing bodies, and policymakers. The task force could be staffed through secondments from partner organizations to help foster a culture of collaboration within the ecosystem. Its mandate will be to assess the feasibility of implementing ROLN in the region by completing three specific tasks:

STEP 1: COMPLETE A REGIONAL HUMAN CAPITAL DATA AUDIT

The task force will first complete an audit of all existing regional human capital initiatives.

- What data is being collected?
- Who is collecting the data?

This audit provides a baseline for identifying existing supply and demand data, potential data gaps, and opportunities to explore pathways to consolidating data collection and analysis at a regional level.

STEP 2: COMPLETE A REGIONAL HUMAN CAPITAL SUPPLY–DEMAND AUDIT

Following the technical guidelines of Report 3 in this series, complete three supply-demand audits:

1. Regional competency demand audit
2. Regional competency supply audit
3. Regional open learning system audit

STEP 3: COMPLETE A FEASIBILITY ANALYSIS OF ROLN

After completing Steps 1 and 2, the task force will have the baseline data to complete a feasibility analysis of implementing ROLN in their region. This would consider the policy, funding, governance, and operational implications of ROLN. Key considerations include the commitment of stakeholders collaborating towards a common taxonomy, knowledge-sharing mechanisms, foresight planning, and harmonized measurement. In addition, this feasibility analysis must evaluate the implications of not implementing ROLN.

BIBLIOGRAPHY

Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology displaces and reinstates labour. *Journal of Economic Perspectives, 33*(2), 3-30.

Akan, M., Barrero, J. M., Bloom, N., Bowen, T., Buckman, S., Davis, S. J., ... & Wilke, L. (2024). *Americans Now Live Farther from Their Employers*. Retrieved from https://wfhresearch.com/wp-content/uploads/2024/03/Americans-Now-Live-Farther-From-Their-Employers.pdf

Alan, S., Baysan, C., Gumren, M., & Kubilay, E. (2024). *The persistence of remote work* (NBER Working Paper No. 32183). National Bureau of Economic Research.

Amir, R. (2024). Measuring regional competitiveness through the regional development index. *Gorontalo Development Review, 7*(2), 196–210.

Anielski, M. (2007). The economics of happiness – building genuine wealth. *New Society Publishers*. Retrieved from https://www.truevaluemetrics.org/DBpdfs/Ideas/MarkAnielski/The-economics-of-happiness-Building-genuine-wealth.pdf

Arora, H. (2019). *Apple App Store Statistics 2024 – Trends and Figures*. Big Oh Notation.

Arora, K. (2023, April 24). What is a labour market? *Labour Market Information Council*. Retrieved from https://lmic-cimt.ca/what-is-a-labour-market/

Association of Supply Chain Management. (2022). *Supply Chain Operations Reference Model SCOR Digital Standard*. Retrieved from https://www.ascm.org/corporate-solutions/standards-tools/scor-ds/

Autor, D. (2022). The labour market impacts of technological change: From unbridled enthusiasm to qualified optimism to vast uncertainty (No. w30074). *National Bureau of Economic Research*.

Azar, J., Marinescu, I., & Steinbaum, M. (2020). Labor market concentration. *The Journal of Human Resources, 57*(S), S167–S199. https://doi.org/10.3368/jhr.monopsony.1218-9914r1

Barney, J. B., Ketchen Jr, D. J., & Wright, M. (2021). Resource-based theory and the value creation framework. *Journal of Management, 47*(7), 1936-1955.

Bleidorn, W., Schwaba, T., Zheng, A., Hopwood, C. J., Sosa, S. S., Roberts, B. W., & Briley, D. A. (2022). Personality stability and change: A meta-analysis of longitudinal studies. *Psychological Bulletin, 148*(7-8), 588.

Bomal, Laure-Anna (2023). *Small businesses in Canada hit hard: The big financial toll of labour shortages—Canadian Federation of Independent Business*. Retrieved from https://www.cfib-fcei.ca/en/research-economic-analysis/financial-impact-labour-shortages-in-canada

Borgos, J., Kinser, K., Kline, L. (2023). The Borderless Market for Open, Distance, and Digital Education. In: Zawacki-Richter, O., Jung, I. (eds) *Handbook of Open, Distance and Digital Education*. Springer, Singapore. https://doi.org/10.1007/978-981-19-2080-6_22

Brannen, M. Y., & Thomas, D. C. (2010). Bicultural individuals in organizations: Implications and opportunity. *International Journal of Cross-Cultural Management, 10*(1), 5-16.

Chamorro-Premuzic, T., Arteche, A., Bremner, A. J., Greven, C., & Furnham, A. (2010). Soft skills in higher education: Importance and improvement ratings as a function of individual differences and academic performance. *Educational Psychology, 30*(2), 221-241.

Chesbrough, H. (2017). The Future of Open Innovation: IRI Medal Address. The future of open innovation will be more extensive, collaborative, and engaged with a wider variety of participants. *Research-Technology Management, 60*(6), 29–35.

Che, Y., & Zhang, L. (2018). Human capital, technology adoption and firm performance: Impacts of China's higher education expansion in the late 1990s. *The Economic Journal, 128*(614), 2282–2320.

Christopher, M., & Holweg, M. (2017). Supply chain 2.0 revisited: a framework for managing volatility-induced risk in the supply chain. International *Journal of Physical Distribution & Logistics Management, 47*(1), 2-17.

Conference Board of Canada. (2019) *Building Skills Connections Series: Skills for a Prosperous Alberta*. Retrieved from https://www.conferenceboard.ca/focus-areas/education-skills/building-skills-connections-series?AspxAutoDetectCookieSupport=1

Cunha, F., & Heckman, J. (2007). *The technology of skill formation. American Economic Review, 97*(2), 31–47.

De Geus, A. P. (1988 March/April). Planning as learning. *Harvard Business Review*, 70-74.

Di Battista, A., Grayling, S., Játiva, X., Leopold, T., Li, R., Sharma, S. & Zahidi, S. (2025). Future of Jobs Report 2025. *World Economic Forum.* Retrieved from https://www.weforum.org/publications/the-future-of-jobs-report-2025/

Di Battista, A., Grayling, S., Hasselaar, E., Leopold, T., Li, R., Rayner, M., & Zahidi, S. (2023, May). Future of Jobs Report 2023. In the *World Economic Forum*, Geneva, Switzerland. https://www.weforum.org/reports/the-future-of-jobs-report-2023

Dovbischuk, I. (2022). Innovation-oriented dynamic capabilities of logistics service providers, dynamic resilience and firm performance during the COVID-19 pandemic. *The International Journal of Logistics Management*, 33(2), 499-519.

DuBow, W., Hug, S., Serafini, B., & Litzler, E. (2018). Expanding our understanding of backbone organizations in collective impact initiatives. *Community Development*, 49(3), 256-273.

Durand, M. (2015). The OECD Better Life Initiative: How's life? and the measurement of well-being. *Review of Income and Wealth*, 61(1), 4–17.

edX for Business (2023). *Navigating the Workplace in the Age Of AI.* Retrieved from https://campus.edx.org/hubfs/B2B%20PDFs/edX_Workplace_Intelligence_AI_Report.pdf

Elhussein, G., Leopold, T., Silva, A., & Zahidi, S. (2023, January). Defining education 4.0: A taxonomy for the future of learning. In the *World Economic Forum, white paper* (pp. 1–28).

Finch, D. J., Levallet, N., Saunders, C., Field, E., Ribeiro, J., Raby, S., ... & Campbell, A. (2023). A dynamic capability view of career adaptation: an exploratory study. *Education+ Training*, 65(5), 769–789.

Finch, D. J & Levallet, N. (2020). A dynamic capabilities view of talent acquisition: quality assurance and risk management. Included in: *A Dynamic Look at Organizational Behaviour Topics.* Edward Elgar Publishing: Cheltenham. U.K.

Finch, D. J., Peacock, M., Levallet, N., & Foster, W. (2016). A dynamic capabilities view of employability: Exploring the drivers of competitive advantage for university graduates. *Education+ Training*, 58(1), 61–81.

Finch, D. J., Hamilton, L. K., Baldwin, R., & Zehner, M. (2013). An exploratory study of factors affecting undergraduate employability. *Education+ training*, 55(7), 681-704.

Finch, D. J., Nadeau, J., & O'Reilly, N. (2013). The future of marketing education: A practitioner's perspective. *Journal of Marketing Education*, 35(1), 54–67.

Government of Ontario. (2020). *Intellectual Property in Ontario's Innovation Ecosystem.* Retrieved from https://www.ontario.ca/document/report-intellectual-property-in-ontarios-innovation-ecosystem/introduction#:~:text=Figure%201%20shows%20a%20shift%20in%20the,(17%)%20to%20the%20majority%20(91%)%20in%202019

Gruzina, Y., Firsova, I., & Strielkowski, W. (2021). Dynamics of human capital development in economic development cycles. *Economies*, 9(2), 67.

Guastella, G., & Timpano, F. (2016). Knowledge, innovation, agglomeration and regional convergence in the EU: motivating place-based regional intervention. *Review of Regional Research*, 36, 121-143.

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring. *American Psychologist*, 53(4), 449.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics*, 24(3), 411-482.

Hirt, M., Smit, S., & Bradley, C. (2011). The strategic yardstick you can't afford to ignore. *McKinsey Quarterly*.

Hitt, M. A., Ireland, R. D., & Sirmon, D. G. (2011). Creating value for individuals, organizations, and society social capital to the management of multinational enterprises in Asia and west view project all things great and small: Organizational size, boundaries of the firm and a changing environment view. *Academy of Management Perspectives*, 25(2), 57–75.

Ivanov, D., Tsipoulanidis, A., & Schönberger, J. (2021). Basics of supply chain and operations management. *Global Supply Chain and Operations Management*: A Decision-Oriented Introduction to the Creation of Value, 3-19.

King, A. (2018). *Living standards analysis model: The first prototype* (No. 18/05). New Zealand Treasury Working Paper. Retrieved from https://www.econstor.eu/bitstream/10419/205710/1/twp2018-05.pdf

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education*, 4(2), 193-212.

Kotsantonis, S., & Serafeim, G. (2020). Human capital and the future of work: Implications for investors and ESG integration. *Journal of Financial Transformation*, 51, 115-130.

KPMG (2022). The future of higher education in a disruptive world. KPMG. Retrieved from https://kpmg.com/xx/en/what-we-do/industries/government/education/the-future-of-higher-education-in-a-disruptive-world.html

Krishnan, K. (2020). Our education system is losing relevance. Here's how to unleash its potential. In the *World Economic Forum*, Geneva, Switzerland, https://www.weforum.org/agenda/2020/04/our-education-system-is-losingrelevance-heres-how-to-update-it

Lane, J. & Griffiths, J. (2023). Matching People with Jobs & Jobs with People. *Canada West Foundation.* Retrieved from https://cwf.ca/research/publications/report-matching-people-with-jobs-and-jobs-with-people/

Lanvin, B. & Monteiro. F. (2023). *The Global Competitive Index* 2023. INSEAD. Retrieved from https://www.insead.edu/system/files/2023-11/gtci-2023-report.pdf

Luksha, P., Cubista, J., Laszlo, A., Popovich. M. & Ninenko, I. (2018). Global education futures report: Educational ecosystems for societal transformation. *Global Education Futures Initiative.* Retrieved from https://www.joshuacubista.com/uploads/7/8/9/8/7898654/gef-report.pdf

Madgavkar, A., Schaninger, B., Maor, D., White, O., Smit, S., Samandari, H., Woetzel, L., Carlin, D., & Chockalingam, K. (2023). Performance through people: Transforming human capital into competitive advantage. *McKinsey Global Institute.* Retrieved from https://www.mckinsey.com/mgi/our-research/performance-through-people-transforming-human-capital-into-competitive-advantage

Murgatroyd, S. (2024a). *The future of higher education in an age of artificial intelligence.* Ethics Press.

Murgatroyd, S. (2024b). Interregnum: disruption and the in-between time for higher education. *Journal of Open, Distance, and Digital Education*, 1(2), 1-14.

American National Standards Institute (ANSI). (n.d.). *Credentialing Bodies.* Retrieved from https://www.ansi.org/

Noe, R. A. (2020). *Employee training and development.* McGraw-Hill.

OECD. (2001). *The well-being of nations: The role of human and social capital.* OECD Publishing. https://doi.org/10.1787/9789264189515-e

OECD (2025). *OECD geographical definitions.* OECD. Retrieved from https://www.oecd.org/en/data/datasets/oecd-geographical-definitions.html

Osiobe, E. U. (2019). A literature review of human capital and economic growth. *Business and Economic Research*, 9(4), 179-196.

Parry, N., & Jackling, B. (2015). How do professional financial services firms understand their skill needs and organize recruitment practices? *Accounting Education*, 24(6), 514–538.

Pedulla, D. (2020). Making the Cut: Hiring Decisions, Bias, and the Consequences of Nonstandard, Mismatched, and Precarious Employment. *Princeton University Press.*

Pelinescu, E. (2015). The impact of human capital on economic growth. *Procedia Economics and Finance*, 22, 184-190.

Peter, M. K., & Jarratt, D. G. (2015). The practice of foresight in long-term planning. *Technological Forecasting and Social Change*, 101, 49-61.

Powley, R., & Childs, E. (2005). Council of ministers of education, *Canada Research Report.* Retrieved from: https://www.academia.edu/download/54875696/Final_Report_May_31_-_V7.pdf

Powell, W., Frachetti, M., Pulak, C., Bankoff, H. A., Barjamovic, G., Johnson, M., ... & Yener, K. A. (2022). Tin from Uluburun shipwreck shows small-scale commodity exchange fueled continental tin supply across Late Bronze Age Eurasia. *Science Advances*, 8(48).

Reid, J. R., & Anderson, P. R. (2012). Critical thinking in the business classroom. *Journal of Education for Business*, 87(1), 52-59.

Rezapour, S., Farahani, R. Z., Ghodsipour, S. H., & Abdollahzadeh, S. (2011). Strategic design of competing supply chain networks with foresight. *Advances in Engineering Software*, 42(4), 130–141.

Rivera, L., Sheffi, Y., & Welsch, R. (2014). Logistics agglomeration in the US. *Transportation Research Part A: Policy and Practice*, 59, 222-238.

Robert Half (2025). Canada Remote Work Statistics and Trends for 2025. Retrieved from https://www.roberthalf.com/ca/en/insights/research/canadian-remote-work-statistics-and-trends#toc1

Robinson, K., & Aronica, L. (2015). Creative schools: Revolutionizing education from the ground up. Penguin UK.

Borgos, J., Kinser, K., Kline, L. (2023). The Borderless Market for Open, Distance, and Digital Education. In: Zawacki-Richter, O., Jung, I. (eds) *Handbook of Open, Distance and Digital Education.* Springer, Singapore. https://doi.org/10.1007/978-981-19-2080-6_22

Saccani, N., Bressanelli, G., & Visintin, F. (2023). Circular supply chain orchestration to overcome Circular Economy challenges: An empirical investigation in the textile and fashion industries. *Sustainable Production and Consumption*, 35, 469-482.

Sado, E., Cannon, E. & Jenkins, T. (2017). Work-integrated learning provides learners the skills to prepare them for the changing labour market. *Policy Options*. Retrieved from https://policyoptions.irpp.org/magazines/march-2017/linking-the-classroom-and-the-workplace/

Schotter, A., Mudambi, R., Doz, Y. L., & Gaur, A. (2017). Boundary spanning in global organizations. *Journal of Management Studies*, 54(4), 403-421.

Sheffi, Y. (2012). Logistics-intensive clusters: global competitiveness and regional growth. In *Handbook of global logistics: transportation in international supply chains* (pp. 463–500). New York, NY: Springer, New York.

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management*, 37(5), 1390–1412. https://doi.org/10.1177/0149206310385695

Statistics Canada (2024, January 18). *Research to Insights: Working from home in Canada*. Statistics Canada. Retrieved from https://www150.statcan.gc.ca/n1/en/pub/11-631-x/11-631-x2024001-eng.pdf?st=sdelgn2P

Stek, K., & Schiele, H. (2021). How to train supply managers–necessary and sufficient purchasing skills leading to success. *Journal of Purchasing and Supply Management*, 27(4), 100700. https://doi.org/10.1016/j.pursup.2021.100700

Tamilia, R. D., Ferrell, O. C., & Hopkins, K. (2020). *Marketing Channels and Supply Chain Networks in North America: A Historical Analysis*. Springer International Publishing.

Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, 51(1), 40–49.

Trust, T., Carpenter, J. P., & Krutka, D. G. (2017). Moving beyond silos: Professional learning networks in higher education. *The Internet and Higher Education*, 35, 1-11.

UNESCO (2015). UNESCO Global Network of Adaptive Cities - Guiding Documents. *UNESCO Institute for Lifelong Learning*. Retrieved April 17, 2020, from https://uil.unesco.org/fileadmin/keydocuments/LifelongLearning/learning-cities/en-unesco-global-network-of-learning-cities-guiding-documents.pdf

UNESCO Institute for Statistics. (2012). International standard classification of education: ISCED 2011. Montreal: UNESCO Institute for Statistics. Retrieved from: http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf

Wang, C., & Hu, Q. (2020). Knowledge sharing in supply chain networks: Effects of collaborative innovation activities and capability on innovation performance. *Technovation*, 94, 102010.

Wang, J., Ma, F., Bouri, E., & Zhong, J. (2022). Volatility of clean energy and natural gas, uncertainty indices, and global economic conditions. *Energy Economics*, 108, 105904.

Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International Journal of Production Economics*, 176, 98-110.

ACKNOWLEDGEMENTS

THE
Productivity
Project ———

ACLMR

The Alberta Centre for Labour Market Research (ACLMR) is a premier resource for labour market expertise in Canada. It offers unbiased, high-quality information and research on labour markets to inform provincial, regional, and federal policies. The ACLMR is funded by Alberta's Ministry of Jobs, Economy, and Trade. Visit ACLMR.ca

MOUNT ROYAL UNIVERSITY
Institute for Community Prosperity

The Institute for Community Prosperity is a hub of social innovation, systems-learning and community engagement that bridges the knowledge, wisdom and experience of community with academic learning and scholarly insight. We bring together community, students and faculty from across disciplines, sectors and backgrounds to tackle the complex social and ecological challenges of our time. Visit MtRoyal.ca

CANADAWEST FOUNDATION

The Canada West Foundation is the only public policy think tank that focuses on issues that matter to the West. We provide solutions in three areas: resources, environment, and economy; skills, innovation, and productivity; and trade and trade infrastructure. We advance policies that decision makers trust. Visit CWF.ca

LearningCITY

The LearningCITY Collective is an independent, member-founded, and funded organization committed to transforming Calgary into a city that never stops learning. The research and policy group conducts research to stimulate evidence-based policy debate on education, learning, and labour force development. Visit LearningCITY.ca