SCTE CABLE-TEC EXPO 22
SEPTEMBER 19-22 • PHILADELPHIA, PA

2022 Fall Technical Forum
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Shaw's Technology Forward Future

A Technical Paper prepared for SCTE by

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1. Introduction

Over time, the rate of advancement in new technology tends to accelerate. As technology companies, we are continually faced with the challenge of not only keeping up, but also keeping ahead of the technology wave so we can use it to drive success. To do this, we need to support a continuous flow of new ideas into our companies and vet these ideas to determine relevance and assign priority. The ideas that rise to the top need to be quickly integrated without exceeding budgetary constraints, overwhelming employees, and negatively impacting customers.

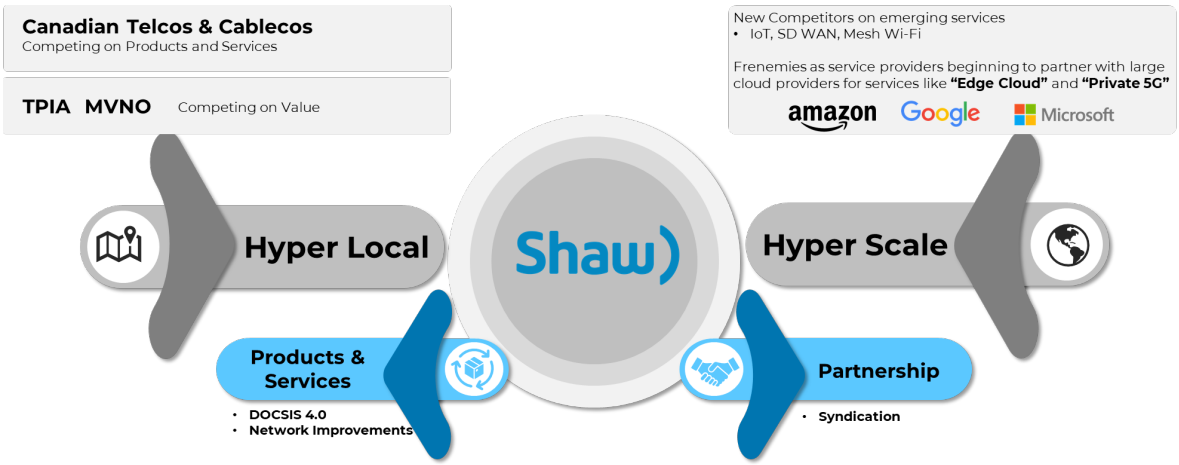


Figure 1 - Current Business Environment

Service providers face competition from two primary sources. The first source is direct competition from other service providers in the same primary business and geography. This hyperlocal competition is evident through price competition and feature competition. The price competition tends towards selling certain popular products and services and little or no profit in the hope of enticing customers to switch providers. Such offers are clearly not sustainable in the long run, so the bilateral churn leads to commoditized pricing.

The second major competition is from *Hyperscalers*. These are large multinational companies that can afford to compete on price because they are pursuing markets that are not primary sources of revenue. In addition, they often negotiate preferential pricing from vendors due to their scale. This competitive landscape severely constrains the competitive options for service provider.

The competitive landscape may require us to radically change our approach towards technology as a whole and adopt emerging technologies intelligently. If we can accomplish this, there are numerous benefits. We can anticipate rather than react to market changes. We can increase internal efficiency and improve customer products to benefit the customer experience. And as an additional bonus, we can provide employees with more interesting and valuable work, which consistently establishes a reputation for an interesting work environment and attracts new talent. Then the cycle repeats.

In this paper, we will discuss how we are trying to leverage and improve the intelligent adoption of new technology and this virtuous cycle at Shaw Communications.

2. Industry Perspective

Cable operators work in a competitive environment and must respond to global and industry-specific challenges such as supply chain issues due to COVID 19, geopolitical events, the rise and encroachment of *Hyperscalers* in the telecom domain, evolving customer demands and expectations, and cybersecurity and privacy issues. As these challenges increase, so too does the pressure to commercialize our core products and services. To meet these challenges, cable operators need to find sustainable advantages.

Our Emerging Technology Strategy is formed in combination of self-reflection (our strengths and areas of opportunities) and researching where the industry is heading (through peers, technology pioneers, and academics). As part of our research, we found multiple points of view that helped us identify our areas of focus.

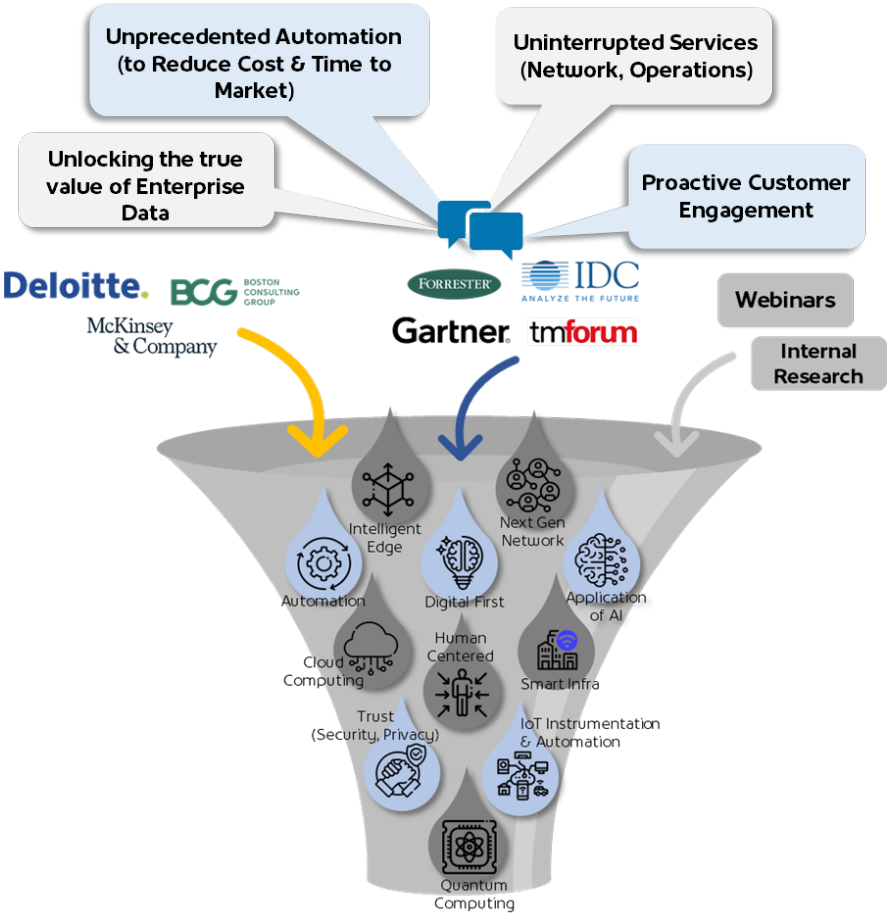


Figure 2 - Emerging Technology Research Process

Gartner's Technology trends 2021 [1] and 2022 [2] helped us narrow our research down to the following nine technology themes that operate together to build and reinforce each other.

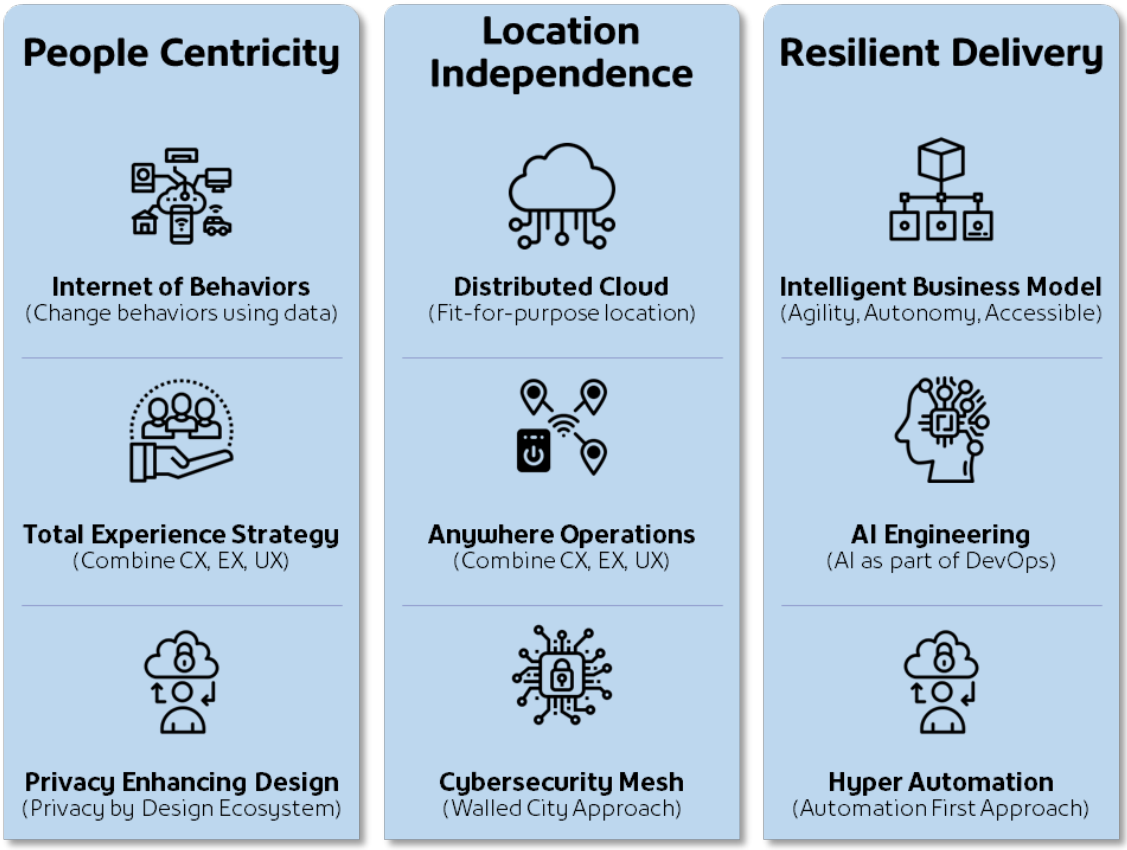


Figure 3 - Industry Perspective - Emerging Technology Themes

- **People Centricity**:
  - **Internet of Behaviors** – Internet of Behaviors is taking Internet of Things (IoT) to the next level. It refers to the ability to use the data collected to determine patterns and influence customer decisions.
  - **Total Experience Strategy** – Traditionally, experience strategies have been very siloed. The concept of *Total Experience* combines these disciplines (customer experience, employee experience, agent experience, and user experience) and links them to create a better overall experience for all parties.
  - **Privacy Enhancing Design** – Privacy Enhancing Design refers to creating an ecosystem of trust that enables organizations to safely store, share, process, and protect customer and employee data that is growing at an exponential rate.
- **Location Independence**:
  - **Distributed Cloud** – Distributed Cloud refers to providing an efficient multi-cloud environment or an "invisible cloud" environment. Essentially, users should be responsible for the maintenance, operation, and evolution of their services and not worry about physical infrastructure. The right cloud (public, private, or hybrid) backbone will

power users' needs around latency, performance, resiliency, and data sovereignty perspective.

- **Anywhere Operations** – Anywhere Operations refers to an operating model designed to support end users anywhere and everywhere and manage the deployment of business services across a robust distributed infrastructure. The model for Anywhere Operations is "digital first, remote first".

- **Cybersecurity Mesh** – The Cybersecurity Mesh is a distributed architectural approach to scalable, flexible, and reliable cybersecurity control. It enables any person or device to securely access products and services, no matter the location, while providing an optimum level of security.

- **Resilient Delivery**:
  - **Intelligent Business Model** – Intelligent Business Model refers to agility and resiliency in the business process that can withstand disruptions. Business models and process should provide the following traits: agility, autonomy, and accessibility.

  - **AI Engineering** – AI Engineering refers to combining the best of both the worlds—human and software engineering—using a human-centered design powered by the performance and scale of software engineering. A robust AI engineering strategy will facilitate performance, scalability, interpretability, and reliability to ensure it can be used in day-to-day life and reap the full value of the investments.

  - **Hyper Automation** – Hyper-automation or an automation first approach is a practice in which organizations automate as many processes as possible using modern tools. For example, using automation to hyperscale agility and time to market.

Starting from these themes, we researched how large enterprises are responding to trends and quickly concluded that the competitive landscape requires us to radically change our approach towards technology as a whole and adopt emerging technologies intelligently into our day-to-day business operations.

3. Framework Approach at Shaw

The following sections describe a framework for innovation that leverages existing core infrastructure and builds upon that foundation.

3.1. Shaw's Emerging Technology Strategy Introduction

Shaw's Emerging Technology strategy and existing areas of focus suggest that we should leverage the core strength of our network as a foundation, while building technology services to provide a competitive advantage to differentiate us from our competition. Shaw's approach to emerging technology is based on the following building blocks:

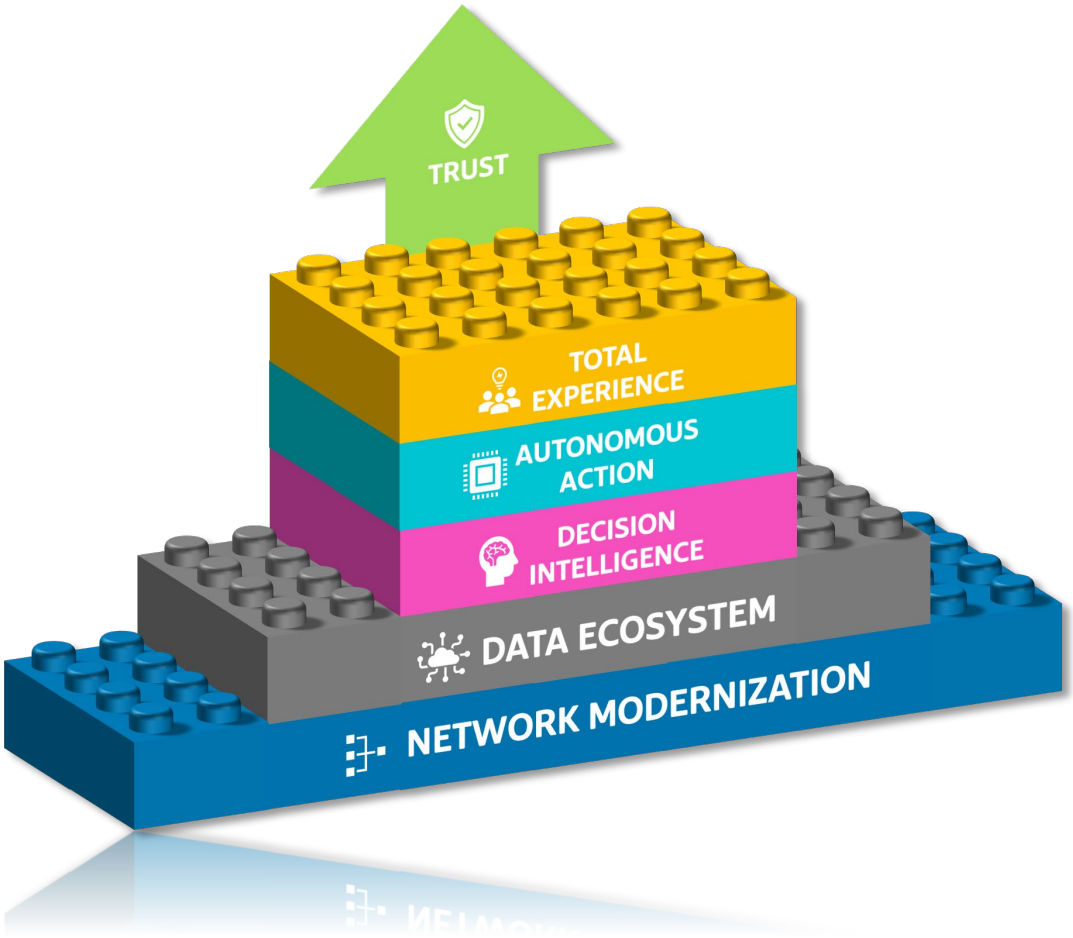


Figure 4 - Shaw's Emerging Technology Focus Areas

- ✓ **Network Modernization** – Construction of networks that optimize speed, latency, and density.
- ✓ **Data Ecosystem** – Collection of more data from more sources more often.
- ✓ **Decision Intelligence** – Installation of tools to interpret the collected information both in real-time and offline using big data principles.
- ✓ **Autonomous Action** – Enabling the ability to act on the interpreted data for ultimate optimization.

- ✓ **Total Experience** – Creation of radically simplified and differentiated products using these tools.
- ✓ **Trust** – Achievement of the above with security and privacy as absolute requirements designed in from the start to build trust.

3.2. Nework Modernization

Over the past several years, Shaw has pursued an aggressive plan to modernize our networks. Our networks are not only the basis of our business, but over time—as communication networks have increased in speed, latency, availability, and reliability—they have become essential infrastructure in the world economy. They are the basis of business for many of our customers. The COVID-19 pandemic proved this beyond any doubt as people became more reliant on networks to communicate and get business done when in-person activities were restricted.

The pressures of the pandemic have begun to ease, but many of the network activities that were initially undertaken to address pandemic related concerns continue to operate on the network now by choice. These activities were generally expected to increase operational efficiencies and reliability on the network until the pandemic drove the need for fast improvements.

The way forward involves improving all aspects of the network. This includes data throughput (how long it takes to send a certain amount of data), latency (how long it takes a specific piece of data to travel from point A to B), and density (how many streams of data can be moving on the same network at the same time).

Let us look at each of these features individually.

3.2.1. Data Throughput

Traditionally, this is the measurement that is commonly referred to as speed. If you run a speed test on your network connection, you will get a download and upload number in megabits-per-second (Mbps). This figure is an average performed over several seconds and does not provide a lot of detail about how long it took an individual message to traverse the distance. If we think of the network path as a freeway, throughput is the capacity of the freeway in general; it does not consider fast lanes or on- and off-ramps.

3.2.2. Data Latency

Data latency measures the time it takes an individual message to travel from point A to B. In many cases, this may not be critical. When loading a web page, for example, you will likely be more interested in loading the entire page rather than any particular word on the page. If, however, you are relying on the communication of a particular command to your self-driving car or the remote surgery to remove an appendix, timing is critical. Advanced networks can reduce latency and even potentially make some guarantees to meet time-critical requirements.

3.2.3. Data Density

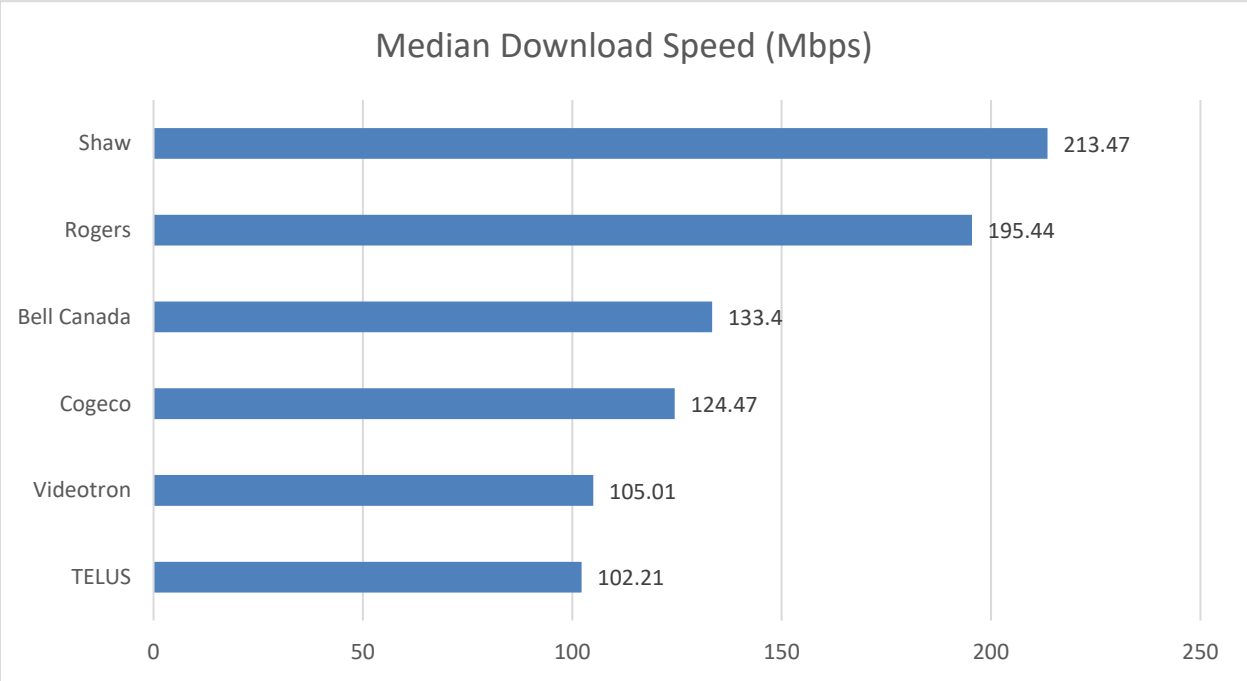
A dense data network can run more simultaneous network paths in the same amount of space. This feature is useful in locations like stadiums, where thousands of people may be trying to access the network at the same time. Networks that allow more simultaneous networking streams will enable more users to be on the network at the same time in the same amount of space.

3.2.4. Preparing for the Future

The networking features identified above are some of the most common features in modern networks such as 5G wireless and advanced wireline networks.

Fortunately, Shaw's emphasis on modernizing our networking infrastructure sufficiently prepared us in advance of the pandemic. Maintaining and expanding our network during a pandemic was challenging, but our preparation kept the networks viable when they were under extreme pressure.

We were not alone in this, however. The networks of market competitors also performed well.



Source: Speedtest Intelligence Q1 2022 [3]

Preparing our network is essential to our success, but it is not sufficient. Networking will always be under commoditization pressure, and as service providers, it is important that we move up the stack.

3.3. Data Ecosystem

While basic networking is always improving, most emerging technologies of particular interest to cable operators sit above the basic Open Systems Interconnection (OSI) stack. The enabling networks are assumed to be available and able to meet requirements of complex applications. An increasingly common thread of these emerging technologies is a reliance on data—a lot of data.

"Big data," as it is commonly identified, is data that is so abundant that it is difficult to comprehend without extensive processing by computers. Big data processing can identify subtle correlations and anomalies in a data set that would be nearly impossible to notice otherwise. These identifying features of large data sets can be used to extract important insights. Computers, however, are not always aware of the

relevance of data features to human priorities. Data scientists are needed to decide how to process the data and what information to look for.

Often, important insights are not clear when the data is originally collected. Therefore, it is important to store the data for long periods of time. While the cost of data storage can be expensive, it has dropped dramatically in recent years and helped to make the use of big data more practical.

Simultaneously, the advent of the IoT has led to the instrumentation of everything imaginable. Part of this instrumentation includes the collection and networked transmission of the data for immediate processing and instantaneous interpretation, as well as data storage for later analysis.

3.4. Decision Intelligence

Automatic analysis of massive amounts of data can not only bring timely insight, but in many cases, can also be interpreted with enough reliability that it can be used to make immediate decisions. Artificial intelligence (AI) can be used to make both analytical and intuitive decisions. Machine learning (ML), as a form of AI, uses massive amounts of data to draw correlations between observations and actions. This can be leveraged by training an ML algorithm with data that is clearly tied to specific outcomes. Additionally, as more data is collected, it can be incorporated into the training and used to improve accurate analysis over time.

In fact, some correlations are particularly predictive and can allow AI algorithms to notice potential problems before they become actual problems. For example, telltale vibrations coming from a piece of machinery can indicate that a part needs to be replaced soon. The part can then be replaced at a convenient time without bringing the machine down during production or risk causing further damage.

3.5. Autonomous Action

Autonomous action is the ability to act on interpretation. It refers to self-managing and self-healing systems that use the insights of and provide feedback to the decision intelligence systems, so that it can learn from its surroundings. This helps form a closed loop environment that focuses on end-to-end services and not just segments. The concept of autonomous actions offers a unique opportunity to provide highly resilient and repeatable services at scale. Allowing our people to be more successful and our customers to be more satisfied with their services and ensuring we get the most out of our resources and technology investments.

Organizations cannot scale manually at the rate that is required to meet the business needs and customer expectations. Here, relying on governed and monitored automation can help us to not only keep up with the pace of change, but also deliver cost effective, reliable, and productive solutions (e.g., automatically handle simple problems, notification and actions). Human intervention can be reserved for more complex problems.

3.6. Total Experience

In today's world, organizations do not independently decide how customer experience (CX), or employee experience (EX) works. It is best determined by the end-users. Total Experience that unifies the end-user experience could not only help control costs and provide sustainable growth, but also build long-term relationships with our customers and employees and improve brand trust.

- ✓ **Customer Experience** – Customer experience aims to provide an experience where we know our customers and are delivering a simplified, personalized, relevant experience to them through the channel of their choice.

- ✓ **Employee Experience** – Employers can use talent and culture as a competitive differentiator. We strongly believe in investing in people first, and that our talent is scarcer than other resources. Studies have shown a positive correlation between talent experience and organizational performance. That is, happy employees respond to customer needs more quickly and adapt to business changes faster.

3.7. Trust

Companies cannot expect to retain customers in the long-term without trust. Building and maintaining trust is of paramount importance to an organization as customer behaviors change and trusted products increasingly include claims like "locally-sourced" and "sustainable". For service providers, taking a pragmatic and proactive approach towards trust (i.e., privacy, security, and data protection) is not an option, but a necessity.

The concept of building trust with our customers is not a new idea, but with increases in digital working environments and amounts of data being collected and processed—and the emphasis on and complexity of building trust—it has increased manyfold. As the "new normal" and actions of organizations come under intense scrutiny, companies' actions have greater consequences and influence customer opinions. These actions will determine if existing customers choose to continue their relationships with a brand and whether new customers will choose to start them. With so much at stake, it is important to rethink our approach, skills, processes, and technologies that support a Trust Ecosystem.

Shaw undertook a current state assessment to understand where we stand on these areas of focus and to identify opportunities and mechanisms to operationalize our Emerging Technology Strategy.

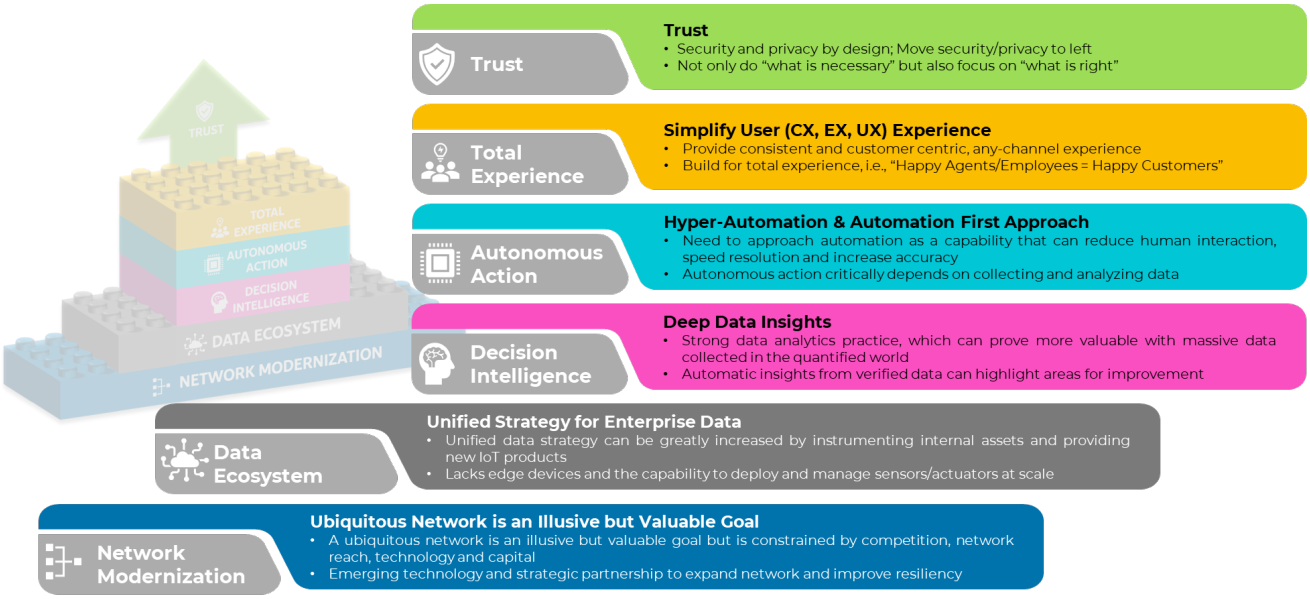


Figure 5 - Emerging Technology Deep Dive

4. How to Operationalize?

In this paper, we have laid out a logical structure for integrating emerging technologies into a cable operator's business model and suggested the benefits of doing so. However, to operationalize this structure and successfully integrate new technologies into the business, it is important to consider current operations. While it may be possible and at times necessary to swap out technologies completely and quickly (for example, after a security breach), a well-considered transition that minimizes current operational disruption would produce better, more sustainable results.

It is important to have a long-term strategy. When a new technology is introduced, there are serious practical considerations. Why is the change necessary? How much will it cost? What are the expected cost savings or revenue increases? How will employees and customers react? A long-term strategy should directly address these and similar questions. Resistance to change will be reduced when the reasons for the change are clear.

Communication is also critical. Adoption of a new technology cannot be accomplished without the assistance of those who will be implementing it. They need to understand the motivation, but also the information to plan thoroughly to minimize downtime for employees and customers. A proof-of-concept (PoC) trial may be advisable to verify the details of how the technology will be installed and connect with existing systems. Furthermore, the deployment plan must be carefully created and executed. For example, it may make sense for the technology to be introduced using an already planned operational upgrade rather that creating new projects.

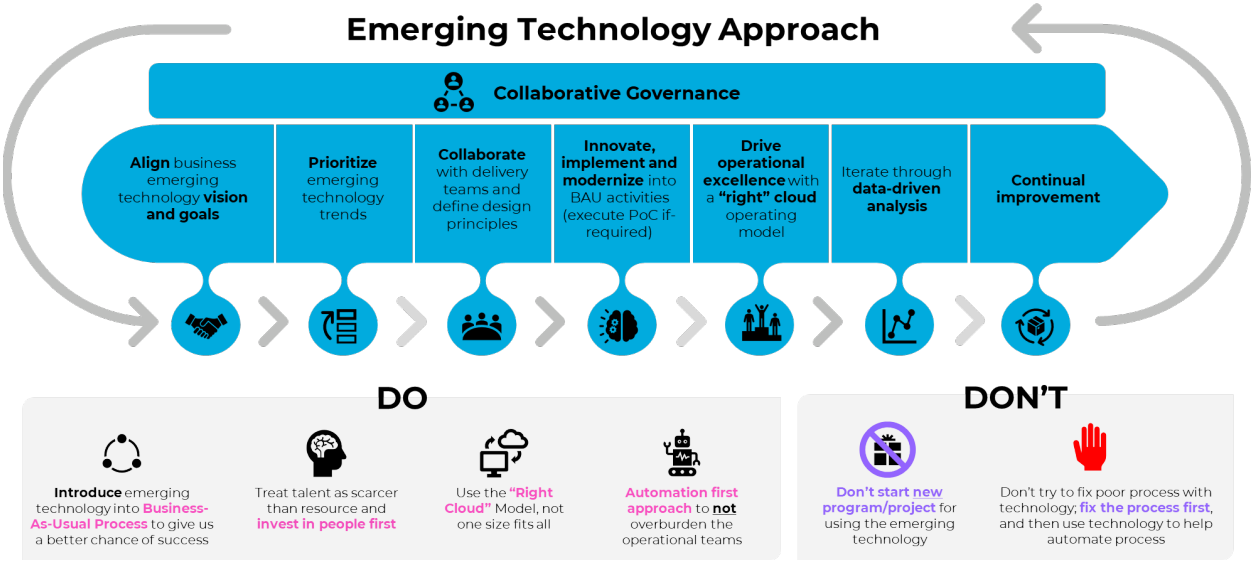


Figure 6 - Emerging Technology Operationalization Approach

The introduction of the technology through the deployment plan should be clearly communicated to all impacted groups—and potentially even to groups who would not be impacted by the upgrade but would support if technical issues arise. When people are aware that a change is happening, regardless of how minimal it is expected to be, they can anticipate that change and plan appropriately.

It is also important to establish roles and responsibilities. Those impacted by the transition should know exactly who to ask when they have questions. Who is responsible for making decisions? Who has the information that will inform those decisions? Who needs to complete which tasks and on what timeline? Are there executives or other people who need to be informed of the progress and alerted when problems arise?

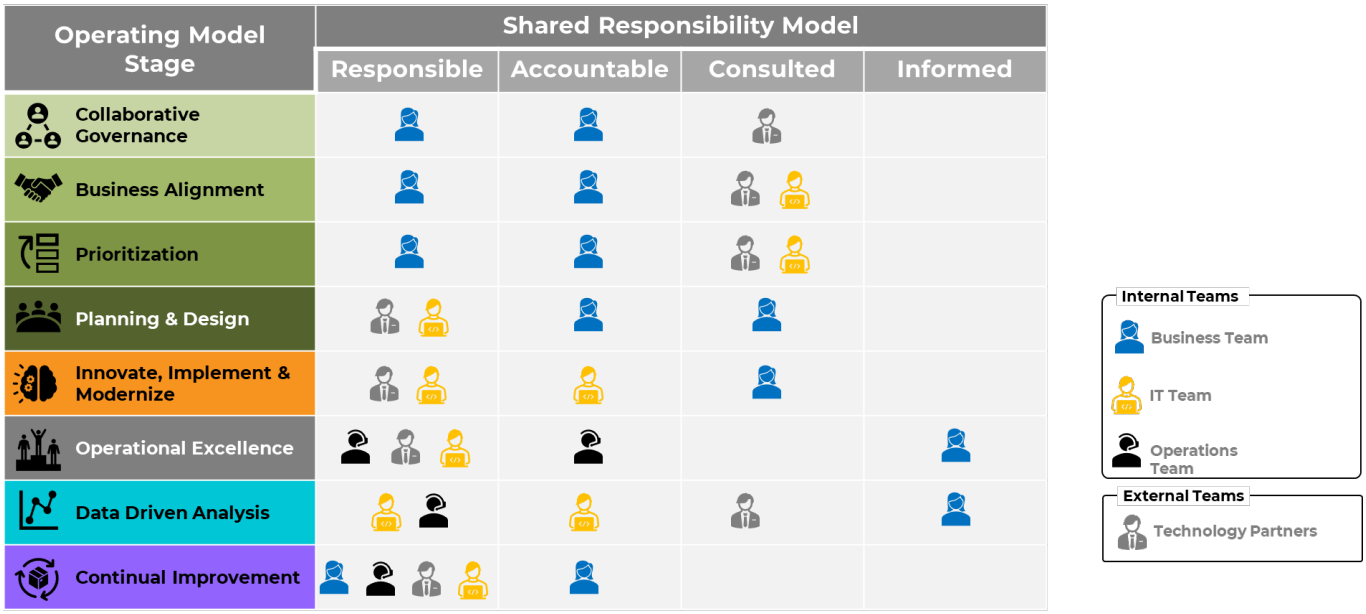


Figure 7 – Hypothetical Shared Responsibility Model

For those who will be using the new technology, a thorough training plan is likely necessary. Training should be planned sufficiently in advance of the actual change so employees are as comfortable as possible during the transition.

With instrumentation and data collection intrinsic in modern business, all operational considerations can be handled more efficiently, and sometimes even automatically.

Referring to our framework, the network lies at the foundation. Information must be instantly and reliably communicated. This includes not only information between people, but also information between machines, sensors, actuators, and data systems. Data must be collected from every conceivable source, the verity of that data must be dependable and timely, and it must be reliably delivered to the appropriate destinations over the network. Where possible, the data should be used for accurate analysis and automated action. Finally, all these interactions need to be protected with strong security that can quickly react to breaches.

The fundamental operations of the business do not change. Businesses still create products and sell them to customers. For cable operators, we have both end customers who use our products to enrich their lives and business customers who use our products to support their own customers. We can better serve both types of customers when we operationalize new technologies into our business.

New products often rely on new technology and new capabilities, but many new technologies will now include instrumentation that will allow products to be monitored for health and usage. In some cases, problems can be diagnosed and fixed before the customer even notices them. Important data about how

the product is being used and how it can be improved can keep product teams informed on what improvements to consider and additional markets that will embrace the same product. The product development cycle does not fundamentally change; it becomes more efficient. In this new cycle, the product team can better meet the needs of customers, customers are more satisfied with the products, and customer care teams can more accurately diagnose problems or avoid them altogether since they can be diagnosed and repaired without human interaction.

Operationalizing emerging technology is a success-based cycle. With a careful integration plan, initial disruption can be minimized. As the benefits of the new technology are observed, enthusiasm for the technology increases for all involved parties, which encourages the adoption of more relevant technologies. As employees see that technologies are being adopted to solve problems rather than for technology's sake, they are more willing to trust management. As the value of emerging technologies is operationalized, employees at all levels have greater job satisfaction, which in turn attracts new employees in a very tight job market.

5. Conclusion

While not all emerging technologies are based on networking, data, and IoT, a very large number of technologies are improved by these features. The cable industry has been extremely successful over many decades because we observed early on that our networks, originally designed for broader distribution of live television, could be used for much more than that. Indeed, we find ourselves at the nexus of the information age with advanced, industry-leading, reliable networks that are becoming essential infrastructure to modern society.

As with any valuable resource, many companies want a share. The value of networks will always be subject to competitive forces that will push them toward commoditization. In order to overcome the gravity of commoditization and continue to operate as profitable businesses, cable operators need to continually look for new revenue opportunities.

At Shaw, we have observed that there will be an increasing need to measure, analyze and automatically react to information, regardless of the source. Fortunately, we are well-positioned at the center of that revolution. There is a great opportunity now for cable operators to adopt fundamental technologies and create new lines of business in order to participate in new waves of opportunity in the future.

As cable operators, it is essential that we build the flexible infrastructure required for the information, intelligence, and automation that will ride on our networks. We need integration, deployment, maintenance, and automation systems that will scale to accelerating consumer demand. This will provide new revenue opportunities in the future and set us up for the next information revolution—one that even we have yet to imagine.

Abbreviations

AI	artificial intelligence
BAU	business as usual
BCG	Boston Consulting Group
COVID	Coronavirus disease
CX	customer experience
DOCSIS	Data Over Cable Service Interface Specifications
EX	employee experience
IDC	International Data Corporation
IoT	Internet of Things
IT	information technology
ML	machine learning
OSI	Open Systems Interconnection
PoC	proof of concept
UX	user experience

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