YALETOWN

The Intelligent Industry

The Investment Activity Catalyzing A New Intelligent Industry Technology Constellation

An Emerging New Category of Technology Investment

The Intelligent Industry represents an unprecedented opportunity to capitalize on the convergence of three key trends—digitalization, transformation, and sustainability—to catalyze climate resilient growth. Yaletown published its seminal paper in 2019, "Intelligent Industry: The Engine Driving Climate Resilient Growth", which highlighted the coming trends and transformations to vast sectors of the traditional economy. Since publishing the paper, new technology companies delivering these solutions continue to see explosive growth in North America and across the globe. Software, data and device technologies are disrupting and modernizing traditional industries, services, real estate, and infrastructure, through a surging and unparalleled wave of adoption. The market driven foundation of the Intelligent Industry is finding opportunities to deliver real value today, while building towards a more resilient future by driving improvements in the productivity of physical capital, infrastructure, and other asset-intensive operations. This convergence will lead to a reduction in natural resource consumption and carbon intensity, enabling climate resilient growth.

Over the past three years, financing activity for technology companies of the Intelligent Industry has reached a sufficient scale to qualify as a distinct category across the globe in all major geographies, achieving similar scale to the long-established Life Sciences and Biotech sectors.[1] In each of the past two years, nearly $25 billion has been invested across North America and Europe in the technology companies of the Intelligent Industry, dwarfing the cumulative $25 billion invested in those same regions over the 10-year period of Cleantech's peak activity.[2] As a result of its early leadership in Intelligent Industry investment activity, dating back as early as 2012, Canada now has the largest concentration of financings in this sector globally, making up more than 1/7th of all financing activity in Canada and surpassing the Cleantech trends of 20 years ago.

This paper provides a summary of research conducted by Yaletown Partners analyzing the investment activity into the technology companies of the Intelligent Industry, and the geographic trends across Canada, the United States, and Europe, over the past decade.

[1]Source: Life Sciences totaled $22Bn in the United States in 2019 compared to $20Bn for Intelligent Industry companies in the United States. Sources: NVCA Yearbook 2020, Yaletown Research, Pitchbook.
[2]Benjamin Gaddy, Dr. Varun Sivaram, and Dr. Francis O'Sullivan, "Venture Capital and Cleantech: The Wrong Model for Clean Energy Innovation", MIT Energy Initiative, July 2016

Technologies Enabling the Intelligent Industry

At Yaletown, we define the Intelligent Industry as the adoption of the "digital full stack" from devices to data to the software that integrates and operationalizes it all. Key technologies, including machine learning, artificial intelligence, software defined systems, and the Industrial Internet of Things, are driving the digitalization of economic sectors historically defined by heavy physical capital and, until recently, often under-penetrated from a technology perspective; for example, built environments, such as buildings and infrastructure, industry activity, manufacturing, transportation, logistics, agriculture, and cities. While the adoption of these technologies can transform isolated activities, such as a single manufacturing line, it can also transform activities across sectors and their integrated networks by forming a new technology constellation that is both disruptive and catalytic for economies. Simply put, the Intelligent Industry, powered by the digital full stack described above, is the evolution of Industry 4.0. By seizing opportunities for intelligent automation, and other ways of adding digital intelligence across organizational value chains, businesses can further digitize systems and processes, enabling the innovation of new platforms and portfolios, and ultimately yield greater profitability and sustainability.

The Technologies of the Intelligent Industry

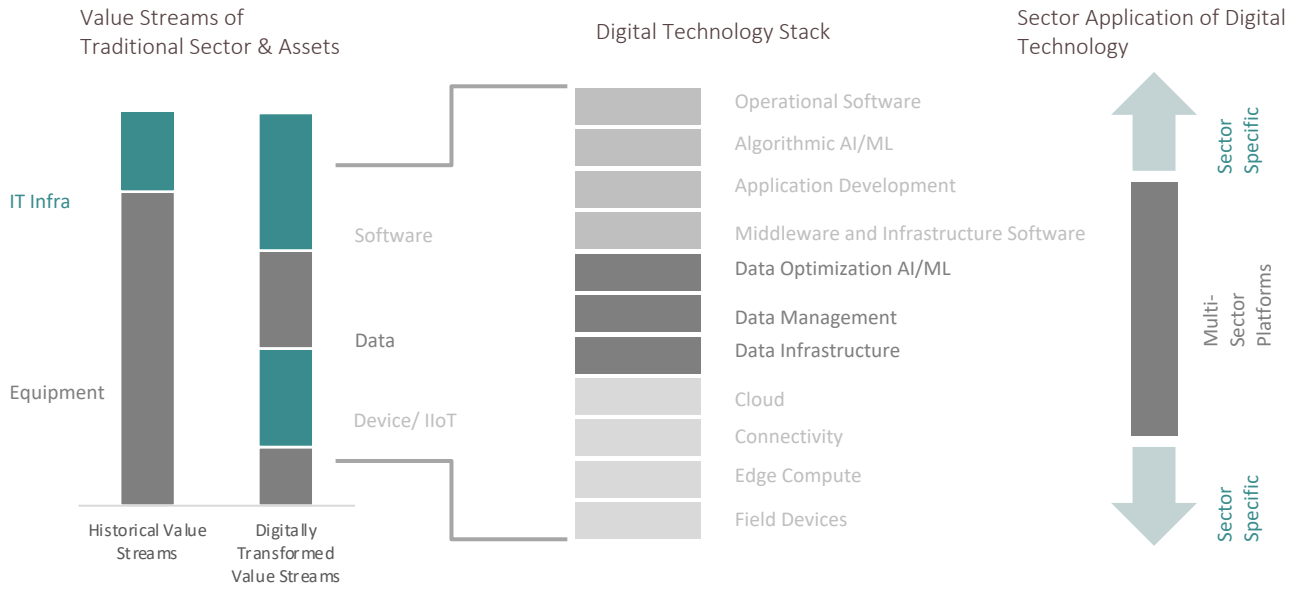
The Intelligent Industry is driven by the key themes of Information Technology and Operational Technology ("IT-OT") Convergence and Digital Transformation. The technologies underpinning these themes and their uses are a combination of platform technologies with sector specific applications and infrastructure across the "digital full stack." Among others, the Intelligent Industry encompasses major technologies and applications across the device, data and software layers and include:

1. At the Device Layer: Operational Technology & Digitization, converting an analog systems & processes to digital
   - IIoT, Field Devices, Edge Computing

2. At the Data Layer: IT systems for data processing & analysis
   - Data Infrastructure (storage, data lakes, big data systems), Data Management (data warehouse, data sharing), Data Optimization AI/ML (data prep and cleaning)

3. At the Software Layer: Digital Transformation and Implementation
   - The Software stack including middleware, integration, and application development software, as well as the Operational Application Software delivering industry-specific use cases, including algorithmic AI/ML, Digital Twins, and Automation.

Intelligent Industry: Mapping Technology to Device, Data and Software Layers



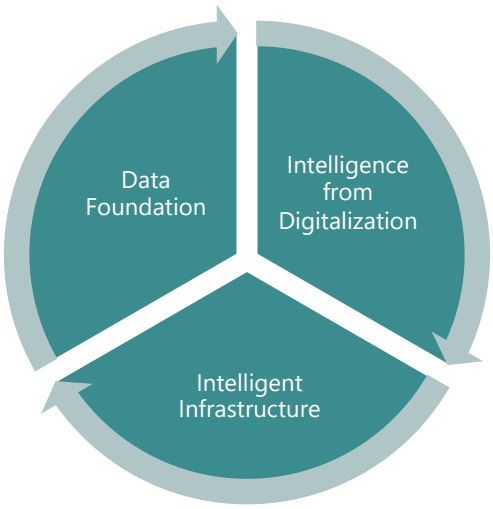
Adoption Cycle of Digital Transformation in the Intelligent Industry

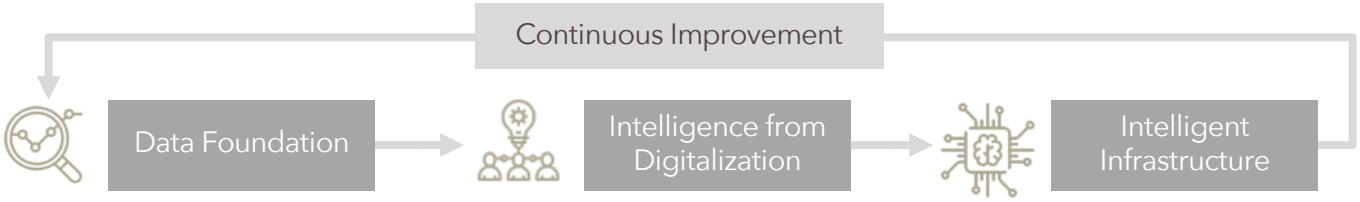
The adoption cycle of these technologies has a sequence that tends to repeat as systems and processes, once digitally transformed, are structured for continuous improvement. In essence, IT-OT Convergence and Digital Transformation are an embodiment of the Kaizen approach, which has become both the gold standard for industrial and manufacturing innovation, and the software analogue of DevOps CI/CD (continuous improvement / continuous deployment) architectures of cloud infrastructure and SaaS deployments.

As outlined in our 2019 white paper, "Intelligent Industry: The Engine Driving Climate Resilient Growth", adoption of the Intelligent Industry follows three key steps. The cycle starts with Device, advances through Data, and is implemented through Software. It then begins again as data needs and sources expand and new opportunities for productivity and efficiency are examined.

The first step involves the Digitization of operations, or what we refer to as the Data Foundation. The enabling technologies for the Data Foundation are concentrated in the Device Layer. With the data available from operational processes, the second step involves data analysis to determine pathways to productivity and efficiency gains and is what we call Intelligence from Digitalization. This second layer is where all data technologies, AI/ML included, become key enablers. These first two steps are critical for OT-IT Convergence. With these pathways analyzed, optimized, and identified, the third step of Digital Transformation can be implemented through software , establishing the base for Intelligent Infrastructure.

CONTINUOUS IMPROVEMENT





Digitization

- Creation and generation of data
- Collection, storage and management of data
- Interpretation, analysis and organization of data to develop insights

Device Layer Technologies

- IIoT
- Sensors
- Field Devices
- Edge Computing
- Networking
- Cloud

Data Processing & Analysis

- Converting physical or cyber-physical processes and operations to be fully digital, enabling constant improvement and optimization
- Enablement of digital processes to be linked to broader systems, and, with the aid of software, contextualizing decisions with human input

Data Layer Technologies

- Storage
- Data Lakes
- Big Data Systems
- AI/ML
- Data Prep
- Data Science

Digital Transformation

- Partial to full automation of processes and workflows, managed by software
- Self-analysis and optimization to achieve sustainable outcomes

Software Layer Technologies

- Integration & Middleware
- Application Development
- Digital Twins
- Predictive Maintenance
- Automation Platforms
- Smart Physical Assets

Growth of the Intelligent Industry

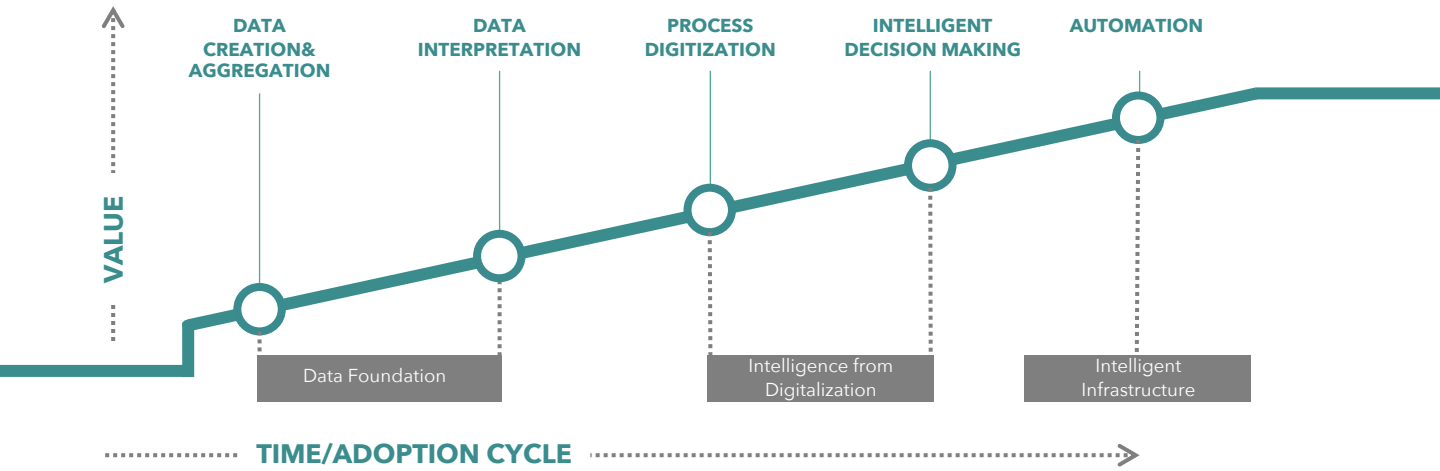
After achieving similar scale to the long-established Life Sciences and Biotech sectors over the past three years, financing activity for technology companies of the Intelligent Industry is now considered a distinct investment category in all major geographies across the globe[3]. In each of the past two years, nearly $25 billion has been invested across North America and Europe in the technology companies of the Intelligent Industry, dwarfing the cumulative $25 billion invested in those same regions over the 10-year period of Cleantech's peak activity[4]. Of particular note, Canada's early leadership in Intelligent Industry investment activity, dating back as early as 2012, has grown into the largest concentration globally, with investment in Intelligent Industry now making up more than 1/7th of all financing activity in Canada and surpassing the Cleantech trends of 20 years ago.

Evolution of the Intelligent Industry as an Investment Category

Investment activity related to the Intelligent Industry can be separated into 3 distinct periods over the last decade. The initial period from 2010-2012 was defined by rapid growth, as the first major wave of funded companies emerged. The growth period from 2013-2016 was defined by scale, as the number of funded companies reached 10% of all annual activity. The capital expansion period from 2017-2019 was defined by significant growth in invested capital and average size of financings to the space. Canada has been a first mover through each of the periods, followed by the United States and Europe.

The Intelligent Industry opportunity enables organizations to effect complete transformation across their entire value chain—from R&D to product design and development, and across manufacturing processes—rather than adopting the digital transformation of processes in silos. This, in turn, materially contributes to building for climate resiliency by streamlining and improving decision making through the transformation of data into insight and action. It also unlocks new sources of value by increasing innovation opportunity at multiple entry points.

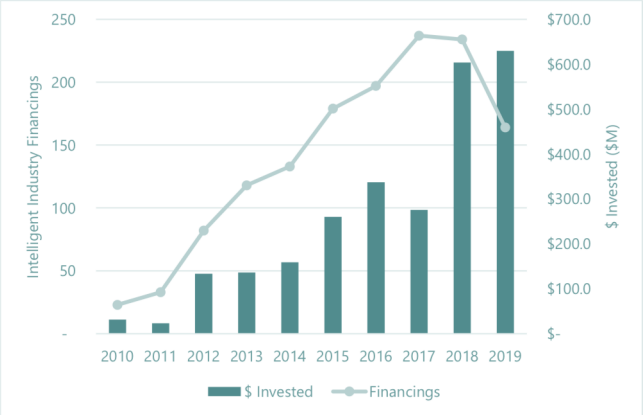
The new value creation stream

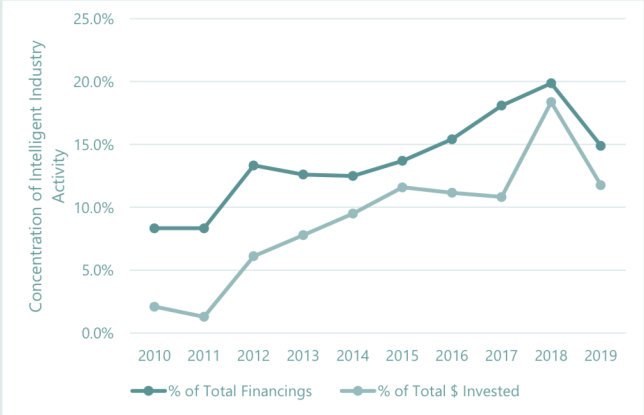


[3]Source: Life Sciences totaled $22Bn in the United States in 2019 compared to $20Bn for Intelligent Industry companies in the United States. Sources: NVCA Yearbook 2020, Yaletown Research, Pitchbook.
[4]Benjamin Gaddy, Dr. Varun Sivaram, and Dr. Francis O'Sullivan, "Venture Capital and Cleantech: The Wrong Model for Clean Energy Innovation", MIT Energy Initiative, July 2016

Canada: A Leadership Role

Canada has been a leader in investment activity in the Intelligent Industry across each of the three periods discussed above. Over the past decade, Canada has seen a surge in activity. Total capital invested has increased over 20x since 2010 and Canada currently boasts the highest proportion of Intelligent Industry funded companies, as compared to the United States and Europe, reaching as much as 18% of all financing activity in Canada in 2018. Canada also was the first geography to exceed 10% of activity in 2012, two years ahead of the United States and Europe, and four years ahead of the United Kingdom. Despite outpacing Europe and the United Kingdom on activity and concentration, the average deal sizes for technology companies of the Intelligent Industry in Canada still lag those in the United States.

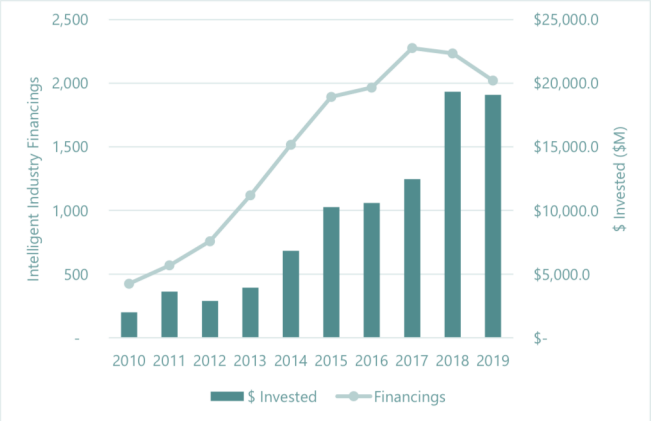


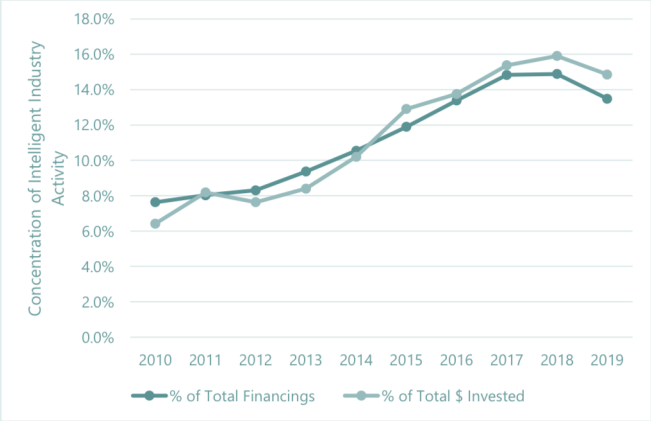


Canada's Intelligent Industry clusters are active in each of the country's three key ecosystems: Ontario, Quebec, and Western Canada. Ontario stands out as the most mature sub-regional ecosystem, with its proportion of total capital invested into technology companies of the Intelligent Industry increasing from 7.1% to 20.8% from 2014 to 2018. In Western Canada, the concentration of financing activity in Intelligent Industry companies has historically been higher than in other ecosystems. However, capital investment in Western Canada lags financing activity, indicating an ecosystem that skews more towards earlier stage. Similarly, Quebec has greater financing activity, but the lowest percentage of invested capital from among Canada's sub-regional ecosystems.

United States:
New Ecosystems Driving Growth

The United States is the largest technology ecosystem, representing some 50% of all investment activity in technology companies worldwide. Investment activity in technology companies enabling the Intelligent Industry is no different; nearly $20 billion was invested in each of the last two years, an increase of approximately 10x since 2010. In comparison to Canada, the U.S. showed more stable growth: the percentage of capital allocated doubled and the percentage of funded companies quadrupled over the past decade. The percentage of Intelligent Industry financings in the U.S. increased from 7.6% in 2010 to as high as 14.9% in 2018, and the percentage of capital invested increased from 6.4% in 2010 to 15.9% in 2018.

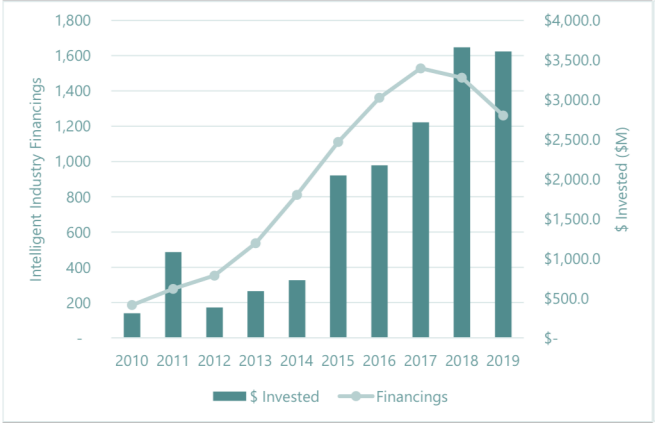


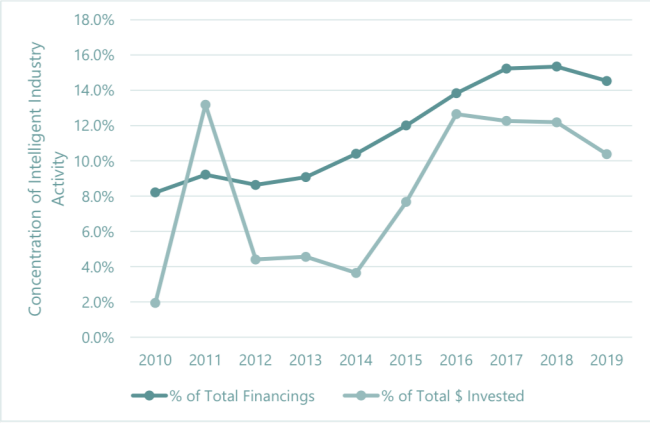


However, this only tells part of the story. Several sub-regional ecosystems in the United States have seen explosive growth, and each is located outside of the mature technology markets of California and New York. The DC Metro area (District of Columbia, Maryland, and Virginia) and the states of Texas and Washington are emerging as leading ecosystems for the Intelligent Industry. In the past two years, the percentage of capital invested in each of these regions has accounted for approximately 19-25% of capital invested nationally in the Intelligent Industry, on average. In addition, the Rust Belt (Illinois, Michigan, Indiana, and Pennsylvania) has consistently seen over 10% of its funded technology companies enabling the Intelligent Industry, though capital allocation remains lower than other regions. Each of these sub-regional ecosystems has a unique industrial base, fostering opportunities for technology companies to support IT-OT Convergence and Digital Transformation initiatives, and accelerating the development of these specialized innovation ecosystems.

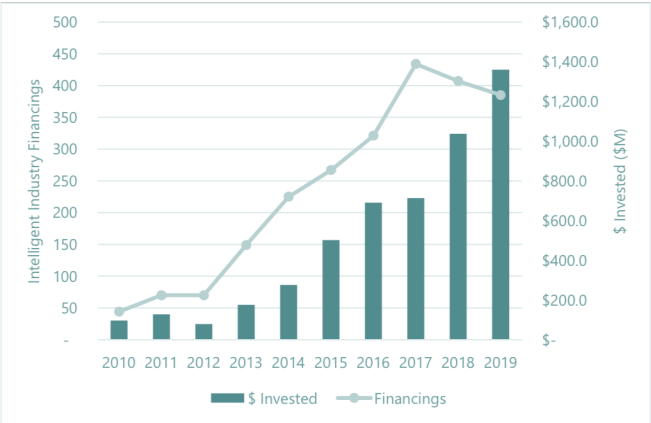
Europe and the UK: A Long History and a New Emerging Ecosystem

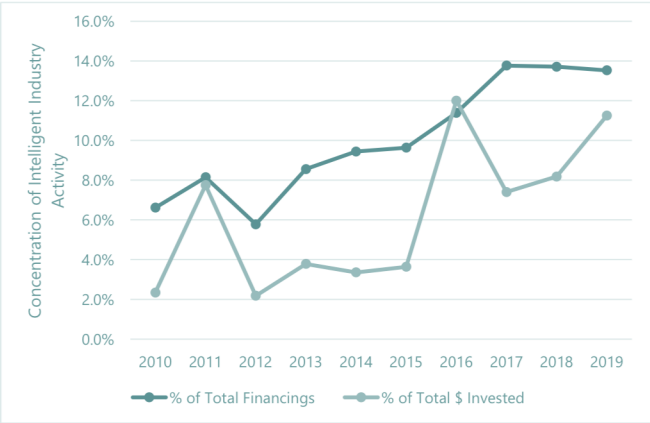
Similar to the U.S., Europe has shown stable Intelligent Industry financing growth, keeping pace with the overall market. Capital invested into Intelligent Industry companies has grown by more than 11x since 2010, and concentration has increased from 1.9% in 2010 to the 12% range in recent years. Given Europe's long history in industrial technologies and pioneering activity in the Industry 4.0 movement, the percentage of Intelligent Industry financings has been higher than in other locations, but has grown more slowly and only exceeded a market concentration threshold of 10% in 2014, the same year as the U.S. and two years later than Canada.





The United Kingdom has demonstrated higher-scale growth than mainland Europe, with almost all factors increasing by about 4 times as much. Secondly, the momentum seen within the U.K. is more recent than in other geographies, marking the United Kingdom as one of the key emerging ecosystems. The percentage of Intelligent Industry financings as a percentage of total financings surpassed 10% in 2016 and has seen a nearly 14x jump in capital invested since 2010. Even though the U.K. has not exhibited growth as strong as that of Canada, the U.K. has the largest proportion of young companies (founded less than three years ago) as compared to the other regions.





Summary

Investment activity supporting the technology companies of the Intelligent Industry is growing rapidly and maturing across multiple regions around the globe. The Intelligent Industry reached "category" status, representing more than 10% of technology company financing activity worldwide from 2012-2016. Canada has been an early leader and boasts one of the most mature Intelligent Industry ecosystems globally. Europe and, in particular, the United Kingdom, has seen rapid growth, with the U.K. emerging as a major centre of Europe. The United States has seen an overall rise, driven by the evolution of sub-regions such as the DC Metro region, Texas, Washington and the Rust Belt. With over $25 billion invested globally in each of the last two years, the Intelligent Industry has cemented its position as a major new category of investment.

Methodology

Yaletown utilized Pitchbook to derive its data and search methodology and employed a multi-layered approach to conducting its research. The general parameters set a defined universe of interest: companies founded from 2000 onward and having received some institutional or angel capital. Yaletown then selected industries, verticals, and keywords to capture Intelligent Industry companies specifically using a sample matching approach, followed by a search term reduction method based on both minimum independent and incremental count thresholds using stratified sampling techniques. Cross tabulation of terms, verticals (as identified by Pitchbook), and industries (as identified by Pitchbook), and clustering of keywords around each were used to minimize unintended sampling errors.

Yaletown Insights

Yaletown Insights is the business, technology, and economics research and insights arm of Yaletown Partners. Our mission is to provide our stakeholders with the fact base needed to develop a deeper understanding of topics relating to everything from public policy to vital management and investment strategies. We aim to be thought leaders at the cutting edge of emerging ecosystem development, techno-economic paradigms, and private capital market dynamics for disruptive technology. We also seek to help to inform better decision making around holistic approaches to integrated, responsible and forward-thinking investing frameworks.

Building off the experience of the team at Yaletown Partners of seasoned investors and successful entrepreneurs, Yaletown Insights further leverages the global network and expertise of its Impact Directors; a group of world leaders in matters of public policy, economics, climate change, technology and finance, including former heads of state, software multi-nationals and international financial and management consultants. We take great pride in our empirical approach and regularly publish whitepapers, author opinion editorials and participate in innovation roundtables with a goal of building and contributing to global ecosystems and driving value to our portfolio and investor partners. For more information please visit https://yaletown.com/insights/.

Yaletown Partners

Yaletown Partners is a leading Canadian investor dedicated to closing the scale-up capital gap and focused on the Intelligent Industry opportunity. We invest in emerging-growth companies that enhance sustainability and productivity for industrial and enterprise customers. Our investments enable the application of data and technologies to digitally transform traditional industries, drive innovation, create operational efficiencies and reduce the impact of climate change. In 2017, Yaletown received the CVCA's Venture Capital Deal of the Year award for its investment in BitStew, Canada's largest venture financed exit of 2016. Backed by leading institutional investors, including pension funds, and a network of successful technology entrepreneurs, Yaletown has offices in Vancouver, Calgary, Toronto and Montreal. For more information, please visit www.yaletown.com.

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