Smart Innovation, Systems and Technologies 118

Parag Kulkarni
Jay Rajasekera
Bidyut Baran Chaudhuri

AI Empowered Digital Business Innovation

KES International

Springer

Smart Innovation, Systems and Technologies

Volume 118

The Smart Innovation, Systems and Technologies book series encompasses the topics of knowledge, intelligence, innovation and sustainability. The aim of the series is to make available a platform for the publication of books on all aspects of single and multi-disciplinary research on these themes in order to make the latest results available in a readily-accessible form. Volumes on interdisciplinary research combining two or more of these areas is particularly sought.

The series covers systems and paradigms that employ knowledge and intelligence in a broad sense. Its scope is systems having embedded knowledge and intelligence, which may be applied to the solution of world problems in industry, the environment and the community. It also focusses on the knowledge-transfer methodologies and innovation strategies employed to make this happen effectively. The combination of intelligent systems tools and a broad range of applications introduces a need for a synergy of disciplines from science, technology, business and the humanities. The series will include conference proceedings, edited collections, monographs, handbooks, reference books, and other relevant types of book in areas of science and technology where smart systems and technologies can offer innovative solutions.

High quality content is an essential feature for all book proposals accepted for the series. It is expected that editors of all accepted volumes will ensure that contributions are subjected to an appropriate level of reviewing process and adhere to KES quality principles.

Indexed by SCOPUS, EI Compendex, INSPEC, WTI Frankfurt eG, zbMATH, Japanese Science and Technology Agency (JST), SCImago, DBLP.

All books published in the series are submitted for consideration in Web of Science.

Parag Kulkarni · Jay Rajasekera ·
Bidyut Baran Chaudhuri

AI Empowered Digital Business Innovation

Springer

Parag Kulkarni
Tokyo International University
Toshima-ku, Tokyo, Japan

Jay Rajasekera
Tokyo International University
Toshima-ku, Tokyo, Japan

Bidyut Baran Chaudhuri
Techno India University
Kolkata, West Bengal, India

ISSN 2190-3018 ISSN 2190-3026 (electronic)
Smart Innovation, Systems and Technologies
ISBN 978-981-96-5592-2 ISBN 978-981-96-5593-9 (eBook)
https://doi.org/10.1007/978-981-96-5593-9

Dedicated to Mothers

Late Manisha Kulkarni

Late Renuka Chaudhuri

and

Late Lilly Rajasekera

Preface

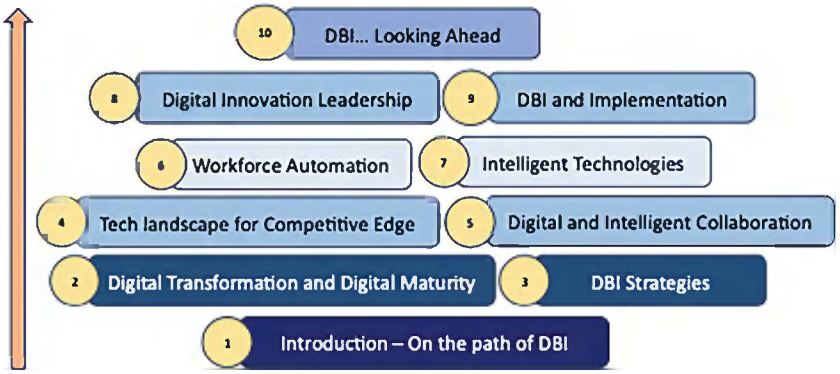
Digital innovation and AI revolution transformed almost every business. It changed the way the business had been done in the past. It created numerous new business opportunities and multitude of new avenues to do business. It has created various opportunities to strategize business by using and positioning existing and emerging technologies. While working with different companies from India, Japan, and USA, we have witnessed this transformation and even had opportunities to participate in the transformation at different organizations across all levels. We were also fortunate to get opportunity develop products for companies that have become vehicles for Digital Business Innovation (DBI). Additionally, we also got opportunity to shape up the DBI departments at a number of universities including our own Tokyo International University. We thought that this is the apt time to share our experiences and knowledge of digital business innovation with global audience. That's how this book started taking shape.

The well-known story of rabbit and tortoise where rabbit sleeps resulting in win for tortoise. Later someone transformed the story in which rabbit wins as it has learnt from past experience. Today, both rabbit and tortoise win as rabbit helps tortoise to win with its pace while tortoise helps rabbit with its strategies, vision, and persistence. It is exactly true in the business too—there was an era where people won simply with strategies, then in some cases, technologies overpowered to create various avenues for success. Digital business innovation is about strategies embedded with digital technologies to script your success. It is neither strategy nor technology in isolation—it is technology and strategy both come together to win. Additionally, in the modern era, it is rather "intelligent" business innovation with the golden touch of AI. Thus, businesses have become intelligent to replicate pace of rabbit and the wisdom of tortoise. Hence, today whether it is strategy or technology, it needs to be AI powered. It could be elections, agricultural reforms, water management, manufacturing, health care, social well-being, or whatever, AI empowered DBI has become an inherent part of the journey to accomplish business success.

Traditional businesses changed with the need to reach out to masses—it is pace, reachability, strategic positioning, and expansion of business boundaries. Business is a vision of perceived needs capitalized to create value for customers as well as providers. The value comes in different forms. This book attempts to deliver different aspects of DBI right from its role as a business enabler to one helping to redefine the business as a whole. It approaches digital business innovation as a holistic process and discusses the role of digital and intelligent technologies across the entire business life cycle. It is the "strategy enabler" that leads organizations to the position of strategic advantage. The book presents case studies of different organizations that transformed businesses with intelligent technologies. They have innovated the business and created new ways to do business using digital technologies. So, let us get ready to under take the journey of digital business innovation. We are certain that professionals, managers, and entrepreneurs will find this book useful while taking their organizations on a strategic path of digital transformation. Students working in technology as well as business domain will find it useful as a reference book to nurture deeper understanding of digital transformation. It not only provides them theoretical aspects of DBI but also will provide proven directions to implement it successfully in order to create strategic advantage. We are certain that this book will also provide a futuristic perspective about digital business innovation to transform vigorously, but with a pinch of salt about ethical and human-centric aspects.

The organization of book is as follows:

The figure below depicts the book's organization. The book opens up with an introduction. Chapters 2 and 3 deal with strategic aspects of digital business innovation/intelligent business innovation. Chapter 4 discusses technological landscapes and introduces different technology and thumb rules for technology selection. Chapter 5 discusses digital collaboration among different entities and human resources—which is followed by Chapter 6 which discusses work force automation. Some advanced technologies are covered in Chapter 7 along with their DBI pointers. Chapter 8 discusses about making DBI happen and leadership aspects of DBI. The detailed implementation aspects are covered in Chapter 9. Chapter 10 concludes with numerous potential future possibilities.



Book Organization

Tokyo, Japan — Parag Kulkarni
Tokyo, Japan — Jay Rajasekera
Kolkata, India — Bidyut Baran Chaudhuri

Acknowledgements

This "book journey" would not have been possible without support from many individuals and organizations. We would also like to thank entrepreneurs Sanjay Katkar of Quick Heal, Yoichi Yamane, founder and CEO of Mogic, Mr. Chitale of Chitale Dairies, Dr. Shaila Apte of Anubuti. They shared their experiences and hands-on case studies to enrich the contents of this book. We would also like to thank our students for interesting deliberations. We also take opportunity to thank all innovators and entrepreneurs we got the opportunities to interact who had transformed businesses with their insightful visions and unmatched technology strategies.

It has always been great support from our family members and friends. We also take opportunity to thank them. Technology created many more avenues; and innovators transformed these avenues to utilities and innovative products. Business visionaries created new possibilities and expanded business horizons. Researchers, entrepreneurs, and innovators directly or indirectly contributed to make this world a better place to live in. They are continuously striving to address perceived risks of advanced technologies. We thank all those change makers for their unprecedented efforts and courage that created unlimited new possibilities. They questioned the paradigms; they questioned the best performing options for the betterment of humanity. Digital business innovation is the culmination of such efforts that expanded horizons by challenging the boundaries.

Parag Kulkarni
Jay Rajasekera
Bidyut Baran Chaudhuri

Contents

About the Authors

Parag Kulkarni (Ph.D., D.Sc.) is an entrepreneur, AI/ML researcher, professor at Tokyo International University and author of best-selling innovation strategy and AI books. He holds Ph.D. from IIT Kharagpur, Management Education from IIM Kolkata, and was conferred higher doctorate D.Sc. by UGSM Monarch Business School, Switzerland. Parag's AI ideas resulted in commercially successful pioneering products to deliver unprecedented value. He contributed to the success of over two dozen startups through his research and paradigm shifting strategies. Parag headed research labs of many companies including IDeaS, Capsilon, SAC Siemens, etc. and was the research brain behind two 100+ million dollar acquisition success stories. Founder, chief scientist and advisor of iKnowlation Research Lab, Parag exited two startups successfully. Parag has published over 300+ research papers, invented over a dozen patents and authored 16 books. His book *Knowledge Innovation Strategy* was listed as a game-changing business book by Hindustan Times. Fellow of IETE and The IET, Parag was the first Ph.D. guide in Computer Engineering at COEP Technological University Pune and has guided 20 Ph.D. candidates.

Dr. Jay Rajasekera is a specialist in digital business and computer algorithms. He is currently the vice president and dean of Graduate School of Business and Commerce at Tokyo International University. He started his career at AT&T Bell Laboratories in New Jersey, USA, following his Ph.D. in Operations Research and Computer Science. While at Bell Laboratories he designed and patented the computer algorithm for the construction of the world's first undersea fiber optic cable TAT-8 between USA and Europe; world's first demonstrations of the Internet too were done using this cable. From 1995 to 2017, he was with the International University of Japan, holding various positions. In 2018, he moved to Tokyo International University and contributed to establish a new Digital Business and Innovation (DBI) program. In 2023, he and his team won a global AI competition, which led to applying AI for issuing cyber alerts for one of top global airports. Companies he had offered consulting include IBM, Fujitsu and Hitachi.

Prof. Bidyut Baran Chaudhuri retired from Indian Statistical Institute, Kolkata, India as INAE Distinguished Professor and J. C. Bose Fellow in 2018 and acted as Pro VC of Techno India University for five years. Currently, he is a distinguished Emeritus Professor at Techno India University and visiting professor of several other Universities. His research areas of interest are AI and machine learning in computer sciences, especially in pattern recognition, computer vision, natural language processing and their applications in various fields. He published more than 450 papers, authored or edited 10 books in these domains. He also authored several patents and acted as chief investigator of externally funded projects like UNDP, Indo-European, Indo-German and Indo-France and many domestic projects. He is a life fellow of IEEE and fellow of IAPR, AAIA, TWAS, INSA, INAE, INASc, IETE, etc.

Chapter 1
Introduction: On the Path of DBI

A new company started by two technocrats wanted to enter into a tourism space. As any other company, it began with a market survey. The detailed market survey revealed that tourism industry was highly saturated and there were many financial and political barriers to enter this space. Small players were struggling for survival while the industry was dominated by big players like SOTC, Kesari Tours, and Veena World. There was need of deep pockets and strong political contacts to take on these players. The CEO was already of the opinion that adding simply a few new tours, enhancing certain existing features, or providing some discount was not a way to go for this new company. Margins were shrinking and customer segment though increasing but were highly biased to services provided by big players. These big players were focused on providing luxurious hotels, accommodating more and more customers and taking guest to number of tourist places. There were a number of expensive add-ons provided by these players simply made survival of small and new players exceedingly difficult. When Manoj began to think about this problem, he was just concerned of what can be that innovation or change that could help their company to survive or even progress further to create history in this crowded and particularly biased market space. The first very interesting question he had in his mind—that why he never used these package tours in his entire life? What is that he wanted out of the tour that these companies were not offering? He tried to answer this question again and again. While trying to answer this question, he realized that he has many wishes to fulfill when he goes on vacation. Those were ranging from some adventurous trails in some remote mountain to some focused interactive activities with natives in a particular region. These very personal and specific wishes those always forced him to avoid group tours and go separately for exploration. That has made him to arrange customized tours himself or with the help of travel agents. He definitely is of the opinion that planning a tour is the most enjoyable part and most of the package travelers are missing on that fun part. But going alone or with just a couple of friends have their own issues. There are seniors who wish to have this fun but in the controlled manner. Are they looking for the half-cooked tours and want their involvement in giving them a final shape? These observations led to some interesting ideas. First of all, this led to a thought of interactive package tour where

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_1

participants plan and create tours as per their preferences. But on top of that, it should be a group tour with association of like-minded people. The experience is created by participants. In this way, individuals were provided with a dashboard to create tours and they can keep on adding stuff—once they are happy with their tour, they can post it on the tour platforms. Similar tours are clustered to make a few representative tours and slowly customers with common interests select these tours and a group is formed. The groups interactively refine the tours. This helped the company to create a new market segment of travelers who were not choosing travel companies. This also attracted other travelers who refrain from traveling due to missing element of adventure in such tours. The digital technologies, intelligent technologies, and strategies to address altogether a new market segment fueled the intelligent business innovation in the company.

1.1 AI Role: DBI Contributions to Digital Strategic Revolution

Technologies changed the way business could be done. It is not simply advent of modern technologies and use of technologies but also about evolution, uses and strategies those contributed to this change. While some businesses excelled to create history, some of the well-established businesses gone through very tough times. New businesses emerged and existing businesses graduated to all together a new digitized level. Banks transformed into to IT companies, malls transformed to online super shops and universities transformed to digital interactive virtual classrooms. While this digital transformation is happening, intelligent technologies offered a completely new landscape expanding thinking boundaries for overall evolution. Digital business innovation encompasses these business transformation and innovation empowered digitization along with innovations empowered by digitization. Thus, it definitely needs to consider different technology trends and their impact on business strategies. But on the top of that, it also needs to consider learning opportunities with reference to existing products and business processes. It is required to understand association across businesses, domains, and technologies. A new model for selection and elimination to create better value is the foundation to it. It is not simply driven by machines but evolves with the platforms where humans and machines collaborate. There is augmentation of intelligence; there is substitutive and collaborative intelligence competing for absolute market dominance. At times, it may merge with human actions to become inherent part of business. This further takes you to intriguing questions regarding learning efficiency, ethical concerns, explainability, data scarcity, and data policy issues. Thus, digital business innovation is much more than business and technology evolution—it is rather about technologies, machines, and strategies coming together to define new routes with unlimited possibilities for business and redefining the business. Technology is rather a vehicle. On the other hand, you cannot simply say that machine intelligence and advanced technologies

are the future of digital business innovation. It lies in associative and collaborative technologies strongly based on strategic pointers. But the whole change is empowered by AI—not just AI as a technology but AI as a thought process and "thinking in AI way" where human and machine capabilities strive for market dominance.

This book is about identifying learning opportunities in businesses, understanding intelligent collaborative opportunities working with other businesses. It includes digital business innovation strategies, AI strategies for businesses and learning as well as collaborative learning strategies. Digital business innovation thus embeds digital and learning technologies to empower business or to create pathways to change the paradigm of business. This in turn helps organizations to create better value for customers and address the customer needs and problems those were not possible to address in the past.

The improved **efficiency** through digital means is platform to it. The overall efficiency improvements help in establishing new business ideas and new business paradigms. Efficient financial transactions through digital means transform banks. It further results into **improved customer experience** contributing to higher level of customer satisfaction. The online shopping and tracking by online marts like Amazons and Flipkart changed the way we buy and transformed the business of retail non-consumable and consumable article selling. Additionally, **improved accessibility and search space** through technologies changed the way we book tickets, we book hotels—Make My Trip, Red Bus, and Booking.com changed the booking space and ideas about reservation systems. This change along with **scalability** allowed to do the business worldwide for all these companies on a very large scale. Definitely the role of improved technologies for **better security measures** cannot be undermined in this overall transformation. The **improved collaboration** means changed the way meetings are held; classes are conducted and on larger scale the way universities and schools are run. It even created and changed the concepts of online schooling—the platforms like Zoom, Google Meet, WebEx, Microsoft Teams transformed business meeting, the company cultures, and business collaborations. The collaborations at different levels created avenues for different businesses sometimes bringing up new challenges to cope up with.

Thus, digital business innovation can be approached in three levels with increasing contextual participation. These three levels are technology, strategy, and value creation. Apart from different technological and business facets of intelligent business innovations, this book also contains real and compelling stories of digital business innovation of companies from different parts of world including Japan, USA, India, and Singapore. Authors themselves contributed and witnessed these innovations and bring first-hand experience to help you to participate in this journey to create new success stories.

1.2 Understand DBI

DBI: contributing to Digital strategic revolution:

Businesses changed in recent years. The digitization innovated businesses revolutionized them and created new markets. It even changed the way businesses were operating. Traditional business models became obsolete and new business models emerged. Some businesses took a completely new shape to address new customer and market segments. The first two questions we would like to take a crack at are: What is digital business innovation (DBI)?—what exactly is DBI for an organization? Our friend and one of the revered academician and entrepreneur Dr. Chande strongly advocates that—digitally driven business innovations are paving new horizons for creating the values which were unthought off, thereby influencing strategic paradigm all over. When we asked him—do digital ideas are about technology?—he says that "digital technologies are all about exploring their holistic use for society fulfilling their emotional needs. It is also about liberating strategies with technologies." Another well-known IT thought leader of this century, Dr. FC Kohli always reiterated that value can be delivered when we understand the context at the bottom of pyramid and real digital business innovation can begin from that point. He used to stress that it is very systemic, contextual but local in nature [1].

Thus, digital business innovation continuously strives to expand boundaries and extent of value creation or redefine value creation through pace, efficiency, scalability, and precision.

Take an example of Uber or Air BNB—where business strategies found technology vehicles and digitization liberalized them to create worldwide impact. Strategy of effective resource utilization powered by cultural embeddings met versatile technologies to achieve scalability, reach and accessibility. In case of Air BNB, cultural experience and affordability met with the needs of natives and resource utilization to redefine hospitality business. While in case of Uber, affordability and resource allocation are at the center. In both cases, the technology helped to allow distributed providers to serve distributed customers with strategic and technological means. Thus, DBI and most importantly power of AI is definitely the backbone of the change.

In last two decades, we got opportunities to work with various companies in India and other parts of the world where they wanted to make their products intelligent. We worked with companies those wanted a "chat bot" to be developed to answer any query by customers, even with the companies they wanted to survive to make AI a core part of their business strategy. There was a company that wanted to implement intelligent parking system where parking seekers could meet available parking spaces creating competitive edge for the organization. For another company we provided the most accurate forecasting to buy consumables from the most appropriate seller. Thus, strategic aspects of most of the businesses are—making buyers to meet sellers or providers to seekers and mapping products to customers.

At times, strategy is tightly coupled to technologies—but DBI allows to innovate strategies while keeping strategies and technologies separate. DBI is liberating

strategy with technology wings. DBI offers the most important flexibility to take strategies to really next level not just technological level but even in terms of innovation. Then it makes us to think that is it a digital business innovation or intelligent business innovation? Is it autonomous vehicles or fully automated answering machines? or is it more about collaboration of machines and humans? Frankly speaking, digital business innovation changed its landscape and overcame the traditional technology limits obstructing growth. Probably, it is more intelligent business innovation where intelligence refers to strategies, intelligent technologies, and communication. Hence, we will refer it more as an intelligent business innovation throughout this book.

Thus, digital business innovation goes much beyond traditional thoughts of technology selection or using technologies to enhance efficiency. Technology itself is not a strategy but right use of technology is! Rather it is **identifying strategic opportunities to embed intelligence in business and redevising strategies to expand boundaries**. It is further about **associating multiple such opportunities to deliver systemic impact**. It is more than creating single event of impact but rather about sustained values through evolution and learning. This chapter will introduce you to this overall view of intelligent business innovation—rather AI empowered DBI. Let's go through digital to intelligent, autonomous to collaborative and information-driven to wisdom-driven transformations to achieve it. Let's break the shackles of traditional pathways and perceived limits. These "wise businesses" or "wise machines" are not simply those can classify data and simply search a song and play for you when asked or give you wonderful dashboard full of numbers with some insights. But these machines and businesses understand you and work with you. These businesses are more than statistical in nature—they go beyond probability and try to understand you. These intelligent businesses are expected to empathize with all stakeholders. We can conclude based on the book "Hit Refresh" by Microsoft CEO Satya that empathy is core to innovation [2]. Hence, these machines are expected to understand it and respond accordingly especially when interacting closely with humans.

1.3 Intelligent Business Innovation: Signals and Drivers

Intelligent business innovation is about three important drivers: Technologies, innovation, and strategy. In the last decade, many businesses strategically changed the way they were doing their business. Such business innovations have become possible through identification of leverage points. These leverage points are typically innovation drivers. They make it possible to visualize learning opportunities, strategic business opportunities to attract new customers, and technological opportunities to enhance current offerings and offer possible new services. Additionally, these opportunities help to reposition the business. We will refer to it as an intelligent business innovation rather than digital business innovation since AI is core part of all these transformations. Take an example, where intelligent business innovation

in taxi business done by Uber. Here, existing business models changed with technology, intelligence, and strategy. Air BNB did the similar transformation in hospitality industry and Netflix did it to media and communication. The cultural needs of travelers and budget constraints acted as leverage points for AIR BNB. Similarly, flexibility and freedom in entertainment acted as a leverage point for Netflix. Leverage points are typically pointing where small change or repositioning at crucial strategic level resulted in big change across the business.

"Change" word is used so commonly that it fails to give the feeling of what we expect out of it. In fact, businesses changed over the years and most recently due to digital means. Some businesses reached to new heights while in last few centuries, many businesses suffered a severe setback. They struggled for revenue oxygen. New chasms are created and businesses fall through them. These chasms were technological as well as strategic. Shall we call it business or paradigms? Many well-established paradigms got severely suffocated. Which are those paradigms?—These paradigms included traditional circus paradigm, traditional taxi service paradigm, traditional school education paradigm, traditional selling paradigms, and probably traditional library and book shop paradigms. Some paradigms suffered because of advent of new technologies while others suffered because of increased expectations and possible pathways created in allied businesses. When one paradigm is cornered—many businesses start suffering and a few new paradigms evolved. It looks very revolutionary but in fact it is evolutionary. Whether it is online selling, or online education—whether it is cineplexes to multiplexes to streaming of movies online, it has always been going through changes at various points. The evolution always offers hints of change. **Intelligent business innovation is about identifying the new paradigm, identifying the supporting strategic moves, combining them with relevant technologies allowing to introduce intelligence, and creating sustainable value in the given new context**.

Intelligent business innovation has strong foundation of strategy based on social and business context. No longer mere product positioning is the strategy and neither is playing in the region of weak forces. Changing the rules of game remains at the center of all strategic actions but it is very general way of visualizing it. When the gap between products and services is diminishingly confusing, positioning product in different forms has been becoming increasingly commonplace—the strategic innovation needs to be looked at form new perspectives. Intelligent business innovation is about taking a new leap to provide a platform for greater value creation irrespective of competition. Hence, intelligent business innovation cannot simply rely on technologies. It has many facets with strategy and technology at the heart of it. Let's take a brief look at what could inspire intelligent business innovation? There are various drivers for this intelligent business innovation. Some of these drivers are listed below:

- Uncertainty in the market.
- Technological change.
- Change in expectations.
- Depleting resources.

While US-based investment advisory champion "Envestnet" has identified opportunities through changing investment context [3], "Ketan food" a food product company from Maharashtra India, sensed the opportunity for combining scalability with handpicked taste of nourishing snacks [3]. These opportunities go beyond verticals and industries to create new business models. These opportunities are sensed by organizations, visionaries, and innovators. There are various signals primarily indicative of the opportunities those allow you to realize leverage points or innovation drivers.

These signals include:

1. Sharp sustained fall in opportunities.
2. Frequent variations in business.
3. Possibilities of new association.
4. Advent of relevant intelligent technologies.
5. Significant cultural and emotional migration.
6. Surprising events leading to leverage points.
7. Changing context.
8. More uncertainties.

Cirque Du Soleil is an entertainment company from Canada. When it realized that circus industry is going through a difficult period—company reinvented entertainment with technology, strategy, and innovation [4]. They got rid of costly animals, they invented new themes and stressed on entertainment through interactions. The company sensed depleting business and changing business scenario. They could visualize the new possibilities by sensing sharp fall in opportunities in case of Circus in 2001, 2005, and even 2010 [5]. These opportunities reflected in continuous fall in earnings, reduced demand, and increasing obstacles. The company invented new ways to deal with this situation. The digital business innovation happened with repositioning of entertainment business, reducing cost, and eliminating redundant resources. The technologies allowing dynamic and interactive participation for audience helped them in this repositioning. But in last couple of years, there are new challenges. Old strategies are not working today and company gone through a real difficult phase in last couple of years. But there are definitely new intelligent business innovation opportunities, they have explored which are coming through association and use of intelligent technologies. The association of their immensely popular shows with intelligent technologies, robot participation in these shows or even reshaping of entertainment during pandemic could be answers to these problems. Who knows, there could be a completely new perspective and paradigm that will emerge due to this difficult time, rewriting the entertainment positioning once again.

In some cases, there is no sustained fall in opportunities but there are frequent variations in business yield and indirect business parameters. There are some indicators of arrhythmia. These variations act as signals to serve as indicators of innovation drivers/leverage points. IBM and Microsoft have witnessed such variations in the first decade of this century.

Tesla is a typical example where advent of new relevant technology along with social needs created new opportunities. Whether it is electric car, ChatGPT, or space

venture—Tesla always sensed opportunities through technology and its association with social needs. Apple is another example of it. New relevant technologies created pointers for them and these companies conquered the business boundaries irrespective competition. The strategies in most of these cases were not crippled even though there was no weak force zone as such. There were capable and strong players in the market. But digital business innovation allowed these companies to redefine business. The context and new knowledge create need, and with technological advent, the need is converted into new opportunities and new ways of carrying out business. Senior Engineering Manager, Scientist, and Computer Engineer Shridhar Diwan is of the opinion that—"*it is not necessary that you should always be first mover… but the most important thing is to identify the right technological opportunity with respect to timing. There are many companies who grabbed the second or third wave to create history.*"

Cultural and emotional migration has always been driving many intelligent business innovations. It includes companies like shadi.com as well as online puja companies. It even impacted other business in health care and educational sectors. In the similar way in many companies, intelligent business innovation is driven by surprising events. These surprising events include—sudden change in government policies, political leaderships, change in relationships among companies, or even some social or business calamities. These things also contribute to change in context. Many online education companies as well as online business companies innovated business ways during pandemic and even change in political leaderships in different countries. Opportunities have cognitive impact—in the sense that we visualize the need and DBI can convert it into opportunities where different perspectives of intelligence meet innovation. In the next section, let us discuss how different companies made it possible.

1.4 Making It Happen—Overcoming Hurdles

Knowledge is the key for DBI or IBI. It is important to acquire and manage knowledge. Knowledge management is about making available the right knowledge with the right person at the right time. What is meant by right knowledge? It could be knowledge regarding how to go about strategic opportunities or technological know-how in alignment with utility and value creation. Digital business innovation is truly about identifying the opportunity and converting it into action. Then question arises—what refrains even great companies form possible digital business innovation? While many small companies could handle it gracefully and emerge as successful players, many big players suffer from it. We find multiple reasons for these failures. These reasons include:

1. Use of wrong matrix.
2. Failure to do multi-class classification required to identify market segments.
3. Looking at a right matrix in a wrong way.

4. Failure to visualize impact of intelligent technology/technologies.
5. Paradigm inertia.
6. Prison of past stories.
7. Looking at opportunities as obstacles.

Let us discuss these reasons in greater detail:

1. Looking at matrix of your convenience and then falling in the trap of own matrix is habit of organizations for years. Failure of Nokia after the great success can be attributed to this category.
2. Let us take an example—one may look at average income of customers to sense the opportunity but may not look at how the customers with different incomes are spread across the country. Hence, the company may fail to identify market opportunity as new focused players arrive in the market. Sony Vaio after initial success failed to redefine market segment. It may be necessary to look at average as well as spread but company may look at average but not spread. The addiction of mean-based evaluation leads to strategic failure. In typical scenario, company may classify customers in two classes—rich and poor but there may be four or five classes and the relevance may be visible only after multi-class classification. Companies may look at binary classification rather than multi-class classification at some very crucial points.
3. Many times, right matrix is looked at and analyzed in a wrong way. The spread is ignored and average gets more importance. The increasing spread may be looked positively but it may be detrimental to positioning. Hence, there is need to look at matrix from right context. Sometimes, absolute numbers are relevant while in other cases relative ones. Looking at most relevant numbers is the key. Knowing but not understanding the fact is issue of concern. Average number is same but shrinking spread may direct to opportunity but company may miss on that.
4. There is always reluctance to adapt new technologies, and at times, companies may fail to visualize impact of advent of new technologies on their business. "Barns and Nobles," one of the leading book companies from USA, could not visualize impact of new technologies and online book delivery on their business. Companies like Kodak come under these failures.
5. Companies may stick to a single business paradigm. Many big retail giants fail to show agility needed to accept new business paradigms. Many traditional taxi companies could not adapt to new paradigm and suffered as players like Uber, Ola entered the marketplace.
6. Past success of one of the method/techniques makes organizations to apply the same one again and again. Companies may become prisoner of their own past success stories. Failures of coaching classes those stuck to traditional methods could be attributed to it. It typically happened with big brands and when they try to come up with the next version. They are generally not ready for the change.
7. Opportunities through liberalization or even through technologies are looked as obstacles and companies may fail to grab them. In the beginning companies like Bajaj, an automobile leader in past century from India suffered from a setback due to it.

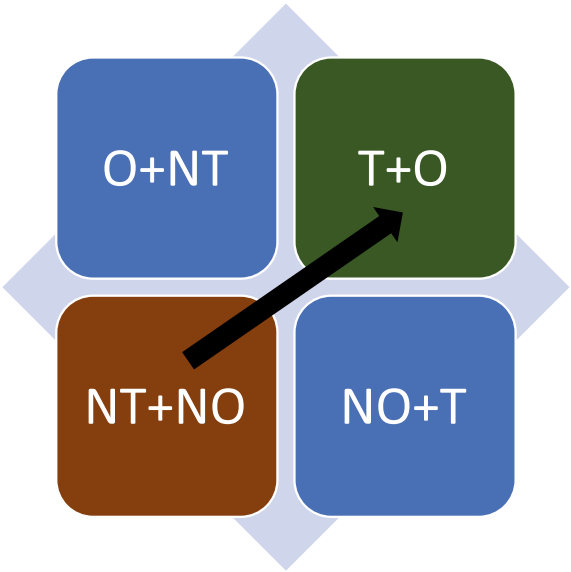


Fig. 1.1 Opportunity and technology

We will try to look at these aspects in more detail as we will move to subsequent chapters.

There are a few companies those have very successfully graduated to intelligent business innovation. They could make it happen by identifying the opportunities, looking at right numbers and using relevant technologies. Is there a compelling technology that decides opportunity?—is there a perceived opportunity well ahead of time? This typical scenario can be depicted using a simple matrix depicted in Fig. 1.1.

Here:

O indicates opportunity, T indicates technology available.

NT means no compelling or requirement meeting technology available.

NO means no opportunity.

There are two basic approaches while looking at intelligent business innovation. While first approach is driven by technologies, the second one is driven by opportunities. Technology-driven approaches begin with advent of new technology and later organizations look for new interesting opportunities those could unveil with these technologies. For example, many companies emerged after people realized that natural language programming and machine learning are working very well and supported by equally good technologies. Same is true for many "voice to text"-based companies. As these technologies started becoming popular and practical, many companies sensed opportunities in allied areas. On the other hand, in many cases, visionary companies identify business opportunity first and then look for technologies and positioning to meet those market needs associated with these opportunities. Cultural and travel needs led to business opportunity. This resulted in emergence

of companies like AIRBNB. In similar way, Amazon identified the online business opportunities ahead of many other technologies those helped the company to penetrate it across the globe.

O indicates opportunity, T indicates technology available.

NT means no compelling or requirement meeting technology available.

NO means no opportunity.

MR: Is market ready.

In fact, to have a successful intelligent business innovation, there is need of both, i.e., opportunity and technology. Even though opportunity is identified without technology, companies may fall through a "technology chasm" while chasing that opportunity. Here, technology chasm is typically defined as a gap created between expectations with reference to opportunity and constraint ability or limitations due to existing technologies to deliver expected value due to technology limitations. Similarly, in spite of new technologies without opportunity, companies may fall through "opportunity chasm." This may happen due to multiple reasons like failure to identify opportunity, over estimation or sector mismatch. Further, it may also result in over engineering or over architecting for the opportunity in the focus. Many companies based on making product intelligent using AI technologies emerged 20 years ago but could not become successful since there was no required technology support like processing power. Apart from technology and opportunity, there is need of market preparedness. Is market ready for your digital business innovation? Is customer ready to accept it? Can they use these technologies effectively? Are they willing to write a check for your solutions or services? The companies and concepts those fall apart in 2000 became successful with big bang in 2010 or 2015. Many AI-based companies are the examples of that. Even online shopping and online grocery was not a new concept but it took time for market to become ready for it. Figure 1.2 depicts this complete scenario.

1.5 Known Opportunities to New Opportunities

There are many known opportunities in the market—it is exceedingly important to identify those opportunities and mapping them to right technologies and customer segments. For example, there are opportunities in various domains like e-learning, telemedicine, online entertainment, and online deliveries. Many visionaries have identified it and a few companies made fortunes in these domains. There are a few coaching classes actively involved in coaching students to get ready for admissions in good schools at various places. They were coaching students in various subjects and various screening exams. These exams included GRE, TOEFL, SAT, and few local exams in India like UPSC, MPSC, CAT, GATE, JEE, and entrance examinations by various states. The models were offline and teacher driven. They had many expert teachers at various centers across the country. The model was not very scalable one but still it was a big business and a few players were dominating this whole stuff across Indian market. But after 2010, few players realized the limitation of their model. They

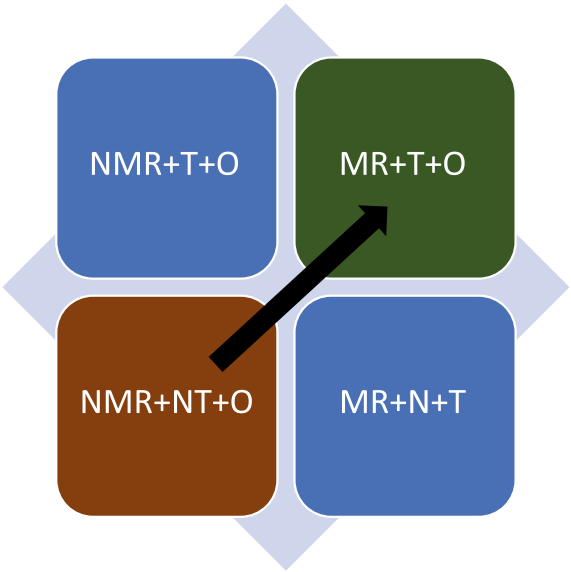


Fig. 1.2 Opportunity, technology, and market preparedness

realized that the highly paid and very large number of teachers is a bottleneck. Further getting such teachers was a nightmare. On top of that, these teachers were very expensive. There were also infrastructure and reachability issues. These coaching classes needed a very good infrastructure at some centralized location. They need to spend a lot of money on advertising and reaching out to students. Further, at any point of time, these systems could not accommodate a very large number of students.

To overcome this issue or to make digital business innovation, initially some players began with video tutoring systems and made the online streaming from a centralized place to number of locations in the country. This in fact overcame the limitation of number of teachers since only one teacher can address larger audience. But the online streaming has quality issues that time. To overcome this limitation, even some coaching classes started making recorded videos available for students in their coaching centers across the country at any time. This enhanced the reachability and was one of the ways out of pressing resource limitation. But this was not working that well due to a number of reasons:

1. Students did not have interactive experience.
2. Students still needed to travel to coaching centers to watch videos.
3. The overall learning experience was not satisfactory due to number of reasons.
4. This education system and market was not matured to replace existing teacher student systems with in-person experience.
5. The video quality and streaming quality were not good.

Basically, human being likes interaction and learning through interactions was not fulfilled through these systems. This led to next level of revolution where number of video conferencing companies began to venture into this area. They tried to

develop different tools to create the experience that could be comparable to classroom teaching and learning experience. Few players raised millions of dollars. In pandemic, these companies further prospered to make huge money and attracted different schools and universities as their customers. Just a few years ago what was simply an experiment to try out for a short-term alternative with digital innovation became an able alternative to traditional (in-person) teaching learning paradigm. Still the tussle is going on between two schools of thoughts representing classroom in-person teaching/learning and online teaching/learning. When I spoke to a few visionaries in this business and a few great academicians, they endorsed that this is a just beginning and there is a huge opportunity in this field. It could be viewed as an intelligent education innovation. Prof. RD Kharadkar, Director of one of the well-known education groups from Pune, India, thinks that "It should be a more collaborative and selective learning system with both online as well as personal experience that is actually a way to move ahead." He does not call it hybrid but he calls it an "intelligent collaborative education system." He does not call it hybrid but he calls it as an "intelligent collaborative education system." But it is not easy to build such a collaborative experience. Right now, most of the tools are really not intelligent. Enhancing existing tools or inventing new ones to take existing experience to interactive experiential learning in online format would definitely change the game. Or it could be the collaborative learning where one can change the way teaching and learning is perceived or rather takes place now. We can visualize it as a great intelligent business innovation opportunity. On one side, social scenario or vison of innovators creates opportunities for intelligent business innovation while on the other side, advent of new technologies creates new business opportunities. In most of the cases when advent of new technologies matches with vision, new intelligent innovation ideas converge to new business milestones resulting in the great success stories.

1.6 Opportunities Created by Technologies

Technologies create opportunities or rather pointers to new opportunities. These technology opportunities can be of various types:

1. Centralized to distributed.
2. Infrastructure intensive to zero or minimal infrastructure.
3. Human resource intensive to autonomous.
4. Static to dynamic.
5. Static to interactive.
6. In-person to online.
7. Local to global.
8. Mono-lingual to multi-lingual.

Advent of new technologies creates options for business innovation by increasing the possibilities or uncovering the infeasible opportunities. These options are specific

to industry or vertical but general trends are like going from heavier to lighter with the reduction in complexity for users always dominates the show. Very popularly strategist calls it more for less. Who does not like more for less. But achieving or giving more for less is not an easy job and that actually results through technology innovation or strategic innovation. Companies need to make it feasible either through numbers or strategic games or come up with the technologies which could make it possible. In "more for less," the most important question is what is more? Which parameters are used for the measurements? It typically stands for more value. Technology and business visionaries who could define "more" in apt and in measurable way could create business revolution and succeeded in changing the business paradigm.

1.7 Intelligent Business Innovation Life Cycle

Intelligent business innovation life cycle does not follow the typical product life cycle path. It is slightly different than the traditional product life cycle. It generally has initial sharp pickup—which remains there for a short while and then goes it down and picks up again as the intelligent technologies continue to mature and start delivering value. The market maturity pace defines the overall nature of the curve. It could suffer from multiple hiccups if there is an unstable technology driving the business (Fig. 1.3).

There are two boosts in the beginning—or whenever it becomes available—one is referred as technology boost while other one is opportunity boost. Without both of these, no intelligent business innovation is successful. Thus, intelligent business innovation life cycle is divided into six parts:

1. Opportunity validation.
2. Technology + opportunity validation.
3. Market preparation.
4. Early results.
5. Leveraging the outcome.
6. Decline/new opportunity.

Though intelligent business innovation follows a life cycle represented in Fig. 1.4, it has two different presentations. One is for a completely new intelligent (AI) product. In this case, product life cycle begins with problem and then goes through technology hiccup and settles in later half. Hence, initial behavior is identical to general product life cycle.

Another presentation of life cycle is for an existing company identifying AI opportunity to reposition the existing product. Here, this company has already its own captured market segment. Either it is depleting or demanding something more. Here, the existing product may be in declining phase or is going through the constrained growth. The transformation in the beginning shows a chasm where the product suffers a bit in the beginning. This is generally due to time required to gain a bit of maturity

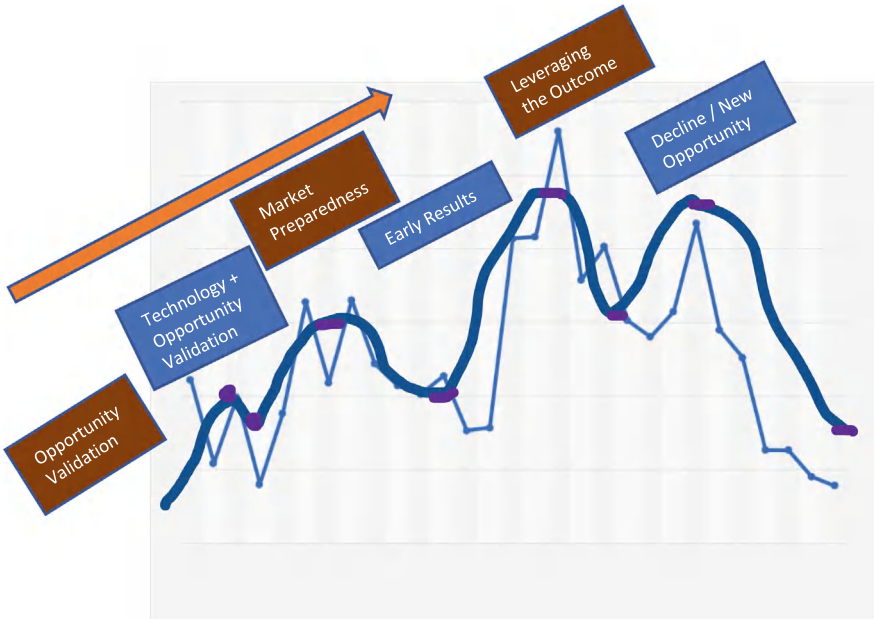


Fig. 1.3 Intelligent business innovation life cycle

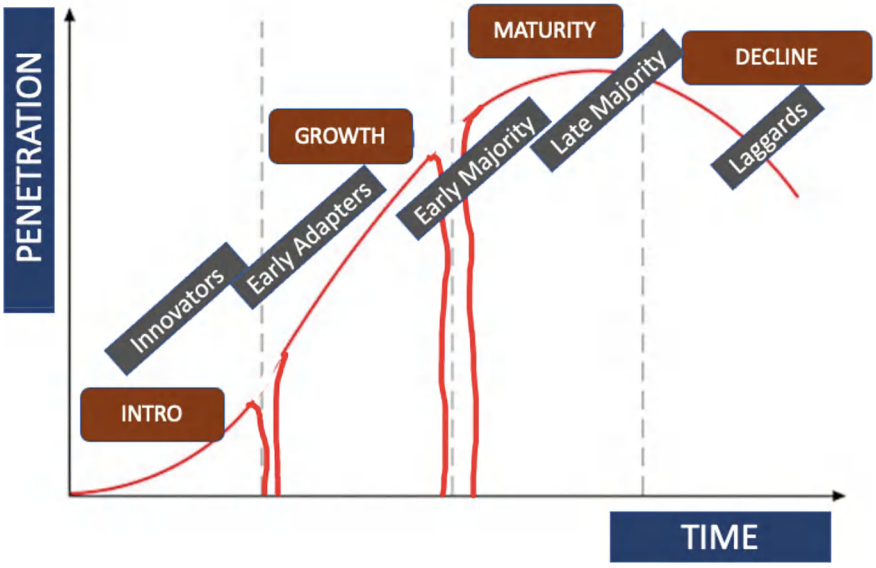


Fig. 1.4 Product life cycle

by the product and to educate customers and then it may follow a standard product life cycle pattern. In many of the cases, intelligent business innovation substantially impacts scalability. This contributes to a sharp elevation in the growth in the beginning unlike steady growth in standard products. It may have saturation phase after reaching to maturity.

1.8 Intelligent Business Innovation Matrix

Intelligence in business has many advantages and those are not simply confined to scalability. The intelligent business innovation matrix is introduced to guide during this process. This matrix is evolutionary matrix, and at different phases, it is expected to look at four key parameters in the context of the phase. Using a single matrix may be bit misleading. Here, four matrices are used for four different phases.

Introduction matrix

1. Opportunity evaluation.
2. Business impact.
3. Choice of technologies.
4. Market space division.

Take off matrix

1. Technology adaptation.
2. New market space division.
3. Market readiness.
4. Acquisition pace.

Maturity matrix

1. Reachability.
2. Market expansion.
3. Allied opportunities identified.
4. Quality of service.

Revival matrix

1. New forces.
2. Market diminishing factors.
3. Repositioning or transformation.
4. New technology adaptation in new context.

It is interesting to see the evolving relationships between these matrices, and we will discuss it in chapter seven.

1.9 Identifying the Need of IBI

Intelligent business or rather AI empowered business innovation can be thought of as a tool for survival when business is going through difficult period. It could also be the business accelerator even when the business is doing good. AI is about making processes, products, and machines intelligent. Intelligence has different facets but the most important aspects are behaving like human where goal directed rational behavior is exhibited. We have taken examples of a few companies those used intelligent business innovation (IBI) successfully to survive and grow. The objective of business is always a sustainable value creation. To achieve this objective, businesses need to innovate and needs to redefine or re-evaluate value creation. Many times, company needs to sense the need of IBI much ahead of time. It is not just bottom line or new technology availability. It requires the customer behavior analysis. One of the companies that we worked with is providing intelligent solutions in agricultural domain (India based agricultural data and insight providing company), sensed the need of intelligent business innovation through the changes in customer behavior. They identified that the traditional forecasting is no longer making sense for their customers and hence focused on the new paradigms of agricultural value creation. Same thing is true for "Envestnet" (US-based investment advisory company), it realized the need of intelligent business innovation based on the interactions of customers with their investment platform.

1.9.1 Machine Intelligence: Business to Digital Business Innovation to AI Empowered Techniques

There are many technologies those contribute to intelligent business innovation. Intelligence is not simply about the algorithm that brings intelligent insights and inference but it also includes the way information is collected and used [6]. On broader aspect, it includes transforming every business activity, associating them, and leading the combined processes into goal directed and optimal outcome. Hence, the landscape of AI technologies includes data sciences, cognitive computing, abilities to sense and deliver data along with learning and generalization for doing things rationally and in a common-sense way. We will try to take a quick survey of some of the technologies and technology paradigms in this section.

Intelligent technologies: We want businesses and products to be intelligent—hence, there is need to understand and use different intelligent technologies relevant in the given context. This includes different technologies related to artificial intelligence, machine learning, data mining, and deep learning.

Big data: The changing scenarios demand a radical change to business models and human resources. The need to look at large volume data made available by technologies and intelligent algorithms. There is constant demand to make this data available and processed. This made big data a corner stone of DBI. Volume, velocity,

variety, veracity, and accessibility are the five key properties of big data. Big data gave birth to different big data tools and technologies those can support big data needs.

Machine learning: We want our businesses and products to be intelligent. Learning is manifestation of intelligence. Machine learning strives to make machines learn and is inspired from the ways in which human being and other living organisms learn. This led to number of techniques including bio-inspired techniques and statistical techniques. There are supervised learning algorithms where supervisor provides pointers for learning in the form of labels. In absence of supervisor, learning takes place by looking at similarity and differences. This similarity and differences allow to form clusters based on behaviors and are referred to as unsupervised learning algorithms. Supervisor may not present all the time so there is learning in presence and absence of supervisor rather labeled as well as unlabeled data—it is referred to as semi-supervised learning. Additionally, there are reinforcement machine learning and evolutionary learning algorithms to handle dynamic business scenarios. To deal with different facets and needs of learning, many learning tools and techniques developed. Intelligent business innovation needs smart technologies with learning abilities. Machine learning involves all techniques and tools those can build abilities in machine to learn to produce the results expected out of them and further enhance their abilities with self-adaptation, exploration, and evolution.

Data science: It is study of data and performing all scientific operations on data to extract meaningful insights of business. All the statistical and association methods and technologies dealing with data to use data effectively by mining it and finding interesting patterns out of it come under data sciences. It ranges from simple statistical tools, mining tools, and even intelligent algorithms. It combines multiple approaches from different disciplines of computer science.

Block chain: It deals with cryptography using peer-to-peer network. DBI comes with security challenges. Block chain has offered one of the way outs for these security challenges. It is a distributed ledger of blocks that are linked together. Connections through cryptographic hash assure security of data. It also mitigates risk due to centralized storage by storing data across peer-to-peer network. There are public, private, and hybrid block chains.

Wearable technologies: Human is always an important part of whole process. Wearable technologies play a key role in health care helping for continuous monitoring of different parameters. These technologies with AI make it possible to provide timely alerts. Right from woman care, infant care, to geriatric care, it touched all the fields to transform health care. These wearable technologies have IoT devices mounted on the daily utility and usage items. These devices could capture the data continuously to keep track of scenarios and warn in case of anomaly.

IoT devices: Internet of things is about sensors sensing continuous data and feeding it to server or cloud. These devices have limited processing capability and make sure that right data is going to repositories. AI and IoT is combined to embed intelligence into these IoT devices. AIoT-NT is having nanotechnologies making sure that tiny IoT devices could keep track along with initial intelligent processing of the data. IoT devices become non-separable part of the modern AI systems as they

can work in real-time setup and give that most necessary sensing of relevant data which is platform for intelligent technologies.

Advanced technologies: All above tools and technologies further evolved and new hybrid learning, data mining and information retrieval technologies emerged. These technologies played key role in intelligent business innovation. In this book, we will touch on various intelligent technologies mile stones with reference to different case studies. There are techniques those combined different bio-inspired and statistical techniques and associated different paradigms also. There are many new technologies contributing to intelligent business innovation, and we will introduce them as we go through different case studies in this book.

As we continue, we will discuss digital transformation, digital maturity, and digital innovation strategies in chapters 2 and 3. In chapters 4 and 5, technology aspects and digital collaboration. Further, we will elaborate on workforce automation and advance technologies in chapters 6 and 7. While leadership and implementation aspects are covered in chapters 8 and 9, we will conclude with possible innovation and future of DBI in Chapter 10.

1.9.2 Digital Innovation—Economic Aspects

60% of recent economic GDP growth could be attributed to digital transformation, rather intelligent business transformation [7]. The intelligent technology accelerators on top of digital platforms worked as an impetus to economic growth. Artificial intelligence, Internet of things, and big data weaved strategic, tactical, and financial elements together to bring digital and economical revolution. Microeconomic and macro-economic impact is realized by intelligent business innovation. While the impact gone across the verticals, it is realized across different sector and delivered growth and economic value at the bottom of pyramid. Then it even transformed the financial sector itself changing the way transactions have been carried out. We will also look into economic aspects and measurement of impact of DBI in this book.

1.10 Summary

Digital business innovation changed over the years to intelligent business innovation with the advent of intelligent technologies. Intelligent technologies though are at the core to it, strategy and innovation are equally important to it. Knowledge management, looking at right matrix and identification of right opportunities, can lay foundation for intelligent business innovation success. IBI life cycle is not identical to a typical product life cycle and it exhibits different behaviors. The behavior has many ups and downs unlike to standard product life cycle. Intelligent business innovation has major component of intelligent technologies. Here, intelligent technologies refer to technologies those help in making business or products intelligent. Various

technologies associated with machine learning, AI, data mining, and security can be considered as intelligent technologies. Businesses need to exhibit overall intelligence and adaptability where business learns and adapt to solve the problem. Intelligent business innovation is about taking business in the direction where learning and decision-making are more evolutionary and allow to create more and sustainable value.

References

1. Kulkarni P (2015) Knowledge Innovation Strategy, Bloomsbury
2. Nadella S (2017) Hit Refresh: The Quest to Rediscover Microsoft's Soul and Imagine a Better Future for Everyone, Harper Business
3. Kulkarni P (2022) Choice Computing, Springer
4. Chan KW, Mauborgne RA (2005) Blue Ocean Strategy. Harvard Business Review Press
5. https://news.microsoft.com/wp-content/uploads/prod/sites/43/2018/11/Unlocking-the-economic-impact-of-digital-transformation.pdf. 24 Feb 2024
6. Kulkarni P, Joshi P (2015) Artificial Intelligence: Building Intelligent Systems, Prentice Hall India
7. https://unctad.org/publication/digital-economy-report-2024. 01 Dec 2024
8. https://www.cirquedusoleil.com/press. 24 Feb 2024

Chapter 2
Digital Transformation and Digital Maturity: Essentials of Digital Transformations, Economy, Technology, and Culture

Organizational learning to cope up with technology evolution builds the required pathway for digital business innovation (DBI). DBI needs to transform the business processes and products with digital means and innovative technologies. It cannot be started without organizational learning, knowledge about technologies, and cultural vision leading to the "digital maturity." Here, digital maturity is not simply the knowledge about recent trends and technologies but it is more about ability to timely responding to the digital changes and technology evolution in a constructive way and knowing which technologies to use and how to use them along with what technological attractions to ignore. It could also be referred as the measure of organization's ability to create value through digital means [1]. It is not a one-time affair and organizations need to work on digital maturity continuously with evolution of technology, changes in the technology landscapes, and the changing competitive scenarios. Digital maturity further refers to the ability of organizations to select relevant advanced technology and creating the value with them across the value chain. The digital maturity milestones help in charting out the path for organizations to adapt and use new technological innovations seamlessly. The digital transformation contributes to inclusion of better technologies resulting in improved processing and information availability. The elements of digital business innovation include advanced technologies like AI, big data, IoT, block chain, 3D impression, etc. The technological development process and cultural development status are two different aspects. While technological development may contribute to efficiency and selection of technologies, cultural developments along with technological development contribute to effectiveness and cultural adaptation of new technologies. The digital maturity considers both of these aspects: Cultural maturity and technological development maturity. In this chapter, different digital maturity models and most importantly aspects of digital maturity assessment will be discussed in detail.

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_2

The first step on the path of digital maturity is to formulate digital strategy. This is about positioning different technical, financial, and soft initiatives along with organizational structure and human talent development in alignment with the digital strategy of organization. There is digitization intention of the company to be aligned with competitive objectives and ultimate goal. Thus, the business model is transformed with technology—it may be transformed from in-campus education to the online education or actual shops to e-shop. Thus, aligning digital strategies with generalized business strategy is the foundation for digital maturity leading to digital transformation. In this regard, relevant digital abilities are developed. Thus, digital maturity is creating capabilities in the organization to respond new technology developments and shifting trends. To leverage the new technology organizations, need map technological advances to organization goals—that demands strategic investment in human resources, their trainings and new technologies and tools. This chapter will try to look at different aspects of digital maturity and initiatives to be taken to achieve it in order to lead the organization on the path of digital business innovation.

2.1 Digital Culture

Culture typically looks at ways of expression, behaviors, customs, and social interactions among population of a region/organization. The digital culture is how they understand each other's digital expressions, technology needs and adapt to change to create value by accepting technological and business needs. Thus, it is basically regarding the relationships, their expressions among different entities along with their evolution with technological means. The cultural aspects also include the way resources are effectively used in order to achieve strategic agenda. Digital business innovation contains digital culture and digital maturity as two fundamental components.

Thus, digital culture could be defined as using digital cultural artifacts effectively in alignment with organization's shared principles, values, and vision. In fact, digital culture is not bound to a particular technology or a set of technologies—it is about the way how overall organization adapts new technologies and makes them work along with existing infrastructure and old technologies. It is also how it gets rid of some old technologies and the concepts those have become obsolete with the new revelations. It includes how people train themselves and their peers and align quickly their actions with strategic initiatives. A typical intersections and broader view of digital culture is depicted in Fig. 2.1.

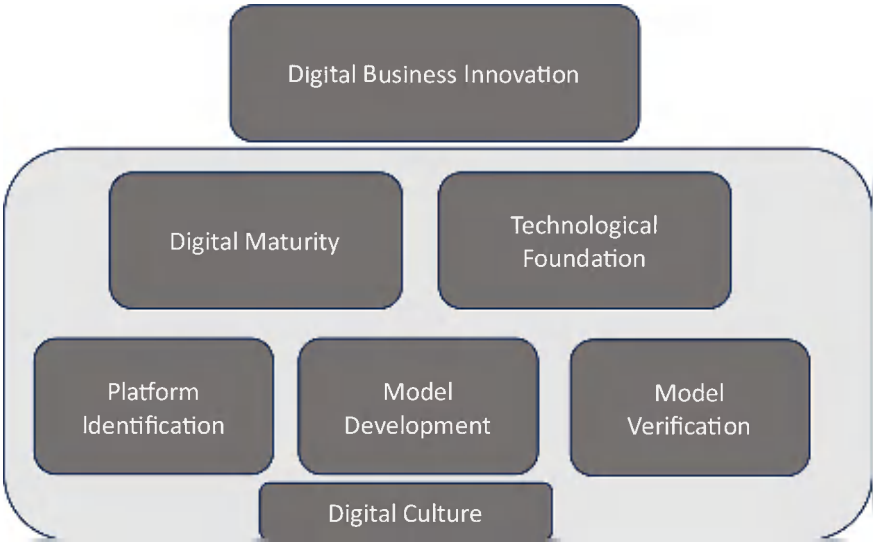


Fig. 2.1 Digital culture to digital business innovation

2.2 Digital Collaboration and Digital Culture

Figure 2.2 depicts different cultural aspects. There is overlap between culture, strategies, and technologies that drive organizations business objectives effectively to create competitive advantage, reposition the products/services, and ultimately lead it to greater success. Interestingly, the technology landscape changes the competitive positioning and even product positioning for the organization. While analytics create insights, culture helps to dive deep into it. The business that is looking for competitive advantage through culture and technology needs should align technological insights and technological positioning with business strategy and cultural aspects.

Digital maturity and innovation management looks at managing culture, technologies, competitive positioning, and organizational learning to lead to business innovation and digital transformation. Digital maturity management focuses on balancing these initiatives. There are six thumb rules for digital maturity management.

1. Suitability ahead of hype or advanced technology: Look for the most appropriate technologies with reference to the business objectives. It is not always necessary that the technology is the most advanced.
2. T1 followed by T2 is not equal to T2 followed by T1: Technology introduction order is the key to success to digital transformation.
3. Less is better than more: Understanding just enough is crucial to advance on the path of digital business innovation. More pace or more technologies could prove to be harmful. Too many advanced technologies at a time could be detrimental to

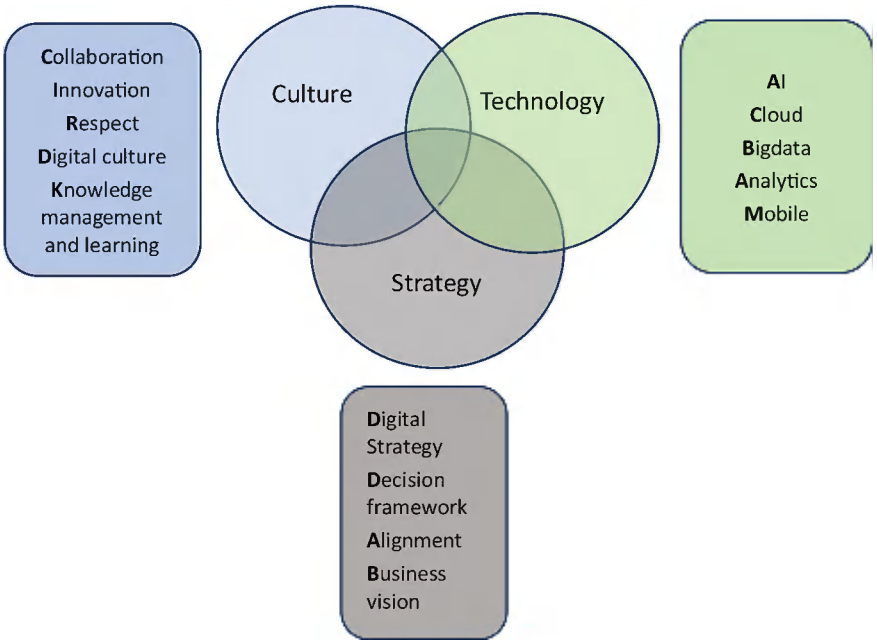


Fig. 2.2 Cultural aspects

organization progress. Thus, pace of introduction of technologies is very important. The digital culture also needs to identify the most appropriate and just right technologies and should able to manage the pace of introduction of technologies.

4. Learn before introducing: Right technologies and mastering them ahead of time are important to the organizational success. Not only understanding technologies and their usages but imbibing them in the DNA of the organization is crucial.
5. Maturity to drive competitive advantage: Let maturity drive competitive advantage and not the other way round. Thus, there is need to have continuous learning about not only technologies but their impact on society.
6. Continuous learning: There is need to have continuous learning for digital maturity management. This helps in assessing cultural acceptance using right digital maturity model most suitable for the concerned organization.

The transformation with intelligent technologies looks at collaboration between humans and machines and the digital maturity progresses while more and more interactions taking place. A typical human–machine collaboration is depicted in Fig. 2.3. The technology introduction leads to new revelations and that could help in leading the organization to the next level of maturity. This progression takes place as follows:

1. Understanding machines and intelligent technologies: It is about shaping the perception of smart machines in a responsible way. “Understanding different

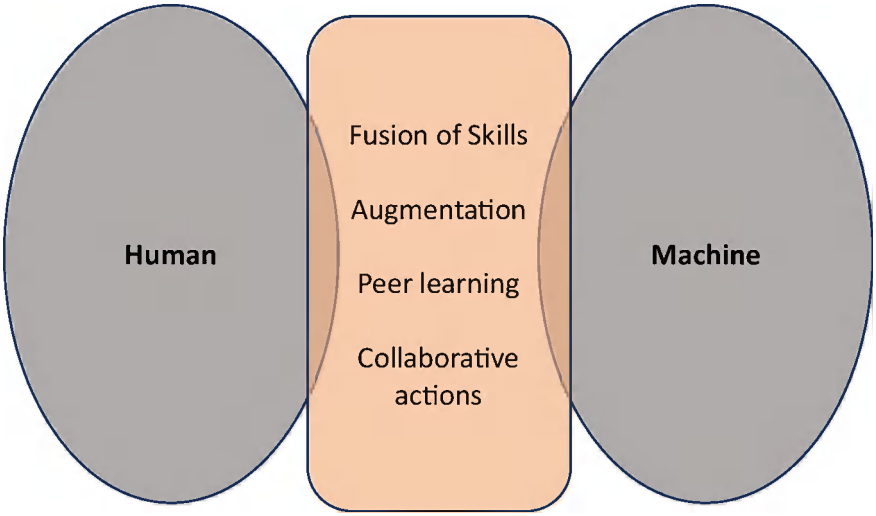


Fig. 2.3 Human-machine collaboration

intelligent technologies" helps the stake holders to deal with the smart technologies and smart machines in very responsible way. This responsibility covers ethical, social, and environmental aspects.

2. Interacting with machine and assess the performance: It includes knowing the way to interact with the machine and realizing and passing judgments on the performance of smart machines. Finally, taking decisions creates platform—for example, with regard to deviations from expected results or limits to the tasks allocated to machines. This aspect covers knowledge about interacting with the machine and intelligent assessment to optimize interactions and effective performance.
3. Know to get the best data analytics: It needs intelligently interacting with the machines and interrogating databases in order to get relevant and meaningful analytics that results from large data sets. Digital maturity is about knowing how to get the best from data analytics—or rather decoding data relationships and meta-relationships.
4. Collaborating with machines: It is about working "hand in hand" with smart machines. It involves data collaboration, information association, and strategic evolution along with technology usage along with providing complementing actions to improve the results.
5. Learning for machines and users: It involves providing continuous inputs to new learning machines to allow them to perform better in new impeding or unforeseen scenarios. It includes something like reciprocal apprenticing, i.e., on the one hand, performing tasks in collaboration and alongside smart technologies including AI so that these can learn to deal with new situations and become conversant with new skills. (In these situations, humans acting as role models,

e.g., for a chatbot or intelligent counselor). Also, on the other hand, users and stake holders learn to work efficiently and sociably with these machines (e.g., by developing robust mental models of how they operate/perform). The collaboration is about developing competence in machine and learning to reciprocate them in accordance with the technical or business objective.

2.3 Rationality and Digital Maturity

In case of digital maturity, the rational behavior is expected from every user. Here rationality refers to.

- Establish realistic expectations about machine deliverables. This in fact requires to understand: what to expect from machines based on practical analysis of what they can do and what they cannot. Additionally, clearly knowing what they can do is acceptable in social and business context.
- No conflict with technologies and social behavior.
- Interactions via natural language or other accepted protocols and understand responses.
- Abide by social and systemic rules.
- Respecting technical insights.

In technology introduction model, it is interesting to chart out how to educate the stake holders. There is an urgency due to number of reasons including new technologies those are knocking at the door at every moment. Further, there are different groups of people like enthusiast, ready to use and reluctant. The introduction of some technologies leads to marginal change in behaviors and practices while some of them lead to the sudden disruption. Thus, the key is how do the stakeholders visualize the advent of new technologies and their impact on existing practices creates the platform for technology or transformation adaption. Thus, strategic vision, prioritization and reprioritizations with changing contexts, is first part of educating stakeholders. It further includes defining and presenting clear goal and creating supportive environment resulting in transformation targeted actions. The peer learning is important where technology infrastructure with users exhibits higher and higher strategic participation.

The digital divide in organization is typically between technology enthusiast and technology laggards. It could also be due to technology biases where individuals are fascinated and biased by a particular technology. While technology enthusiasts try to go with the technology at lightning pace, technology laggard are typically forced into technology usage as the last resort. These both extremes are equally harmful for the organization to reach the destination. On the one side, technology before maturity impacts adversely on the team mindset while on the other hand, laggards delay the transformation, sometimes leading to losing advantageous position.

2.4 Going Ahead with Digital Maturity with Digital Technologies

The information and communication technology can be embedded as a first stage of digital maturity which includes:

- Actions toward enhancing the multi-tasking and co-operation capability. This offers resources and services anywhere, anytime, and information at fingertips. This contributes to development of digital mindset and to establish a digital information culture.
- Technology based and technology independent problem solving by direct and indirect technology adaptation. It helps in developing the understanding and effectiveness of technologies in certain scenarios. Further, it helps in creating the mindset to strike the balance between over digitization and under digitization.
- Improve reaction time and assessment insights. It helps in adaptation to overall pace of transformation.
- Online intelligent reward to improve participation and motivation: It keeps the stakeholders motivated to be part of digital transformation movement.

Understanding different technologies and practicing them in some way or other further necessary for digital maturity.

1. Digital maturity and digital connectivity (advanced connectivity):
   Connectivity remains the core part of technology and information delivery.
   a. Fixed: In these models, the connectivity is basically confined to location.
   b. Mobile: In this case, the location, the information and connectivity beyond location in provided.
   c. On-site: In on-site models, the information, connectivity, and even services are provided on-site.
2. Cloud computing and infrastructure—information sharing and digital maturity:

Cloud computing refers to shift from locally owned services and locally managed devices and infrastructure driven to on-demand services through shared and externally managed infrastructure. It is more like on-demand, self-serving, resource pooling, and rapid elasticity. The transformation of privately owned to on-demand third party needs the change in user's thought process. It has cost aspects, privacy aspects, and auditing aspects. Thus, information as well as resource sharing and on-demand availability contributes to the transformation that even asks for change in the way individuals are interacting with infrastructure. This also involves understanding clearly security and ethical aspects associated with the transformation.

3. Shared information resources and infrastructural devices:

This is about the transformation from fixed to portable and dedicated to shared devices. The devices used to access shared information sources are changing, which improves the need to enhance digital maturity in terms of usage of shared devices,

shared infrastructures, and shared information resources. Additionally, it is also about information maturity—which deals with understanding the information discipline.

4. Applied AI and learning technologies:

AI contributes to make machine intelligent and responds similar to humans. This minimizes required human interventions and improves the pace of work. In the case of astounding volume of data—it makes possible for machine to learn from the historical information and cope up with similar or even not so similar challenges in the future. The digital maturity in this area is more focused on learning to work with intelligent systems and understand the relevant ethical issues. It involves intelligent technology selection, valuing human inputs and understanding roles of different intelligent systems with reference to organizational vision and goal. Ethical issues include understanding the areas where to use these technologies and respecting human participation.

5. E-contents and datasets:

The information industries are dealing with heaps of e-contents coming from multiple heterogeneous sources. Information industries need to master the digital techniques for information maturity. It involves abiding by guidelines of ethical use of contents and respecting privacy wherever necessary. It further includes selecting the source of contents, understanding the tools to modify the contents and most importantly taking into account possible impact of these contents on targeted users. Thus, maturity to select contents, use them, and modify them in the generative modeling and AI era is crucial for organizations.

6. Big data and data analytics:

The data is increasing astronomically with the advent of social media and sequential data stream from different resources. The data analytics look at available data or even at the big data and delivers interesting patterns and useful insights. These insights lead to action pointers in terms of profit management, creating competitive advantage, product positioning and optimal pricing. Data analytics often comes hand in hand with forecasting and helps us to identify future trends. There is **descriptive analytics** that is more about dissection and looking at description of data and data dependencies. It acts as a magnifying glass to look at the data and get analytics or statistical behaviors out. **Diagnostic analytics** look into diagnosis with reference to the insights coming from data analytics. These insights often pinpoint prevalence of some issues or behavioral changes in terms of reasoning or cause of these behavioral changes. These behavioral changes and data trends, patterns, and special behaviors help us to look into the future to know where it is heading. Is it really progressing and taking to some serious problem, or is it heading to new behavior? Or is it heading to some possible grave failures? The future behaviors can provide insights into future pricing, market scenarios, possible complexities and unknown scenarios. These predictive analytics in short are your data window to the future through analytics lenses. When you have prediction, diagnosis and description at your hand you are in perfect situation to recommend corrective actions. This asks for

diagnosis and finally leads to prescription (rather recommended action sequence) to make things better. It is referred as **prescriptive analytics**. Finally, the aims of intelligent systems and data analytics are to solve problems and contribute to business growth. Digital maturity involves use of data without privacy breach—respecting confidential and personal information—logical and ethical use of insights and use of these insights optimally to achieve desired business goal. The digital actions need to be rational, i.e., goal directed, ethical, social, and generous. The actions should avoid conflicts and unfavorable impact on the system components. The size of data increases and huge data need to be processed. It typically includes stream data and unstructured social media data. The above ethical guidelines even hold in case of big data.

7. Learning management systems (LMS):

E-learning led to different possibilities and that led to evolution of learning products and teaching–learning institutions. Learning involves different aspects of delivery of training programs, educational courses and materials aiding in development of participants skills for a particular objective. There could be generalized learning where overall development of participants is at the heart of the whole system. LMS includes software applications for administration, documentation, tracking, evaluation and automation of learning related processes. The all-content evaluation related digital aspects are to be considered while using LMS. Content delivery and evaluation are two key aspects of LMS. Hence, it comes with challenges of maturity related to content creation and content delivery along with fair evaluation of participants. Some of the ethical aspects like *plagiarism-prevention* though could be controlled by advanced software and personalized content evaluation, tricky question sequences. These software use AI, behavioral analysis, text mining, similarity detection, and logical transformations. With generative models, where new constructs are enriching contents and producing variations, plagiarism detection becomes overly complicated. Finally, it boils down to digital maturity and matured combination of AI and human systems.

8. Immersive technologies:

Simulating reality to create the experience and merging physical world with digital experience in such an effective way that users could become part of the events and outcomes without physically being present at the location. Augmented reality (AR) and virtual reality (VR) are two major paradigms in immersive technologies. While augmented reality is more focused on enhancing the physical world with the computer-generated artifacts—like images, graphics, or only past experiences, virtual reality is a simulated experience about certain events or activities. Thus, AR uses real world setting while VR is only virtual with more liberty. In augmented reality, super models are imposed on the real world. In case of learning management service, tourism and even some sort of difficult maintenance applications, training or skill development activities, such technologies are very helpful. With technology evolution, immersive technologies are reaching to maturity making it possible to use them as part of organization's digital transformation vehicles. Digitally creating

something that can invoke a joy of participation, create an experience that could induce improved understanding. That could allow users to learn without exposing to risk while learning—rather creating experience of using some complex tools without exposing users to risks of accidents or side-effects taking place due to errors. Thus, keeping users away from risks of addiction and delusive impact while respecting originality and copyrights is what digital maturity in case of use of using immersive technologies. Additionally, rational goal directed transformation in virtual or augmented environment, agents working rationally, socially, and generously in this environment is the key to the success.

9. Personalization and allied technologies:

All the technologies are trying to achieve some sort of personalization. The very objective is to connect with the user—give her/him/them specific services and improve their involvement. Then it is obvious that personalization needs personal information. The applications of personalization range from recommending product, friend, or even life partner. The algorithms perform in a better way when more information about the person is available. In this case, respecting personal information, protecting it from being leak, and using it sensibly are also part of digital maturity.

10. Collaborative digital technologies:

The collaborative technologies try to provide digital platforms for effective and efficient collaboration. These platforms allow individuals to interact irrespective of their locations. Digital maturity also involves using these tools ethically and without compromising company values.

11. Intelligent and learning systems:

All AI systems try to learn with reference to the environment or perceived world and exhibit human-like intelligence. The broader definitions of these systems encompass simple automation to very complex systems with learning and cognitive capabilities. In such cases, digital maturity involves the following:

A. Selection of right datasets.
B. Maturity selects right learning model or the most suitable off-the-shelve tools.
C. Data maturity helps to decide data to be exposed rather than data to be protected.
D. Understand leverage points as well as weak links where leverage points help to maximize desired impact and weak links help to safeguard confidential and private information.
E. Creating ability and guidelines for AI involvement. Additionally, it includes decoding the extent of involvement in case of different human–machine co-creation activities. Further, in case of new outcomes and scenarios analysis of those scenarios to assess the AI need.

2.5 Digital Transformation and Maturity

Apart from above technology-specific guidelines, there are a few more crucial aspects for any organization and its stakeholders when it is moving ahead on the path of digital transformation.

1. Dealing with intellectual property (IP):

Intellectual property is to be protected legally as well as digitally. It is good idea to protect important aspects by legal means and use patenting, copyrighting. There is IP in the form of processes as in soft formats, those are difficult to protect in formal way and an organization going through digital transformation needs to look for right technologies for creation and protection of intellectual properties. It also intersects with collaboration and access strategies along with maturely handling digital repositories.

2. Standardization and dealing with the change:

While going for digital technology transformation and adaption of new technology, there is need of standardization of practices and interfaces. The purpose being new technologies seamlessly interface with some of the good old artifacts and practices. New players getting involved into digital transformation agenda along with existing players need to be educated regarding these standardization policies and guidelines. The intelligent interfaces create scenario-based outcomes. These outcomes are evaluated based on these guidelines. Take an example of simple intelligent ticketing systems where "classification of tickets" raised by clients, associating these tickets and controlled human interventions are decided based on these policies. All L1, L2, and L3 executives are educated to make the best use of these digital and intelligent insights to improve ticketing turnaround time without compromising the effectiveness and accuracy. The evaluation strategies are very important in these cases.

3. Technology policies and digital maturity:

Technology policies are about decision regarding use of technologies across the complete decision or business cycle. The food industry company "Chitale Bandhu" has slowly adopted technologies with clear objective of taking customers along with them during this transformation and making them partner in the whole process. In the whole process, they looked at striking the balance between digital detachment and personal attachment. While other industries on fast pace tried to globalize, the careful, and progressive customer-centric engagement helped Chitale Bandhu to maintain the customer attachments while progressing with digital transformation [2].

4. Stakeholders' engagement policy:

Digital transformation is equally about people, processes, and technologies. It is always about devising the customer-centric technology policies—that is core to digital maturity. The stakeholder's engagement in the whole process is about creating opportunities for everyone to participate in it. Right from the top management to the

remote customer, everybody should get incremental opportunity to participate in the process. Thus, engaging them with technology help them to contribute in adaption and growth. At **Uniqlo,** the company allows customers to participate in such process. The same is true in case of **IKEA**, where participation and conceptual engagement by the customers create stronger bonds. Thus, when stakeholders are engaged in the transformation, right and corrective actions are possible.

5. Competitive policies

The competitive strategies of organizations go beyond simply product positioning. Information technology strategy tries to encompass use of information technologies and marketing strategies with the focus on business processes. They further strategize based on targeting and selecting customer segments. Competitive strategies even look at expanding the customer segments, redefining the target marketing boundaries. Thus, it includes creatively expanding the conceptual spaces and repurposing the product. Additionally, creating interesting variations of the products and embedding new processes for converting non-customers to core customers help in creating competitive advantage. In this process, enlightening the customers with new messages and creating bonds those were not established in the past prove to be crucial. Technologies create vehicles for new competitive policies and innovations and contribute to repurpose them. Some technological and nutritious enhancements helped **Chitale Bandhu** to repurpose festival food products and associate those with healthy options. That has helped them to redefine the market positioning of their different products from "Mithai shop" to healthy and delicious festival food company. Similarly, the UV clothing options by **Uniqlo** are another such example where the repurposing and technological invention of the outer wears for summer has resulted in competitive advantage for the company.

Along with innovation and repurposing, evaluation policies are also equally important. Technological enhancement comes with different impacts—it may improve efficiency but may not be effective due to customer reluctance. There is need to evaluate the technology impact and adjust the pace of adaption. Digital maturity is also about having a right evaluation process in place.

Thus, digital maturity involves continuous learning, controlling pace of adaptation and educating and engaging stake holders. The continuous learning along with digital maturity enables organizations to:

1. Managing of uncertainty: There are uncertainties related to benefits of different technological initiatives. While focus is on improving competitiveness, the holistic view tells all facts of it. Uncertainty typically is about probabilistically unpredictable scenarios. These scenarios create some events and situations those are somewhat difficult to cope up with typical process-oriented approach. These could happen because of change in social or business scenarios, new revelations about technologies or even target customer space. The digital maturity allows stakeholders to make a logical shift, adapt to new situation/technologies, or come up with innovative means to cope up with these unprecedented scenarios.
2. Understanding when to go beyond conceptual spaces and selective adaptation: Innovation and creativity looks for expanding conceptual spaces to redefine

the market segments, customer segments and repositioning or repurposing the existing products. It demands expanding or evolving the processes to create new perspectives. These strategies look good on paper but the time is the key to introduce these changes and selecting right means to go ahead on these paths. Digital maturity helps the organization to understand that right moment and selecting those right means with appropriate technologies. Digital maturity involves understanding the limitations of the organization and mapping the strengths and learnings to opportunities to decide strategic initiatives to go beyond the conceptual spaces.

3. Involving stakeholders and promoting co-creation: Digital maturity also helps organization to involve right individuals at right moment without compromising privacy and security. It also helps the organization to create co-creation opportunity—at **iKnowlation**—the company has engaged doctors (customers) and health professionals in developing products for healthcare—that resulted in better and targeted results [3]. In artistic and innovative industries, the co-creation is the pillar of success. Manish in his musical therapy startup uses different inputs from users to co-create new music therapies.

2.6 Explainability and Digital Maturity

Explainability in case of intelligent technologies is now picking up momentum. The idea is that the explanation or visible or procedural understanding is equally important along with good outcome. This not only provides insights but also helps in better participation by individuals in evolution. Explainability further improves trust of stakeholders regarding what is happening. It improves the overall understanding regarding system or system components. Explainability has different levels—it could be system explainability, product explainability, process explainability or subsystem or component explainability. Trust and explainability goes hand in hand. It includes ethicality, accountability, transparency, traceability, and reproducibility. Explainability could be viewed as a core for trust or a driver for putting trust.

2.7 Returns on Investment and Digital Maturity

Stressing on digital maturity is very important. At times, digital maturity may reduce the pace of adaptation in the beginning but it results in multitude of advantages in the longer run. Digital maturity could result in the following advantages:

1. Pace matters: Accelerated AI adaptation due to reduced technical barriers and requirements to implement AI. Thus, intelligence is embedded in the overall process and also tries to strike balance between pace and effectiveness.
2. Sky-high productivity: Digital maturity improves productivity for technical employees across ML life cycle.

3. Collaboration beyond walls: Easier collaboration between technical and nontechnical experts on ML model development and also with extended organization in strategic technology adaptation contributes to organizational growth.
4. Scalability and interoperability: Leveraging bigger, richer reused data sets. Digital maturity allows users to value data and effective use of the same.
5. Deployment—at right time: Reduced cost through faster development and deployment, standardized processes, improved technical performance contributes to faster deployment.
6. Nothing is more valuable than security: Improved security and privacy along with reduced risk due to greater standardization and process automation, transparency, and robustness. Digital maturity is not only about valuing technology and its use but also understanding privacy and security setting.

Intelligent Business Innovation at Quick Heal: **Embracing AI to Combat the Malware Explosion** (Specially provided information by Sanjay Katkar—Co-founder and CTO of Quick Heal).

In the early 1990s, the world of computing was a vastly different landscape. The Internet was still in its infancy, and floppy disks were the primary medium for transferring files. It was during this era that Sanjay Katkar co-founded Quick Heal, driven by the vision of safeguarding computers from the growing threat of viruses. Back then, the rate of new viruses appearing each month was relatively low, with only a few hundred emerging. These viruses were often the work of curious minds, crafted to showcase technical prowess rather than cause harm.

However, the mid-90 s brought about a seismic shift. As the Internet began to take root in India and email became a staple of communication, the nature of viruses transformed. Cybercriminals realized the potential for financial gain and began weaponizing malware to exploit unsuspecting users. The once manageable flow of new viruses turned into a deluge, threatening to overwhelm the ability to keep pace.

At Quick Heal, Sanjay and his team faced a daunting challenge. Their virus detection process was manual, relying on a team of engineers with deep knowledge of operating systems and assembly language. These experts painstakingly analyzed each new virus, developed detection algorithms, and crafted solutions to neutralize the threat. But as the number of new viruses skyrocketed, this approach became unsustainable. They needed more engineers with specialized skills, but such talent was scarce, and training new recruits took time they didn't have.

Sanjay realized that if they didn't find a way to scale their operations rapidly, they would be outpaced by the very viruses we were trying to defeat. It was during this time that the concept of automating virus detection process began to take shape. Though AI wasn't a widely recognized term back then, Quick Heal understood that they needed to create a system that could learn, adapt, and evolve to keep up with the growing threat landscape.

Their solution was to develop a machine that could automate the process of analyzing viruses and generating detection algorithms. The idea was simple yet

revolutionary: input a virus, and the machine would automatically analyze it, identify its behavior, and produce a detection update without human intervention. They embarked on this ambitious project with the belief that it was the only way to stay ahead of the rapidly evolving malware.

Over the next 18 months, Quick Heal team worked tirelessly to bring this vision to life. They incorporated early machine learning algorithms into the system, enabling it to sort and cluster large volumes of virus samples based on their behaviors. The machine could then design detection routines and cleaning protocols automatically, significantly reducing the workload of engineers. By the late 90 s, Quick Heal's automated system was capable of handling over 80% of the new viruses that emerged each month—a remarkable achievement given the circumstances.

But the threat landscape continued to evolve. As more people began using the Internet and email for everyday tasks, the volume of new malware grew exponentially. What started as a few hundred viruses per month soon became thousands. Yet, thanks to the automated system development, Quick Heal could keep the pace, providing timely protection to users.

Buoyed by the success, Quick Heal didn't rest on their laurels. They continued to enhance the capabilities of their automation system, integrating more sophisticated machine learning algorithms and expanding its coverage. The goal was to detect and neutralize not just 80% but over 95% of all new malware. The results were transformative. The system became more adept at identifying complex threats, adapting to new malware behaviors, and delivering solutions faster than ever before.

Today, in 2024, the scale of the challenge has grown beyond anything organizations could have imagined in the 90 s. Quick Heal now encounter over 550,000 new malware samples each day—a staggering figure. Yet, the automated system, now powered by cutting-edge AI and machine learning technologies, stands as a testament to team commitment to innovation. It seamlessly processes this massive influx of threats, generating multiple updates daily that are automatically deployed, ensuring they remain protected.

Quick Heal's journey from a small startup battling a few hundred viruses to a global leader in cybersecurity handling half a million new threats daily is a story of adaptation, innovation, and relentless pursuit of excellence. It is the story of intelligent business innovation. It is a story that exemplifies how AI, once a concept on the fringes of technology, has become an integral part of the fight against cyber threats. Through unwavering commitment to harnessing the power of AI and machine learning, Quick Heal has not only survived the malware explosion but thrived, continuing to protect millions of users worldwide.

As cyberthreats continue to grow in complexity, the role of AI in cybersecurity will only become more critical. AI-driven innovations represent a significant leap forward in the fight against cybercrime, enabling organizations to stay one step ahead of attackers while making the jobs of incident responders more manageable.

In the future, we can expect AI to become even more integrated into cybersecurity operations, with advanced AI models capable of predicting and preventing attacks before they occur. This will not only enhance the effectiveness of incident response teams but also help organizations to build more resilient security infrastructures.

In conclusion, AI-driven automation is set to revolutionize the way Quick Heal approach cybersecurity, offering a powerful tool to combat the ever-evolving threat landscape. By automating routine tasks and enhancing human decision-making, AI will enable incident responders to focus on what truly matters—protecting organizations from the next wave of cyber threats. Quick Heal repaced the business and redefined the scope of their solutions to create their own unique position.

Summary

Digital maturity is the foundation for digital transformation and digital business innovation. Technologies are evolving at very high pace and competitions are fiercer that ever. In such a complex competitive technological scenario, it is important to develop digital maturity. Digital maturity is basically about overall understanding of technologies their pros and cons—adapting them with reference to the vision of the organization. Digital maturity includes educating stakeholder, helping organizations to understand privacy and security concerns and wisely incorporating digital means across the processes. Digital business innovation is spread over a large quantum of digital and intelligent technologies like data mining, big data, different AI based technologies, generative modeling, and immersive technologies. There could be some technology-specific initiatives encompassing digital maturity. The organization's digital landscape is built out of these assorted technologies and digital maturity also looks at explainability and understanding to make effective use these technologies. Digital maturity is additionally about creating opportunity for stakeholders to participate in the overall transformation process. These opportunities create understanding about technologies and take organizations ahead on explainability paradigm to revolutionize overall process. This chapter tried to throw light on different aspects of digital maturity with a few examples of organizations those achieved effective digital business transformation on strong digital maturity platform. We will take a closer look at digital strategies and different technologies to move ahead in our journey of intelligent and digital business innovation in the next chapter.

References

1. https://www.bcg.com/capabilities/digital-technology-data/digital-maturity#:~:text=What%20Is%20Digital%20Maturity%3F,companies%20launching%20a%20digital%20transformation
2. Kulkarni P (2016) Knowledge Innovation Strategy, Bloomsbury
3. Kulkarni P (2022) Choice computing: machine learning and systemic economics for choosing (Intelligent Systems Reference Library), Springer Nature

Chapter 3
Digital Innovation Strategies

Michael porter underlined the product positioning along with the difference organization can preserve as major business and marketing strategies (Porter in What is a strategy? Harvard Business School Press, 74–06, pp. 61–78, 1996). Though definition and ways of doing business have changed over the years, product positioning as a strategy still remains a key ingredient of successful businesses. Though the definitions of these strategies have become broader, innovation has become a key ingredient of modern business recipe. Responding rapidly, flexibly, and innovatively to the technology, marketing, and competitive changes is core to it. In absence of these abilities, static positioning of the product and business may cripple the overall business strategy. That creates a thrust on having innovation strategies in place to win business, build companies and create histories. All the businesses need to digitize their ways because of a demand and peer pressure in the modern era. Digital connectivity has become a sort of oxygen for the businesses. Thus, digitization movement has captured increasing business attention. Going from offline to online is not simply a technology transformation, it is about changing the way every stakeholder of the company thinks and operates. Thus, digitization is not simply about operational effectiveness. It is not just about the use of digital means but about graduating to digital maturity. That has changed the strategy landscape.

3.1 Introduction

The modern businesses need digital innovation strategies as a business foundation, not only for competitive edge but also for sustainable value creation. Digital innovation is not a one-time affair but continues across the business cycle. This chapter introduces different aspects of digital innovation strategy including product positioning, digital differentiating, product evolution and continuous learning to cope up with business challenges and building a strategically learning organization. It also

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_3

focuses on data, the most important fuel for illuminating strategy landscapes and technology pathways leading to business goals.

Digital innovation strategy is a combination of digital strategies and innovation strategies creating pathways for rewriting the business cycle. It further helps in improving and diagnosing digital and service product innovation [2]. When any firm is engaged in digital innovation, it will find a number of possibilities leading to uncertainties. There are questions regarding adoption of digital products and services. Digital strategies work toward the effective digitization to achieve business objectives. That includes positioning, sequencing, and organizing the products or processes through digital means and introduction of digital means into processes and operations. It is also about the use of digital means to develop compelling value proposition. It also caters to selection of digital technologies, order, and pace of their introduction. Further, it includes strategic initiatives to educate stake holders regarding the same. On the other hand, innovation strategies include strategizing innovation as a vehicle to accelerate and align business value creation. It can have initiatives like deepening innovation capabilities and understanding the key disruption drivers. It can help to transform digital businesses taking into account culture, competitors and growth opportunities. We were working with a company that has a platform for investment management. The company was trying to reduce customer attrition. This led to strategic initiative of empowering the customers on risk with digital means. This idea is extended to *digital personalized strategies* to identify these customers and retaining them with repositioning of the existing products or introduction of new suitable financial products through digital mappings.

We are working on another product that is intended to revolutionize examinations and empowering students. The system focuses on intelligent sequencing of questions to improve abilities of examinees. Here, digital means are not only limited to sequencing of questions but also helping to improve penetration and reachability creating value for the students. The digital technologies and intelligent systems in this case are used to improve business process, performance, and experience of students with the introduction of new ways for evaluation. Here, the digital strategy makes it possible to use digital technologies effectively to create the most effective assessment scenarios while improving the overall experience of the candidate.

3.2 Digital Innovation Strategy

Digital technologies are playing a key role in modern business evolutions. Think of majority of tech giants and their success stories in recent times. Their success can be attributed to:

- Strategic use of intelligent and digital technologies to redefine or enhance the existing business model.
- Strategic use of intelligent and digital technologies to redefine interaction and engagement models.

- Strategic use of intelligent and digital technologies to change and accelerate business processes.

For most of these companies, digital technology is a vehicle that allowed them to conquer new horizons or reposition the traditional business to reach out to broader audience or at times targeted audience. Amazon redefined selling of books and later other consumable and non-consumable goods with digital means. Uber redefined taxi hiring and in fact short journeys with digital and strategic means. Air BNB redefined hospitality industry by strategically associating needs of visitors and local residents ready to lend. These organizations strategically solved and redefined problems by mapping resources to demands and came up with digital means to address them in a non-conventional way. The differentiating properties of digital technologies make it possible to have new types of innovation processes that have higher pace, wider reach and uncontrollable scope. But if one looks at these innovators of this decade, it is not simply about the use of digital technologies but it is doing a digital technology innovation or using them to create new conceptual business spaces. With this changing competition landscape, it is absolutely necessary for the firms to have dynamic tools along with digital innovation agenda.

Competitive advantage consists of five P's—positioning, pace, penetration, perseverance, and performance. Positioning caters to avenues and means of positioning the product in newer or richer way with the use of digital platform. The pace on the other hand helps in making services, information or products available faster. Digital means make available newer ways of presenting the same products. Perseverance comes in play when we need to make certain technology initiative successful which demands change in organizational culture. Finally, all transformations need to be measured and progress should be tracked. Hence, there is need to track performance and define it in measurable metric.

Digital innovation strategies can transform

- Data to insights.
- Expectations to experience.
- Performance to productivity.

To create competitive advantage, the digital innovation efforts need to consider six important components:

1. Digital layer should be efficient, easy to learn and scale.
2. The experience is the key where flexibility, usability, aesthetics, and engagement are crucial factors.
3. The concerned should define and communicate clear value proposition.
4. Also, it should redefine and exploit innovation opportunities across products and evolving user contexts. Understanding change in behaviors through user interactions with the platform and on social interaction forums are also needed.
5. Acquisition of new skills and enhancement of existing expertise to have co-operation and dynamism in innovation in order to cope with changing digital challenges constitute another important component.

6. Finally, creating opportunity to work in innovation space to extemporize digital practices where experiential learning conquers the boundaries to deliver innovation practices across the organization should be followed.

Digital innovation strategy focuses on making digital transformation possible in effective and efficient way to deliver the desired value proposition. This has two important parts; one is the business agility and other one is effective and efficient collaboration.

Take another look at an example of an investment advisory company which was experiencing customer attrition. This company has a platform where customers, product managers and advisors are registered. Product managers typically come up with new financial products considering the business trends and also perceived customer experiences clubbed with understanding and inputs from advisors. The advisors try to sale these products to the customers to make maximum out of it. Advisors try to identify the most suitable customers for the financial products in hand. In this process, they take shortlisted possible target customers, meet them personally, understand their needs, and sale one or more products mapping to customer from their suit. Once done, the customers do all the transactions through the platform. The company was doing good. But recently, they have realized the pressing problem where they noted that the customer attrition is mounting to new high levels, impacting the overall business adversely. Also, there were a few interesting and innovative financial products those were not getting proper attention and expected traction. The company management wanted to address this problem also. Thus, **iKnowlation** worked with the customers to help them to use all heterogeneous information acquired by digital means and derive the intelligent insights. This helped organization to identify the products on risk, customers on risk and changes in appropriateness over the time.

3.3 Digital Innovation Strategy—Case Study

Being consultant to this company, we (at **iKnowlation**) realized that there was a serious need to relook at and enhance the digital innovation strategy of the organization. With reference to above six major factors, we evaluated the company value proposition, as follows.

1. In part one of the strategies, we worked with management team and UI / UX designers to improve human computer interface. We noted that the senior citizens were hardly visiting the platform. We created interesting, interactive and least complicated interface for them. A two-clique interaction was offered where in two key strokes anyone could interact with the platform. There were some innovative aspects added to it—delivering collaboration with others, advisors on the finger tips, and product enhancement or simple migration to upcoming product. No security-related features were compromised in this process.

2. As a second important part of our strategy, there was a focus on experience. Experience is not just built on simplicity but there is need of engagement. Engagement required an interesting journey and rewards on the way. In this process, we offered interactive platform interface. It was different for different age groups and even this interaction is converted into a form of game where rewards were highlighted and interesting option delivered. There was an investment companion program written with NLP, key stroke tracking, and behavior mining. The behavior of every user was ranked and that is used to take decisions regarding personal interactions with the customers and initiatives to keep customers motivated.
3. The clear value proposition helps to select the right technologies and develop right products. The value proposition is to "deliver maximum financial benefits in given context for every investor" and to make customers happy through financial gains and services. This value proposition needs to be mapped to digital innovation objectives and strategies are to be developed around it. Take first mapping to this value proposition we worked on two initiatives: 1. Identify customers on risk through their digital interactions and provide a digital infrastructure and advisor interaction to mitigate (address) that risk. 2. Identify products on risk to deliver inputs to product managers for product enhancements and mapping and/or reposition the product to make it popular to deliver benefits to customers.
4. Behaviors of the customers change with time, age, and social context. The context before marriage and after marriage is different and that impact on the financial perspective of investors. This is true about before retirement and after retirement context. This change in context results impact on financial investment patterns and risk-taking abilities of customers. Similarly, there is some impact of social and political secessions on the overall context. For identifying the means to mitigate the risk, there is need to understand customer context and know about changes in their behaviors. We used the technologies like time-series analysis, natural language, and speech processing along with behavioral and emotional computing to address this issue effectively in this case.
5. The data volume is increasing with time and there is increasing heterogeneity among customers—further, the customer information resources are changing. The customer behaviors are tracked through inputs coming from multiple sources. These sources include customer interactions in the form of messages, phone calls, financial transactions, decisions. Additionally, the information comes from other sources like social media interactions and updates about personal information. There is a need to make effective use of this information. That makes it necessary to innovate digital means and products allowing digital interactions and effectively tracking and analyzing them. It may involve acquiring some aspects of skills like text processing, natural language processing (NLP), speech processing, IoT and AI, blockchain, cloud computing, etc. Further, skills and technologies for co-operative innovation give an edge. The skill enhancement with right interface improves the interface and value creation for the user, making it easy for customer to use the platform and seek higher value without additional complexity and efforts.

6. The digital learning organization is one which is employed for creating, acquiring, and transforming knowledge with digital means. One should learn to conquer the boundaries through innovative means to exceed expectations. Digital strategy is about connectivity and integration. It is not simply about internal resources, but also connecting to external parties and expanding the boundaries. Expanding these boundaries strategically is one of the core parts of digital innovation strategy. In this situation, we worked on creating digital pointers for learning based on customer interactions. Further, these pointers are mapped to the action items. The continuous learning is ensured through connectivity among the pointers and action items.

During one of his interviews, industrialist Ratan Tata mentioned that communication across multiple companies in the group with innovative interactions can help to improve overall business positioning [3]. This statement points to an interesting paradigm of co-operative digital innovation.

The marketing strategy, operations strategy, and overall business strategy for digital enterprises are different from traditional organizations. Architecting the overall strategies evolves understanding of digital means. Take an example where online retailers offer higher convenience, comparable experience, and cheaper products. The innovation in recommendation, offering multiple ways of delivery with digital framework, helps to create higher values. The old businesses are redefined on digital platform and digital innovation strategy helped them to revolutionize it. Digital innovation strategy is not limited to online retailing or information trading. One company we are working with has effectively worked on digital innovation strategy to bring customers to shops by offering interactive, engaging rich experience to customers. The most crucial question was—how to track customer behavior. There could be multiple ways to do it. Right from buying patterns to social media posts multiple avenues could be used to track the behavior. In one of our projects with a Singapore-based company, we proposed to look at the path of traversal by customers while shopping in the supe-shop to assess the customer behavior. Based on it, we identify very personal and individual likings and interest. This helped the company to offer every customer a personalized experience by recommending them items of their interest. With this, the company is trying to get best of the both online and offline worlds to select optimal product-mix and helping customers to select the best value route.

3.4 Understand Digital Innovation to Build Learning Organization in Digital Era

As we mentioned above:

> *The learning organization in digital era is one which masters continuous creating, acquiring, and transforming knowledge with digital means.*

When we think of developing a learning organization, we need every stakeholder of the organization to learn. This learning is driven by the shared value, shared vision and shared goal. In case of digital organizations, these processes of knowledge building are digitized, distributed, and evolving. *Thus, organizations are supposed to learn continuously and transform them through knowledge sharing and interactions.* Effectively overall organizational capabilities enhance in due process. Learning organization in digital era has two major facets: one developing these digital innovative means making this continuous learning possible and using the digital technologies effectively. Thus, digital means redefine the stake holders and the means of communication. The means of information collection and utilization do change in this scenario. Figure 3.1 depicts such a learning organization in digital era.

In the digital innovation strategy, one important part is data strategy. It is about using, positioning, and enhancing business strategy by taking relevant data and taking it to derive relevant insights. The data strategies range from data as a product, data as a service to data as a service or performance enabler. Data in fact is a strategic driver in this case.

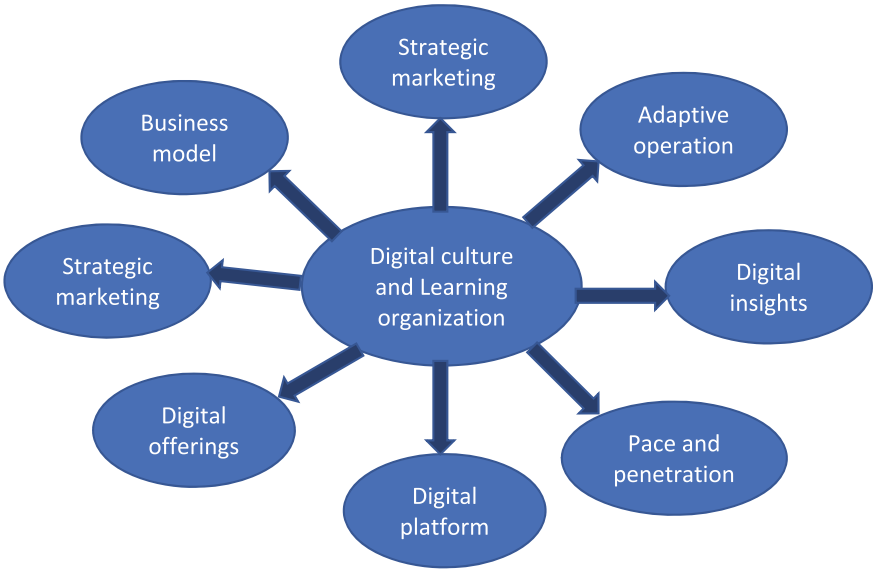


Fig. 3.1 Learning organization in digital era

Dr. Page from National Insurance Academy articulates it in very apt words. He mentioned that "contextual health data and other relevant datasets have been acting as 'Fuel' for 'AI Engines' being used in Health Insurance, enabling them now to realize Innovative Insight-based HC-HI Integrations, for betterment of both, and more importantly for their respective service receivers. In the past, insurance strategies were a bit defensive which were driven by their internal transactional numeric data and through some chosen interviews or surveys, largely based on perceptions (i.e., without deep insights). The multi-source heterogeneous verifiable datasets are enabling them to have the strategies for their insurance solutions & processes—from defensive to customer centric,—from isolated to inclusive,—and from just data-driven to insight-based. Further, this is enabling them to have purpose-driven efficiencies and effectiveness (impactful) toward more economical and flexible coverages/pricing, and claims handling—toward 'Smart Insurance' for a more healthy society."

3.4.1 Digital Culture

Digital strategies are also about the cultures of organizations. The organization culture can work as major driving force to win digitally. The culture could be defined as the collective human intellectual achievements, manifestations, and behavioral interpretations. It is reflected through how individuals and groups behave, how they interact, and how they respond to different scenarios. This also includes their celebrations, festival, and group expressions. Thus, the culture is about interactions and information sharing. Rather than very generalized sense if it is in digital era—digital evolution and manifestation in digital forms or/and due to digital environment—is referred to as digital culture. How an organization respond to digital technologies, new disruptive Gen-AI like technologies—how they interact with each other and how they solve problems using these technologies taking behavioral measures to keep negative impacts limited—is what digital culture is all about. Digital culture of the organization drives the pace and effectiveness of digital transformation. Self-driven and highly performing individuals and teams help in adopting digital culture very fast. There are two ways to look at it: One: Digitization to reinforce such a culture and Two: when such a culture to reinforce digitization. When both these initiatives complement each other, the pathways for great success are led. Digital culture typically refers to how digitization shapes human to human interactions and responses. Taking it to a bit broader definition:

Digital culture is the use of digital tool and practices to shape all sort of communications, responses, and interactions in the organization including human to human communication, human to machine communication, and even machine to machine communication.

Digital culture helps to look at data from analytics and use it in a more impactful way leading to better customer experience. Digital culture improves productivity and innovation. Digital culture and infrastructure ensure business and information technology alignment. Figure 3.2 depicts different components and Fig. 3.3 depicts digital culture major drivers of the same.

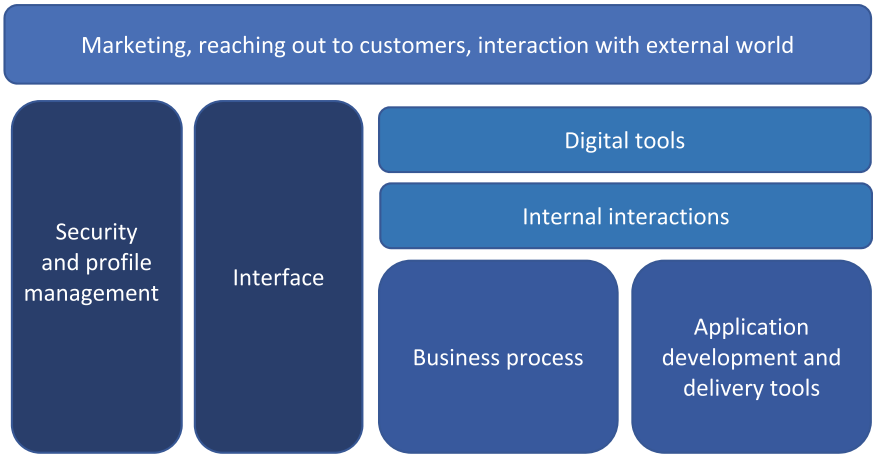


Fig. 3.2 Digital culture and infrastructure

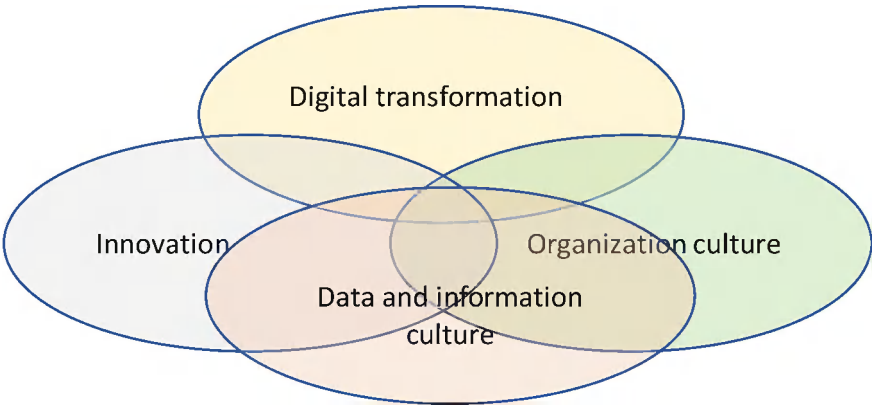


Fig. 3.3 Digital culture

3.5 Digital Innovation Strategy to Deliver Value

Digitization can change our capacity and means to innovate. Digital innovation strategy impacts on business and technology positioning. Business-oriented strategic initiatives are driven by digital technologies. With digital factors clicking in, locations of offices can be decided strategically and may converge to locations those were not relevant in the past. Digital strategy begins with assessment of business environment. The business environment points to innovation and digital strategy opportunities. Further, innovation allows to deliver higher value. This is achieved through scaling and penetration to reach out to customers. DIS redefines the business processes and innovate new business processes to exceed performance parameters. Most importantly, digital innovation strategy involves the use and alignment of organizational resources, strategically reorganizing teams for value creation and redefining the team responsibilities. As connectivity is the core part of strategy, the innovation and resource structuring are driven by value created in the form of connectivity and visibility along with direct value creation. Next level of digital innovation strategy is focused on technological aspects. The data is like pure gold—hence these strategies focus on innovating data acquisition and organization. Strategic position of technology with reference to data flows right from acquisition of data to positioning it for business is core part of data strategy. Data is converted into innovative products. There are ample examples where data along with digital platform have transformed businesses. The key components like infrastructure, constraints, and security need to be looked at while strategizing data-driven innovations.

We have been working with a company that is actively working in retail market. The raw material they buy from different mandies (rural markets). The timely buying of raw material can increase the profit. Price forecasting is the key. The data comes from different mandies and decision about time and place to buy raw material is crucial. The digital innovation strategy of the company is helping the company to identify it and to increase profit around 15 to 20%. Here, pricing data, along with news, farmer sentiment, and market sentiment are used to decide the buying points. The use of data with innovative and intelligent price forecasting and strategic buying plans helps the company to increase yield and also to create higher value for customers by making finished goods available at reasonable price.

3.6 Objectives of Digital Innovation Strategy

Apart from value creation and monitory benefits, strategies are always forward looking. There is focus on delivering personalized experience and improved customer satisfaction. The experience needs to be exceeding expectations, consistent, and rich.

To achieve this digital strategy also needs reliable operations. That involves keeping track of operation and customer satisfaction. This involves effective use of technologies like sentiment analysis and timely addressing concerns. Thus, digital innovation tries to address issues through ease of management, integration of data and services. The focus of the strategy is to create uncontested knowledge space through digital means.

> *Let us take a simple example of ticketing system where customer raises tickets for issues they face and those are addressed by the organization. Digital innovation strategies can help in intelligent ordering of the tickets and timely human intervention with right person allocation to resolve the issues. Further, it could be extended based on business needs to resolve complex issues with selective use of AI and automation.*

With technological maturity and organizational growth, digital innovation strategy graduates to intelligent innovation strategy where machines and humans work together strategically. In this case, augmentation of strategies results from fusion of skills. Complementing each other's skills can help to position new activities. Figure 3.4 depicts different aspects of intelligent innovation strategy.

Intelligent innovation strategies are the strategies where intelligent technologies are core part of overall business strategy. It includes man-machine interface, AI strategies, and also data analytics strategies. One of the legal firms was keen to have a business strategy to create competitive advantage over other legal firms through customer satisfaction and effective problem solving. The key lawyer from the firm realized that they were spending a lot of time on the cases they were not accepting to work on. Also, these customers whose cases they were not accepting are unhappy with the firm since these customers end up in wasting a lot of time without any outcome. He had another observation that 30% of the time of the core legal team was spent in non-productive activities. They decided to work on it to solve the effectiveness-efficiency problem. As a first part of strategy, they divided their lawyers in three layers. The first layer had ~~a~~ set of junior lawyers—looking after filtering the cases those were not relevant at all, or not belong to area of their core competence. These

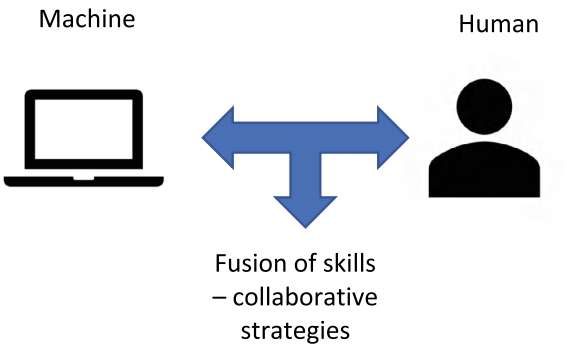


Fig. 3.4 Intelligent innovation strategies and human-machine collaboration

typically are the cases most likely they are not going to accept. The second layer has middle level lawyers, evaluating the cases passed by the first layer and also looking at more technical details critically along with their vision and values. The top layer was the expert lawyers focusing on cases already selected or really the cases for which middle layer could not take any decision to take the final call. This division and strategically handling customers was really working well. But they soon realized that there are many issues even while following this approach. Several junior lawyers could not take decision and company ended up in spending a lot of time on trivial issues and on the cases they could not take. If they would charge based on time for these customers—then customers used to be unhappy. If they do not charge, the firm was losing significant amount of money and time without resulting in any goodwill. There were other issues in overall strategy—which the senior lawyer explained in three words—reachability, satisfaction, and ROI. To address these issues, they came up with three level strategic positioning of firm:

- Reduce time between visit of customer and decision about accepting the case.
- No charge till the customer is on board.
- Measurable value creation for every visitor/customer.

The company came up with legal kiosk as well as software interface for their customers. The customers can tell their story—interact with kiosk—answer questions as a part of registration. They tried to remove all boring and redundant parts of the process by making it simple, objective, and interesting. An intelligent agent is developed and installed to classify and evaluate the stories into three different zones, viz. red, green, and amber. Further, it used to generate summary for all cases. The cases in the red zone were clearly out of the scope for the firm and the customer receives polite reply from the machine regarding the inability to accept it. In case these customers were still interested in going with the firm with a small fee, they could get a meeting with the junior lawyers to check the feasibility. In case of amber zone, machine would think it is the borderline case and the client would get a meeting with middle level lawyers without any charges. For the green zone cases, senior level lawyers take up the case directly. Intelligent innovation strategy by the firm not only improved customer satisfaction but also reduced turnaround time substantially. The company interface further improved the reachability of the firm to remote customers and even converted some of the non-customers into customers. As a strategic initiative, the company further created avenues for customers to interact with their lawyers in multiple ways. They further improved it to an online application with limited functionalities and different choices. Because of overall improvement in services, customer satisfaction, and reduction in turnaround time, the company could get higher ROI. In this way, the digital strategy siting on the top of organizational strategy helped to achieve better penetration. It takes into account infrastructure, location, data, business process, and organization structure.

A typical digital innovation strategy layer is depicted in Fig. 3.5.

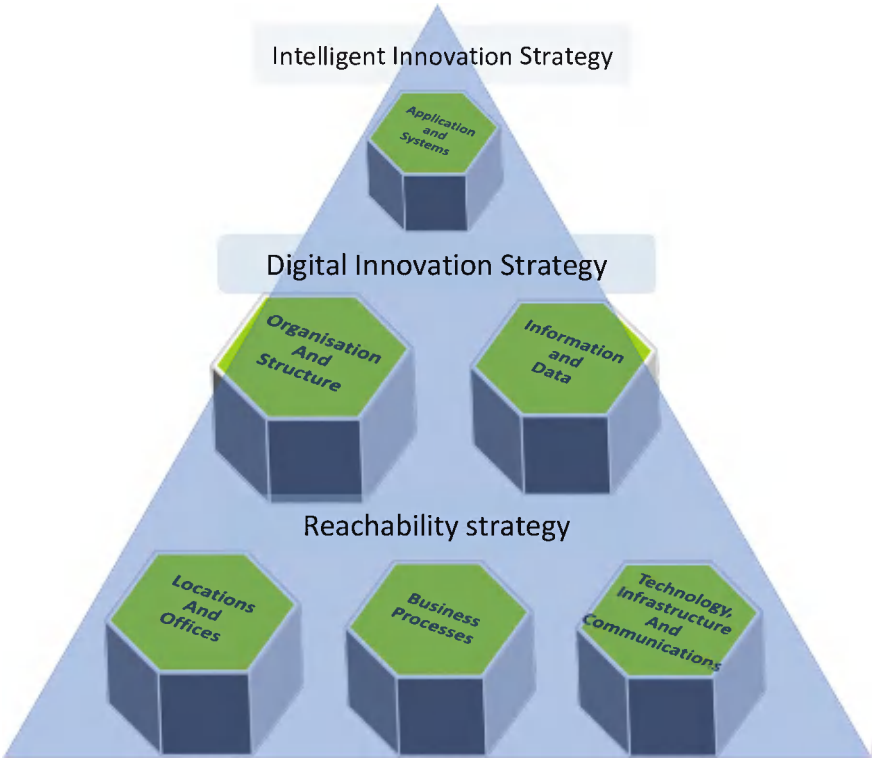


Fig. 3.5 Digital innovation strategy

3.7 Selection of Right Technologies

It is interesting to look at digital innovation strategy from the technology perspective. With a lot of digital technology crowding the space, it becomes very important to select right technologies to derive overall strategic advantage. Across the business space, there are different learning opportunities, connectivity opportunities, information enrichment opportunities, and empowerment through knowledge opportunities. The technology selection is built around it.

Digital innovation strategy is about using and positioning right technologies, changing roles of digital customers and other stake holders in alignment with new digital value proposition. It touches digital technologies, business innovation, and value proposition in the extended space. Take an example of online retailing business. Here, the value proposition may look like a combination of easy availability, easy selection, and immediate delivery. The digital innovation strategy may include an innovative, context specific campaign to turn senior citizens to online shopping. This strategic objective may include selection of technologies those are easy to use for senior citizens. Maybe something like senior citizen cards or even product displays

for seniors along with senior citizen-friendly interfaces could help in this case. Here, strategy to attract new customers and digital means to make it happen along with redefining the business proposition is part of digital innovation strategy. Whether it is Uber or Google, Amazon or Twitter, the digital innovation strategies allowed to separate them from the rest of the companies. Digital innovation strategy thus not only helps to achieve digital transformation but also helps to redefine business objective in new digitally transformed space. My friend, Ex MD of Mettler Toledo, MD of Habasit India, Ashok very interestingly defines the digital innovation strategy—he says that "It is about improving the digital life of the pride of every customer for possessing the product. Providing digital features supporting that pride—where digital utility and digital branding work together to achieve psychological and physical distinction."

3.8 Use of Right Data

I was discussing with my friend Rajesh Hingu. Rajesh is trying to take his new garment and boutique business to greater heights with digital means. As per Rajesh, use of right data is the key strategy. Personalized messaging, recommender systems, and different delivery options work well only if you are using right data. His key statement is "what data tells you; it does not intend to tell—and what it intends to tell, it does not tell you." One needs to identify what it needs to tell. In spite of a large number of digital information tools available, there are very few those can identify right data and unearth what it intends to tell. That is the reason personalized campaigns are not so fruitful. Interestingly, that is the reason very few digital transformations could create history. Data tells the symptoms, context tells the scenario, behavior tells the impact of data, but (Data + context + behavior) can help us to unearth the points where we can get the relevant data that can point us to real problem. Thus, digital innovation strategy is about data strategy, connectivity strategy, and technology strategy. Data strategy is about getting right data and positioning it to create value and subsequently deriving competitive advantage.

For health or life insurance company, this data is not simply about health parameters and life expectancy—but also about climate, nourishing factors, and contextual data of different regions. In some locality, iodine is not part of minerals, while in certain region, there is absence of other minerals—data related to minerals could be one of the major factors to determine prevalence of certain diseases. The healthcare insurance company can have strategy based on this data along with possible impact of it. If this data is used strategically, it can not only benefit clients but also the insurance companies while deciding premium and possible risks. Digital innovation strategy is about using data, using connectivity in a strategic way. These strategies may involve allowing products to communicate, data to speak, and users to experience and interactions to deliver.

Digital technology and open innovation processes:

Digital technology contributes to open innovation process. It is achieved through sharing of information, ranking of outcomes, and collaborative contributions.

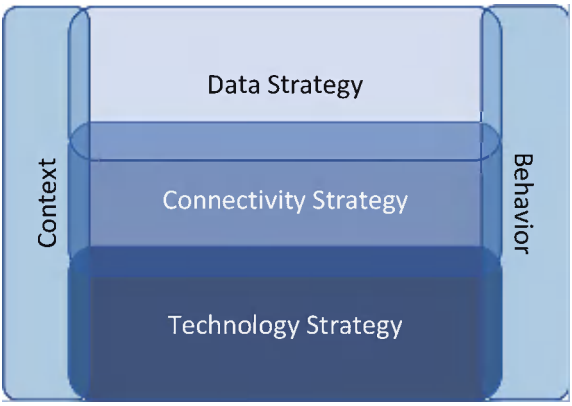


Fig. 3.6 Technology, connectivity, and data strategy

The digital innovation strategies are also about working together by different parts of companies. It includes sharing of knowledge, communication by various means and collaborative delivery. Santosh Kumar, VP HR of Envestnet mentions that—working from home efficiently and use of existing collaborative technology strategically was a key strategy during the covid prevalence (Fig. 3.6).

3.9 Knowledge Innovation

Another important aspect of digital innovation strategy is converting data into knowledge and strategic initiatives/wisdom. Having right data about mineral contents in water in different regions is the initial requirement. Then knowing that iodine contents in a particular region 'A' are very low is the "information" extracted. Because of that, there is iodine deficiency and goiter prevalence in the region and mapping it to possibility of this and allied diseases is the "knowledge" and then working on strategies for preventing the deficiency with reference to the region contributes to "wisdom." This whole cycle with reference to business value consists of a number of strategic initiatives. Knowledge innovation strategy is about creating uncontested knowledge space. Uncontested knowledge space is one which with digital infrastructure creates knowledge value and target extended customers by enriching experience and services [3]. Further, implementation of these strategic initiatives with digital technology helps to address target customers. It even contributes to reach out to new customers and helps in positioning the product to create value. Additionally, it further helps to create higher value for the on-boarding of these customers. It continues with new learnings due to change in behaviors of existing customers or understanding the behavior of new customers.

The right information at right place and at right moment is the knowledge strategy. Further, organizing it and using strategically to meet business objective is also knowledge strategy. Knowledge can deliver more and more value creation opportunities.

Connecting computing strategies and technologies allows to improve pace, efficiency and reachability.

3.10 Digital Innovation Strategy—Technology Building Blocks

Strategies are typically a long-term plan to achieve the objective. It needs to consider the overall uncertainty in the process—possible changes in the environment. It includes selection of available actionable options. It could also be episodic at times—where episode is sub-part of substantial length of actions sequence. Computing technologies need be selected and mapped for each of the episodes. This aspect includes using right software and hardware or digital resources to solve the given problem at hand. It covers three aspects namely selection, positioning, and use. Strategies may govern by need of pace and reachability. It can help is reaching out to customers those in absence of right means and technologies would have not been considered as customers. Thus, technologies allow to make new customers or convert non-customers into customers. Strategy begins with objective of reaching out to these customers and technology strategies help to achieve it.

The technologies include AI and machine learning, among others. In AI and intelligent product strategies, one needs to consider—what to make intelligent and how? It covers identification of learning and intelligent opportunities for products. Dr F C Kohli, in one of the meetings mentioned that reaching out to a broader audience in their native culture is the key IT strategy [3]. Just making right product intelligent is not enough but strategy covers positioning intelligence. Positioning intelligence as companion or as replacement is key when it comes to strategic use of these technologies. For every strategy, the user is at the center. Artificial intelligence refers to building human like abilities in machines to help humans and solve their problems. It could be a matter of debate—whether we should position AI as human companion or as an independent entity that can be used, when needed.

Technology strategies also include connectivity strategies that involve reaching through technologies and interaction strategies. Reaching customers at right moment helping them to make decision is a part of it. Technologies and means to connect are important but using them strategically is key to overall success. Use of mind maps for requirement analysis, use of collaboration tools and bulletin boards as an innovation platform, and recently use of online education to bring students back to school premises are some examples where technologies used strategically. They further positioned strategically to achieve greater impact. Figure 3.7 depicts digital innovation strategy and its impact on various performance aspects.

Digital efficiency: Reaching to target location before certain moment to create advantage could be crucial part of the strategy. Digital efficiency and right resource alignment scale up the business. The impact on productivity and pace may result in opening up additional avenues to capture extended market.

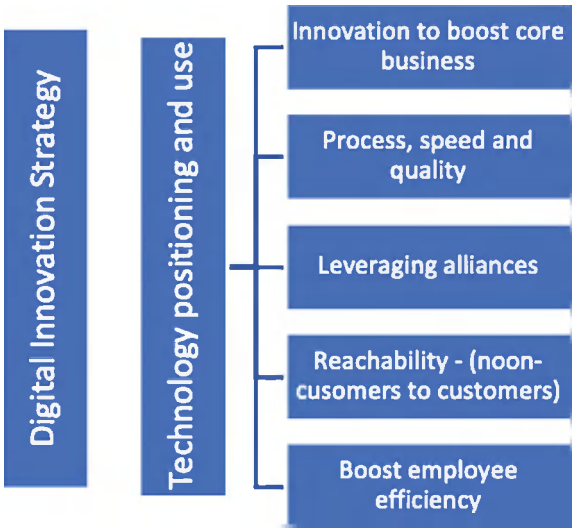


Fig. 3.7 Technology positioning and use

Digital positioning: The digital technologies should be selected and positioned so that they could change relationship with customers and impact positively on operational performance. Digital positioning is not something technology-centric—but overall strategy-driven. On one side, there is digital capability, and on the other side, there is leadership capability. Thus, digital positioning looks at overall product positioning by redefining customer experience and achieving marketing and operational excellence. The digital positioning has two facets: one is positioning technology and services empowered with technology while the other aspect is data positioning. Digital positioning also considers branding of products, organizations, and company initiatives.

The digital innovation strategy is no longer simply positioning and using digital technology. Today, we want every product to be intelligent and understand the user behavior and requirements. Even strategies are embedded in the products and its functionalities. Thus, use of learning system is important in this case. There are various learning systems inspired from the living organisms. These systems are called bio-inspired systems. The car racer and entrepreneur Yutaka Yamagishi claims that "it is their digital innovation strategy that allowed them to make business successful and also compete in some of the premium competitions. The strategy ranged from how they used historical data to how data analytics and positioning of racing cars is used effectively" [4].

3.11 Summary

Digital innovation strategy marked a new strategic era in business evolution. While traditional strategic means still remain relevant, the new platforms, technology and digital pace demands new strategic initiatives. Traditional strategies are though relevant—they are simply incomplete to handle market positioning and business evolutions. The data, interface, and behaviors are three pillars of digital innovation strategy. When technologies and algorithms exhibit intelligence rather use AI technologies, the strategy can be referred as an intelligent innovation strategy. Digital innovation strategy includes data strategy and technology strategy. The positioning of products and businesses in digital domains with digital means open up many strategic initiatives converging to digital advantage. Though strategies are typically very long-term initiatives and positioning to create overall advantageous position, in digital era, it could be thought of in more episodic way. Digital innovation strategy and intelligent innovation strategy are backbones of the modern businesses. These strategies are more dynamic, technology-driven, and data enabled. They can revolutionize the businesses to create history and transform the organization into new global, agile, and customer-centric entities.

References

1. Porter ME (1996) What is a strategy? Harvard Business School Press, 74–06, pp. 61–78
2. Nylén D, Holmström J (2015) Digital innovation strategy: a framework for diagnosing and improving digital product and service innovation. Bus Horiz 58(1):57–67. https://doi.org/10.1016/j.bushor.2014.09.001
3. Kulkarni P (2015) Knowledge Innovation Strategy, Bloomsbury
4. Kulkarni P (2022) Choice Computing: Machine Learning and Systemic Economics for Choosing, Intelligent Systems Reference Library, Springer Nature

Chapter 4
Technology Landscape for Competitive Edge

While big companies are trying to expand their technology horizons, startups are emerging with niche problem statements and objectives. In this era of high pace technology development, business strategies may cripple in absence of right technology innovations and right intelligent digital impetus. Digital business innovation strategies go beyond automation or simply achieving pace through digitization but touch the complete business life cycle to cater to different possibilities of embedding intelligence and exploiting highest leverage points with digital ease. Understanding the opportunities definitely and mapping right technologies and positioning the complete experience are core to it. It becomes almost impossible to separate intelligent technologies—artificial intelligence and machine learning from digital business innovation. It is at the heart of digital business innovation—or it could be a vehicle without which strategies may have major strategic and technological roadblocks ahead. Hence, it is not simply the use of AI but growing with AI and making intelligence a part of DNA of the organization. It is actually the strategic use of technologies meeting learning abilities to harvest intelligence opportunities to weave them into day-to-day operations to march toward business objectives. It is to be undertaken in very systematic and strategic way.

There are many companies that not just practiced intelligence strategies but realized exemplary transformations through modern digital and intelligent technologies. Take an example of the ***Uniqlo***—a Japanese casual wear designer, manufacturer, and retailer. They have been using different technologies and intelligent means extensively across their business processes to create unique value at every juncture. But that is not the only reason of their success. Actually, the use of digital technologies created the most needed platform for their digital business innovation by creating avenues for organizational learning and passing the knowledge to extended organizations along with all of their stakeholders. The experience every customer gets at **Uniqlo** starting from entering their showrooms till billing and leaving the shop is the hallmark of their success. Right from presentation of different garments and new

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_4

arrivals in the show room till unmanned billing and pleasant conclusion of the shopping experience, they revolutionized the buying process and choosing experience for their customers. It is simply tip of the iceberg—the digital transformation at the backend with amazing AI and IoT technologies and their selective use for just enough digitization and controlled use with adequate personalization differentiates **Uniqlo** experience from typical buying drudgery at many other places. While big brands are hovering all over, while everyone is looking for new designs—novelty and personalization, while some big brands had already captured majority of market—**Uniqlo** paved its way through these difficult times to become one of the most preferred brands for majority of customers across Japan and also entered in the global market successfully. It was their digital business innovation and strategic use of technologies that allowed them to deliver higher value.

4.1 Transformation and Innovation

Digital transformation evolved and graduated to intelligent digital transformation in the modern AI era. Most of the digital technologies aided by learning and data analysis led to intelligent insights and became a part of the business processes. Whether it is teaching learning or agriculture, the processes are built around relevant data and this data is no longer simple transactional data or that from static data repositories. It is rather "data" ready to deliver knowledge with intelligent system backbones. Which crop a farmer should cultivate is no longer coming from some sort of table driven or rule-based raw intelligence (expert system) approach but rather driven by the knowledge about situation, context, and the dynamic learning abilities of machines. That is not limited only by the decision about crops but also about the use of fertilizers, pesticides and even water. Also, heat, humidity, and other form of environmental controls in vertical farming are to be considered to cope up with dynamic nature of agricultural challenges. These decisions also consider market opportunities and competitive landscape. Hence, the same aspect is extended to pricing, finished good preparation, and looking for online as well as offline *mandis* or markets. This transformed the whole agricultural business life cycle. It may be called digital business innovation in agriculture. Other domains are not exception to it. Quite similar business innovations are observed in health care also. It is not simply about prescribing a particular medicine or whether to go to a particular doctor or not or decision regarding the type of treatment. It could be complete health planner with predicting risk and remedies. It further considers holistic health care with different indirect actions taken into account. It could make health care personalized and could keep track of minute changes in health status based on responses to every medication.

It is 80% about knowing the problem and 20% about delivering the solution. With these thoughts, we can continue our discussion regarding digital transformations across multiple verticals. It could begin with very simple intelligent agent-based architecture and slowly accommodate multiple complex learning, knowledge building, and innovation aspects as per business needs. To begin with, we need to

look at some AI basics but we shall look at them as a strategic embarkation through intelligent business transformation.

4.2 Strategic Embarkation

AI strategies are about the right use of AI technologies to deliver evolving intelligent behavior resulting in maintaining balance between short-term and long-term business value creation.

Tushar Sankhe, the AI innovation and practice head at Tech Mahindra, India, mentioned during one of the meetings that "AI strategies are not simply looking for an intelligent solution; rather they are focused on intelligent evolutionary behavior to cope up with changing business scenarios."

Solutions are something those are given once for the problem and remain there until someone realizes that they are outdated and need a sort of change. Typically, solutions have some sort of rack life—it could be weeks, months, or in some special cases, years. One needs to analyze them continuously for making the changes or improvements. The intelligent behavior of a product or a system and most importantly, of the business, evolves with the context and have self-evaluation mechanism. These behaviors have most needed adaptability to deal with dynamism and rack life limitations. Intelligent business transformation is about embedding such intelligent behavior into system and is reflected through every action and enhancement. Thus, the behavior changes, enhances, and gets transformed to cope up with changing requirements with time and business needs. It could always be great to have a generalized solution across the businesses, but typically one needs to understand business and opportunities of intelligent business innovation in the given context. Let us look at different steps of digital business innovation with case studies highlighting technological roles at every juncture.

Step 1. **Understand business and look for digital business innovation opportunities (strategic embarkation)**

To understand digital business opportunities, there is need to understand the business process and available technologies. There could be a few evident starting points resulting through business behavior and are derived from the data analysis. These behaviors could be.

- Sale goes down in a particular season.
- A particular region or province is difficult to capture.
- Maintenance budget is increasing.
- The customer behavior is changing.

There could be high level behavioral pointers reflected through bottom line or some sales indicators and customer data insights. This is followed by second level analysis looking for inter-dependencies. There could be micro-level insights coming through detailed behavioral changes reflected through data. There is an expected behavior of the customer. This expected behavior is typically data driven

and derived through analysis of customer behaviors (typically data progression) at large. This behavior changes due to many factors. Individual behavior may differ from the representative behavior. Nikhil Mokashi, head of *Siemens*, Pune, discusses two approaches—one is change in company technological positioning to match the customer behaviors to produce favorable impact and the other one is technological embedding to change customer behavior for the same. In both cases, strategic use of technologies is at the center of the proceedings.

Take an example of *Uniqlo,* a leading global apparel company from Japan. They changed their business through digital means and have been doing it continuously since last one decade. To achieve this change, there is need to understand learning opportunities and pointers those could be used for behavioral modulations. Some of the interesting opportunities for intelligent information registered by the company were:

1. *Information exchange and association opportunities*: Making right information available at right moment results in motivating customers, employees, and even other stake holders. There are numerous information exchange opportunities. Strategic information exchange results in behavioral changes. It could impact not only a single buying decision but makes customer to revisit the shop again and again. It uses information exchange opportunities as a starting point and later with effective association improves the results in multiple business initiatives to deliver greater value. *Uniqlo* is built on top of these opportunities to create foundation for intelligent business transformation. It includes even their Ariake project for supply chain management. In this part, the company looked into information routes, losses across the routes and behavioral enrichment opportunities through information sharing.
2. *Opportunities to create intelligent pointers for behavioral convergence*: Information could be used for personalization, expressing the concerns and also to take care of specific targeted issues for customers. Opportunity to converge the behavior of customer with intelligent personalization creates opportunity associate with customers in more meaningful way. A customer visiting *Uniqlo* can get attention and services personally, but digitally. Intelligent personalization can overcome digital barriers through digital means. The shopping takes you through Japanese culture of trust and respect—making the customer to revisit shops.
3. *More than who purchased what—opportunities to go beyond market basket*: In most of the retail sales initiatives, intelligence is generally constrained by market basket analysis and probabilistic approaches based on that. It typically goes for who purchased what and who may purchase what. The customer behaviors in this approach are derived based on their buying histories. But who purchased what is simply visible aspects of behaviors. No doubt who purchased what is very important available information, but it lacks the contextual knowledge about the purchases. Purchases are constrained due to availability, time, and context and could not be generalized for the behavior. Thus, there is an opportunity to use buying pattern as a foundation—but not as the data for personalization. Uniqlo

identified the opportunities to go beyond the buying patterns and visible behavioral patterns. Here long associations of contextual changes on the behaviors and emotions create a wide range of opportunities for business enquiries. It could be catered with multiple means like beginning with simple recommendation to changing behaviors of apparels and even helping customers to make choice.

4. *Opportunity to attract new customer and intelligently choice architect the behavior of the new customers:* Businesses intend to grow through globalization and expanding the horizons. Every organization intends to enter in other countries and look for more sales, more customers and their presence in a large number of countries. Thus, there is an opportunity along with intense growing competition. In the crowd of brands—attracting a new customer to brand and then holding him/her to make a loyal customer and subsequently brand ambassador is always looked at marketing strategy of organizations. This is a very cozy looking broad strategy that has number of surprises underneath. *Uniqlo* has realized that they would like to target the broad customer segments—but simultaneously every segment feeling that it is their own brand. They had strategy to attract customers just besides the boundary of their main target segment. Here, the system looks for two opportunities—one to attract new customers to the said product and keep them motivated to explore and buy *Uniqlo* products. While attracting these customers, the organization needs to understand behaviors of such customers, and after attracting them, it may even work on changing their behavior to select right products and holding them on to remain with the organization for the longer period. The interesting change from salesmanship to guarding interest of the customers like guardian without interfering like guardians is what *Uniqlo* is trying to achieve through intelligent technologies.

Step 2. Educate the stakeholders to create an environment conducive to innovation: DBS or (some financial startups)

Digital business innovation moves ahead with technologies. Let us discuss some technologies those act as an enabler for digital transformation.

Mobile technologies:

Mobile technology is a primary enabler of digital transformation. Actually, many business executives believe that mobile solutions, cloud computing, and IoT are three pillars of digital transformation. Interactions with customers are core part of strategies to marketing and sales. There is need of frequent and speedy interactions to gain competitive advantage. The real-time data crunching and real-time interactions are important for the same. Organizations and marketers need to collect the data about customers and their transactions. They further understand their behavior and changes in behaviors. Mobile technology allows us to collect that necessary data. Mobile technologies in association cloud computing, big data, and AI refine and enrich the interactions further by recommendation.

Internet of things:

Human intelligence is built on the knowledge about the world acquired through sensing the world with number of sensors including skin, eyes, nose, ears, and tongue. Such number of inputs cumulatively keep on building the picture of the world and

provide insight into how the world looks like and how it has been evolving over the time. This information further develops the picture—how the world will look like in near future? IoT describes combination of physical objects like a set of sensors, software, processing ability, and communication and accumulating devices to communicate and integrate this information. It contributes to reduce operation cost and improve customer experience. It even helps in handling applications where risk is associated with human data collection. Thus, data sensed using IoT devices is used by organizations and plays a key role in digital transformation. Through increase in interactivity, it contributes in improving customer satisfaction by providing enriched and timely responses.

Use and adaptation of technologies often come with many challenges. What looks very simple and easy to deal with for one generation may be difficult to accept and use it for the next generations. Banking is one of the examples of such sectors. Though thousands of senior citizens are dragged into online banking, they find it very challenging and complex to handle it. Intelligent business innovation is also about understanding that no technology is the ultimate solution for the given problem. Let us take a brief overview of some intelligent technologies those are being used by organizations for digital transformation.

4.3 Intelligent Business Innovation—Role of AI

What is an intelligent business?

While working with different organizations, a question needs to be discussed before diving deep is—what should be called an intelligent business? Going with popular AI definition it could be—a business with human involvement where human mental keenness comes into play. We could give many such abstract definitions of intelligence. When we discussed with *Mogic*, the founder said that "it is the business that can learn and improves responses with every new action" [1]. The concepts of learning organization have been discussed on many occasions and even elaborated in association with systemic learning for organizations and machines [1]. A learning business is one that always gives an improved experience through continuous learning from interactions. These interactions are typically with the stakeholders or environment. It could be about processes or even about stakeholders. In another discussion, Ex-professor of IIM, Indore, and entrepreneur Dr. Chande described that "it is like a network of intelligent agents striving to learn with the environment and also along with other agents co-operatively." One of my friends and Professor at National Insurance Academy, Pune, Dr. Page thinks that it is parallel to learning sports teams where the teams learn from experiences and produce better performance in spite of changing scenarios and dynamic nature of player positions. Thus, outcome and impact of the same action could be different at different times. Does it mean that every time for the same action we can expect an improved performance? Probably that is the whole idea—but there will be attempts to improve the performance and it may go either way if considered on a small set of attempts. But on larger set of attempts, it leads to

better performance and delivers the goral directed behavior. In this case, measures of performance are well defined. Interestingly, these measures may also change with new information, at times making the goal dynamic. The utility functions may also change over the time creating challenges while learning. It is also expected that the utility functions also converge to certain objective pattern deciding the overall learning policy.

4.3.1 Agent-Based Approach

Business intelligence is governed by different information resources. The agent has sensors and actuator and it learns in association with the environment. The sensors sense the environment while actuators act on the environment to advance in the desired direction. The agent-based approaches try to work similar to human ways of interacting environment, learning, and responding. Human being learns in association with the environment. He/she tries to determine the state of environment by sensing it using different sensors. The context of the state is built using different features those are acquired and sensed using those sensors. The sensors may be specific to the task or employed selectively—for example to classify food items taste, smell, and visual sensors may be employed. In some cases, even two of them may be enough to provide the required information. But for classifying water quality—different types of sensors may be necessary. Thus, in complex scenario, multiple sensors try to provide information about the environment or the current state of the world. This information, sequence of sensed data, associations among different data series create insights into the behavior to suggest the best possible action in the given scenario. There could be a series of actions and one action gives insights in to best possible next action. It could be reinforced to decide learning strategy.

Figure 4.1 depicts the basic agent structure. The world is perceived through a group of sensors by an agent. Imagine when we see a food item, we can immediately imagine what it could be. That may impact on our decision whether to eat it or not. As an additional sensing if we taste it, then based on perceived taste and also by looking at shape/color/structure, we may reconfirm the perceived value or we may realize that what we imagined about that food item is true or not. In such a scenario, we may take decisions regarding further actions based on new perceived value. Every iteration of sensing followed by action leads to new revelations about the world. These revelations contribute to learning our strategies. Learning and knowledge building strategies are refined multiple times to take individual to pointers helping them to associate the best action with the perceived environment. Every agent need not be very complex to have all these functionalities. But there could be very simple agents where actions are performed with reference to perceived environment at a particular moment. In such a case, the agents may be designed with reference to simple functionality or task at hand. These simple agents basically perform action with reference to certain rule or some already stored guidelines. Let us take a look at how the intelligence could

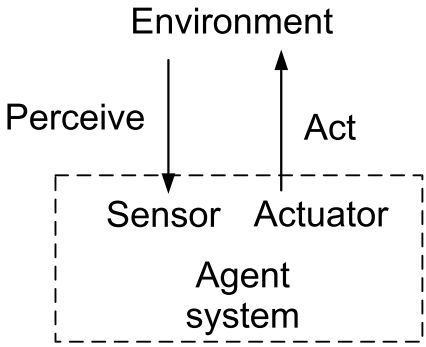


Fig. 4.1 Agent basics

be associated in a more organized way with different agents and how the actuators take action with reference environment.

4.3.2 Intelligent Agents

Digital transformation has two aspects—one is autonomy which contributes to the most required scalability and the other is rationality, which contributes to the key business pointer—customer satisfaction. At any point of time, the customer is interested in quick and logical response which at the next level can be improved through personalized behavioral aspects. Intelligent agents are expected to work without assistance or dome times with interventions of humans. Also, those should have ability to assimilate and interpret sensed inputs coming from different sources. With these abilities, it could sense the environment and decides regarding actions to achieve the goal. In the *Uniqlo* case, the goal could be minimizing billing time and maximizing bill accuracy. This definition of the goal is defined more with reference to performance parameters. Goal could be defined with certain attributes so that the goal state could be defined and mapped clearly. The performance and goal need to measurable and can be mapped to actions. Thus, a customer entering the shop has certain expectations about billing time. These expectations are mapped to the goal state. The agent tries to attain the goal state from the initial state or start state. The complexity of the agent may vary based on the task at hand or the goal state it intends to achieve. The goal state could be as simple as keeping room temperature between 24 to 26 degrees. It could be as complex as providing perfect answers to depressed individuals to improve their motivation and energy by some measurable level. The agent is expected to behave as per guidelines and should always have the goal state in mind. There could be scenarios where goals are refined with new information and changes in the environment.

Figure 4.2 depicts the generalized intelligent agent architecture. Though agent-based architecture has its own limitations, we present it in a more generalized way as a platform for developing intelligent systems. Whether it is neural network and deep

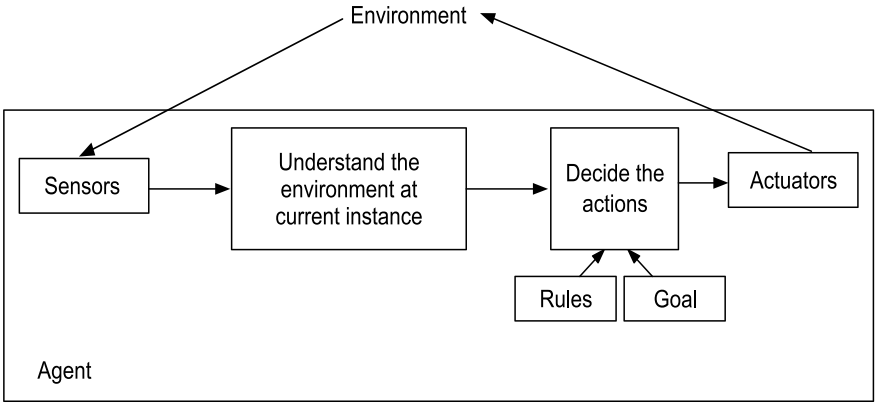


Fig. 4.2 Intelligent agent architecture

learning-based system or it is a simple rule-based system, generalized agent-based architecture can accommodate the variations and intelligent interactions required in these cases. Let us take an example of bot or chat system for a shop like *Uniqlo* or similar garment shop. Imagine a customer enters a shop and looking for ethnic wear. The chat or companion system should chart a path for the customer through interactions with him/her, where customer could see varieties of his/her interest. It should ask minimum questions—make sense out of provided answers and actions. Keep track of responses by users to improve performance of the system. It should further guide customers to the best possible options. The journey should be hassle-free, interactive and enjoyable.

In this case, the sensors sense customers (age, height, physique), sense their interests and needs (through interactions), and sense other attributes if any of those are relevant.

Actuators are expected to make actions—such as provide answers, guide customer to a particular rack, recommend certain options, and visually present how certain apparel looks on him/her. Further, it recommends additional ancillary or complementary services and can provide feedback on decisions taken by the customer. With additional sensing and inference abilities, intelligent agent works as buying companion for customers.

Thus, percept, agent functions, and action sequence are three basic parts of intelligent systems. When agent derives action intelligently, the agent could be called as an intelligent agent. Intelligently means rationally, using past learning and using inference, common-sense and to achieve the desired objective. This actually allows us to think that any intelligent system can be represented as basic agent-based architecture and typically developed on the top of agent-based systems. We will discuss limitations of agent-based systems but sometimes those are not applicable to such generalized representations.

Precept: Intelligence is an informed (knowledge-based) response to the perceived environment and changes in the perceived environment. Thus, percept sequence gives

an idea about what is happening with the environment. Sensors are associated with multiple inputs received by an agent. These inputs at a particular moment help to develop the concept about present state of the world. Here, the world could be as small as space in front of camera or it could be as broad as a set of customers or even the whole world. Obviously, set of inputs required to do a particular task may vary based on the environment. On the other hand, percept sequence is mapped to the inputs received by an agent over the time and includes historical information. This historical information can provide insights into behavioral changes over time. The percept sequence influences agents' decision regarding actions required in the given scenario.

Agent function: Agent function is the representation of agent's behavior. It is rather a form of relationship between percept sequence and possible actions that the agent can perform. In a way, the agent's intelligence is represented in an agent function. The function could be a simple limiting function bounded by thresholds or as complex as a program with huge possibilities and number of statistical/conditional/pattern-based equations. The learning refines agent program and helps to take right action in the case of given percept sequence. The multiple inputs through multiple sensors over the time help agent to find out how the world look like and how it is changing or evolving over the time. It also provides insights into how the world responds to certain actions. Typically, environment is dynamic and partially observable. That means it keeps changing and at any moment we do not have the complete information about the world. One can make assumptions in the given scenario to fit the model or to deal with certain part of the problem. But in the broader sense for the real-life problems, environment is changing continuously and is only partially visible. Thus, agent function has to imagine the whole world based on the parts of information and find out what would happen and how the environment will respond in a given scenario. Thus, agent function defines the working of an agent. It could be single mathematical equation or a number of steps of the processing inputs.

Generally, agents are represented by PEAS where P is percept, E is environment, A is actuators, and S denotes the sensors. PEAS gives the foundation to design an agent. Agent is always expected to behave rationally. Rationality can be defined in very complex way but the crux of rationality is taking best action to achieve goal abiding the rules. Thus, rational behavior is with reference to environment and knowledge available with the agent. This could be attributed to a common-sense rational behavior. The quality of action or preference of action is decided by performance measures. The performance measure decides the performance of agent with reference to the objective or expected outcome. It could be something like whether agent is advancing in the direction of the goal or not. There could be multiple measures for performance and we desire that the soft aspects of performance are to be taken into account. Thus, along with reaching the goal state the means and route also indicative of the performance. This is very true even for humans—it is important whether certain person becomes CEO but it is equally important how he became CEO—was it a stressful journey? Or, enjoyable one?—Does it take toll on his/her health?—All those aspects decide overall success of the person. No longer the performance is a binary variable. New agent designs need to take into account all these

soft performance measures to calibrate overall performance. When we are looking at customer centric performance, measures are to be calibrated to measure customer satisfaction. The customer should not only get the best product from the shop—but the performance is about overall experience which includes minimal waiting time, warm greetings, enjoyable exploration, help in right or most suitable product selection, personalized attention, smooth billing to have overall enjoyable experience with maximum value creation.

Rationality from intelligence perspective:

Intelligent agent needs to be rational where rationality refers to logical behavior. In case of intelligent system, rationality is also associated with intelligence and social behavior. Rationality is about obeying rules and performing actions to avoid conflict and select the route that takes to the goal state in the best possible way. Rational actions demand the proper knowledge about the environment including dos and don'ts—and is based on information gathering. Agent does not rely completely on prior knowledge but also takes actions based on own percept. Thus, rationality is associated with ability to gather all relevant information, ability to learn based on experiences, and ability to refine knowledge in light of new percept and autonomy. A rational agent in a shop is expected to know about customer and interact with him/her—in a way that should intend to understand and motivate customer to select the best possible option.

Flexibility is also associated with intelligence. Flexibility allows agents to deal with dynamic, changing and at times unexpected scenarios. It is also about adapting to changing scenarios, exhibiting rational behavior and taking the best possible route. Flexibility sometimes allows agent to overcome greedy behavior and focus on long-term returns in order to achieve the goal. Agents should be responsive, proactive and social. Responsive means one should respond timely while proactive means it should take an initiative. It is expected to show goal directed opportunistic behavior and take an initiative to achieve the goal. While doing this agent should be social—i.e., it should avoid conflicts and should interact with other agents and even humans in an amicable manner to resolves issues at hand. There are other properties those an agent should have—they include mobility, veracity, benevolence, and learning. In addition to being mobile, agent should be truthful and should do what it is told to do. It should keep on learning to better the performance irrespective of changes in the environment.

4.4 Intelligence and Agent Types

We do not exhibit the same level of intelligence for every task—we need different levels of intelligence to negotiate with changing complexities of the problems. The level of intelligence is also closely associated with the type of environment. In a very straightforward scenario, the environment could be fully observable and static. When environment is fully observable, deterministic and static agent can capture the state of environment fairly well in a single percept. In such a case, one can negotiate with

environment without percept sequence. A simplified representation where action is derived from the percept either from look up table or rule-based system forms a table driven and simple reflex agent. This limited intelligence suffices for simple problems in static environment. But in the real life, problems are quite often more complex where current state alone does not represent what can happen in the next state. Also, environment is dynamic and partially observable. To deal with such complexity, it is need to take into account percept sequence. The model-based agents associate output with input in the form of model that is learnt through association. In this case, the percept history and current percept drive the action. Model-based agents work on knowledge about percept sequence and current state. But typically, such agents are missing on the crucial aspects of information about the goal. Knowing and advancing in the direction of goal is crucial in many cases. Knowledge about the goal along with how the world is evolved is crucial to take the better route to the goal. Goal-based agents decide required action in light of the knowledge about the goal state. Typically, performance is a very broad concept. Along with the goal, means used to achieve the goal are also very important. Means look into some additional important aspects of how the goal is achieved and which route is followed to advance toward the goal. It answers questions like "was the ride comfortable, was the route scenic, was the journey enjoyable and so on." Utility-based agent looks into these aspects along with the attainment of the goal. Thus, performance could be associated with the happiness states. Utility-based agents in this way are associated with human behavioral aspects and have similarities with human learning. Humans basically learn in association with the environment. We have environment-based evaluation mechanism for our actions and those evaluations work as learning pointers for us. The environment gives some sort of response to our every action. It may come immediately after action or may come after some time. The response may be direct or it may come in some other form indirectly. Understanding the response and evaluating the same is necessary for learning. Thus, the response from environment needs to be identified and calibrated. It is then converted into some sort of learning to refine the next action. This is catered with reinforcement learning agent.

Reinforcement learning and learning agents:

A typical learning agent is depicted in Fig. 4.3. The agent gets response from the environment for its every action. It may be defined for every action or for the set of actions—represented by an episode. Every episode could be a logical set of sequential actions. Learning element and performance element are two major parts of learning agent. Learning element focuses on learning with reference environment and making improvement. The performance element is responsible for selecting the best possible action or set of actions. Learning element learns based on response from environment giving insights into how the agent has been doing. It could determine whether customers are satisfied or not? Are they enjoying shopping? Are customers like the recommended garments or not? Are they happy with the services? This response needs to be from a reviewer or a critic perspective—who can observe proceeding without taking part in the process. This feedback can be mapped to a penalty or reward based on response from environment. These penalties and rewards then help in fine-tuning the performance through learning. Reinforcement learning

Reinforcement Learning and Learning Agents:

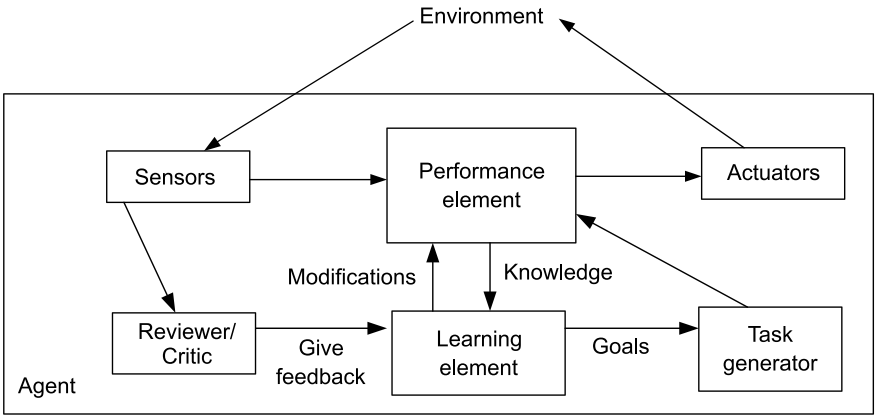


Fig. 4.3 Learning agent

tries to maximize the rewards to make sure that the agent is moving in the right direction. This learning tries to explore the world while exploiting the knowledge it already had about some similar events.

Natural language processing: Intelligent digital transformation works on three important aspects—one is processes where process evolution takes place with IoT and different data processing technologies. Second major part is communication where different interactions with customers and other stake holders are considered. Here, the focus in making customers and stake holders understand the system and system should know customers. It focuses in interaction between customers and the system. Hence, it is based on gestures, NLP, and expression mining. In this case, natural language processing and expression mining come into play. It also considers usability aspects and deals with human machine interactions. The intelligence layer focuses on learning based on captured data, interactions, and events.

Step 3. Maintain an understanding of the enterprise environment

Understanding the environment to identify the learning and intelligence opportunities is followed by embedding the technologies into enterprise environment. It works as a foundation for digital business innovation. Digital transformation is developed on this foundation. Enterprise environment comprises of different technologies working together. The operative, backup, and maintenance technologies together form a vast array of technologies. In this step, the array of technologies is studied and looked into for the possible introduction of new technologies. There is internal enterprise environment—which is influenced by many external factors. Digital transformation takes into account the linkages between them. Figure 4.4 depicts the relationships of enterprise environment and DBI.

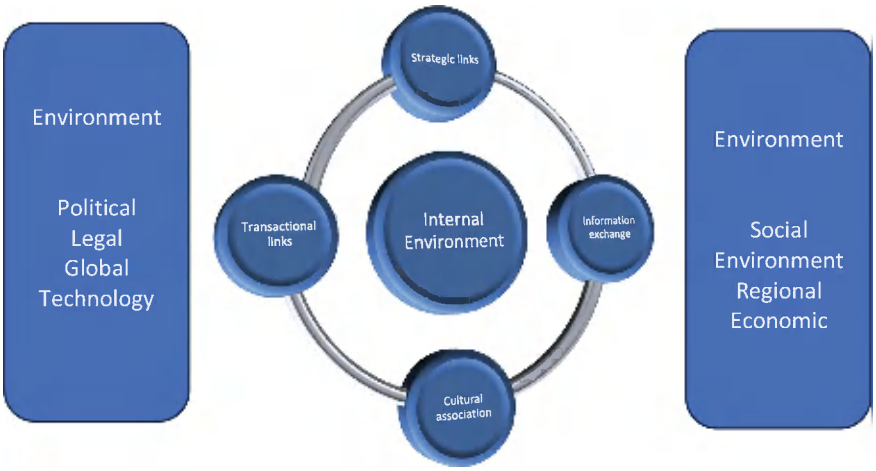


Fig. 4.4 Enterprise environment and DBI

The internal environment of the organization is governed by internal culture and interaction. There are environmental factors like political, legal and global environment.

(Case study TATA Motors—digital transformation is designing cars)

Tata motors watches their customer behaviors closely through different digital means. That allows them to understand and decode the behavioral changes and mapping them to internal or external factors. The embedding of digital modules within vehicles organization allows users to get detailed picture. They established digital spare-part ecosystem, sales ecosystem, and cultural ecosystem to improve efficiency, satisfaction and overall performance. Thus, while compiling with customers' need, they are also enhancing the enterprise and business architecture with effective use of new technologies and paradigms. The digital business innovation allowed TATA motors to reposition their products. Right from cost-effective alternative, they have repositioned it to most reliable mid-segment and small-segment vehicle company. Additionally, they positioned as one of the most trusted electric vehicle companies penetrating across India. Tata motors emerged as one of the leading vehicle companies which hold position in top global fortune five hundred list.

Step 4. Monitor and scan the technology environment

The possible opportunities to introduce improved technologies and association with identified learning opportunities create a platform for DBI. Prioritize adaptive technologies helps to chart the technology path. The information about the different events and their relationships is gathered—the internal and external environment are considered separately and together as well. The environmental scanning allows to identify future business scope and opportunities of business organization. Different historical events and changes in technology are studied to estimate future possibilities. It may include looking for different future challenges and coping up with them. Digital business innovation is a continuous process and requires continuous scanning

of environment and technologies to create platform for it. It is also exploratory to find out new possibilities and some unknown parameters and dimensions of future. It is context driven, dynamic, and changes with the changing environment. Most importantly, it tries to bring different pieces together to create a holistic view. The internal scanning focuses on internal environmental components and technologies while external scanning focuses on external environmental components and technologies. External environment has micro-environmental and macro-environmental components. Micro-environmental components include market, suppliers, and competitors, whereas macro-environmental components include political, cultural, technological, and economic factors. Apart from popular SWOT analysis which looks for strengths, weaknesses, opportunities, and threats, there are other techniques those focus on technology analysis, creating threat-opportunity profile and opportunity scanning.

(Case Study—**Quick Heal**)

Quick Heal had the humble beginning. Sanjay was good at technologies and developed his own antivirus and signature updating tool in his school days. The efforts culminated along with his brother's professional excellence in the form of India's leading software and mobile security provider Quick Heal. Thus, the leading IT security and data protection solutions of Quick Heal providing solutions across the globe. With Intelligent technology revolution in recent years—Quick Heal embarked into endpoint solutions, networks, data and mobility also. They transformed the organization by adapting deep and intelligent technologies, improved solutions and most importantly simplified the security understanding, the user security and information protection needs. Their recent cybersecurity solutions are results of their technology adaption. It is an example how digital transformation has taken place at a prime technology company. They internally adapted the technologies to enrich their solutions and used technologies to penetrate and improvement of solutions. The company positions itself as a leading cybersecurity provider and also contributed to making users aware of the risks. While doing that, company is keeping eye on technology developments and possible new risks developed due to the same. The dedicated team has contributed to the digital transformation and policy evolution with technology advancement to make Quick Heal a name recon for the total IT security solution across the globe.

Step 5. **Marrying technologies with opportunities from a strategic perspective**

This is one of the key steps in intelligent business innovation. DBI not only results in competitive advantage but also helps to position the organization. Strategic use of technologies exploiting available opportunities helps in this agenda. Tech Mahindra worked on *TacTIx*—an intelligent platform to help their telco customers and reduced the turnaround time of the tickets. The product is embedded into their service culture, guaranteeing better performance and pace. Slowly, it is associated with their other intelligent initiatives to create a digital platform for better services. This strategic use of NLP and AI allowed the organization to create competitive advantage. The organization's strategic positioning is also a key aspect. Technology helps organizations to transform from single store to multi-store. With strategic use technologies, Jio transformed from mobile service provider to a communication and entertainment companion. When we look the same thing from different perspective, you can see that

Google got transformed from a search engine company to an information companion platform. The new goals are embedded in vision trough digital business innovation.

(Case study Tech Mahindra)

The technology advancement and competitive landscapes demand the utmost need of providing actionable intelligence based on holistic information. The companies need to map opportunities to the technologies. Tech Mahindra—a leading IT company with global presence—realized the need to use new intelligent and cognitive technologies effectively for varied applications. To transform this space, they have worked on creating a platform for building cognitive applications on top of state-of-the-art technologies. This served as their platform to support and realize digital transformation. Here the advancement in AI and cognitive computing marries to myriad business opportunities to provide actionable insights. In businesses, IT infrastructures and models are evolving with the technology advances. Tech Mahindra realized the opportunities through technology evolution and while undertaking digital transformation—organization even thought of creating means for digital transformation for different organization. The idea was to increase IT business efficiency. That resulted in TACTiX provides an integrated AI Ops solution. It assist organizations though—intelligent data analysis helping to accelerate root cause analysis, automatically analyze, and categorize route tickets, virtual assistance, enabling knowledge sharing, and proactive risk analysis. Thus, TACTiX helped Tech Mahindra repositioning of own competence in the form of platform and helping other organization in digital transformation.

Step 6. Assess the potential of emerging technologies and innovative ideas to create DBI pathways

Technologies keep on evolving every day. These emerging technologies and innovative ideas create the DBI pathways. These technologies offer strategic ways to build solutions on a new platform. The potential of emerging technologies along with presenting it to achieve cultural shift to transform way of business to be done gives further impetus. The adaptation and acceptance of new technology need to rethink about the ongoing practices. This may make some roles obsolete or may demand employees to adapt new technologies to grab new roles.

Envestnet is leading investment advisory company providing a platform to investors, financial managers and product owners. With advanced technology, the roles of employees changed. The digital transformation at Envestnet had multiple aspects but two important aspects is repositioning and mapping the products to investors and redefining the role of technology and humans by creating human machine association. While decoding the signals received from multiple sources, machine helps to determine products on risk and customers on risk. The role of machines is changed from information crunching agents to first line decision-makers. This information changed the role of human agents from product sellers to intelligent information associators and investor transition companion. Thus, innovative ideas about the roles are embedded in the process to revolutionize the business process.

Step 7. Strategic implementation and recommendation of appropriate further initiatives

In is challenging to implement new emerging technologies. Organization could take strategic moves for competitive advantage through implementation of such novel technologies. For implementation of digital transformation, there is need to understand strategic inputs and systematic plan in place. The prioritization of initiatives and use EAI strategy—i.e., begin with initiative which is easy, acceptable, and important. This makes transformation possible and helps in keeping motivational levels high. It is always a good idea to go by parts. Every stakeholder should understand changes and benefits coming out of these changes. The process should be carried out with adequate training and technological personalized support. The complexity and scale of DBI is very massive and it is recommended to prioritize, start small and iterate to take it on a bigger scale. The new technologies and changes can also bring some legal compliance aspects into picture and those should be checked at every step. It could be compliance for government agencies or other external social agencies.

(Case study of Mogic)

LMS is very crowded space and many players were latching at it after distant learning has come up as an able alternative. Mogic when entered in this market with the objective to deliver greater value through online education, training, and allied services. With advent of advanced AI they transformed their role from LMS provider to dynamic, engaging, and intelligent learning and empowerment solution provider. The technology potential is unlocked to deliver required flexibility. In transformation apart from educating customers and stake holders, Mogic focused on developing a system that is self-supported, feature rich, and freedom oriented. They worked on behavior transformation along with product transformation. In the first part, they looked at cost vector—that was the combination of initial cost (onboarding cost), running cost (while boarded cost), usability cost (post-boarding cost), support cost (to remain boarded cost), and locking cost (board freedom cost) [2]. The technology-driven "*lazy max-return option*" worked as a key differentiator. The use of advanced behavioral and cognitive computing allowed them to track behavior and make the journey of customers enjoyable. Thus, strategic implementation of initiatives embedded in technology adaptation to enhance customer value. Mogic has its initiatives recommendations based on technology relationships! Apart from competitive pricing, good relevant features, freedom of choices, and progressing choice stories, Mogic choice architected overall choosing for their B2B customers to redefine LMS for organizations. They extended these stories to capture customers from different domain like insurance, schools, and nursing. Mogic transformed LMS from feature rich to feature generous and constrained to freedom-driven learning management [2].

Step 8. Monitor the implementation and use of innovation with business impact

The digital transformation results in the change in the business landscape. At times, it even results in attracting new customer segments, opening new possibilities, or expanding penetration in the market. The implementation comes with changes and the impact needs to be monitored for improvement and learning. At times, the impact is reflected in behaviors of organizations or extended organizations. These

behavioral changes provide pointers for refining digital business innovation strategy and help in accommodating new initiatives.

4.5 Summary

Digital business innovation may have humble beginning but needs to be firmly built on the top of strong emerging but relevant technologies. Intelligent technologies and change taking place due to adaptation of technologies raise may questions and operational issues. These complexities are to be dealt with in a very systematic manner. This chapter elaborated the eight-step journey of digital rather intelligent business innovation along with case studies of companies those undertook digital innovation and created business, commercial, and social value and transformed not only the organization but the business landscape.

References

1. Kulkarni P (2012) Reinforcement and systemic machine learning for decision making. Wiley
2. Kulkarni P (2022) Choice computing: machine learning and systemic economics for choosing, intelligent systems reference library, Springer Nature

Chapter 5
Digital and Intelligent Collaboration

AI is core at intelligent business innovation. Artificial intelligence plays a key role in making enterprise business processes intelligent. On the one hand, decentralization is inevitable while on the other hand, collaboration among team members scripts the success of business. The complexity and scale of operations have been increasing but physical proximity poses challenges. In such a challenging period, digital and intelligent collaboration offers some resolve. In this chapter, apart from brief introduction to specific AI techniques, we will discuss about intelligent collaboration empowered by intelligent technologies. It cannot be denied that collaboration is always the key to success of organizations. Collaboration is more than simply working together—*it is rather combination of sharing thoughts, complementing each other and working together for a shared goal with shared vision with shared practices following common principles to create ultimate value for customers and stake holders.* Generally, it begins with brainstorming and exchanging thoughts on some common platform. The collaboration and co-working in the past were more confined to a particular place or rather a meeting room or at times common venues for discussions. There used to be need for meeting room bookings and key participants are supposed to present in that room during the given time slot. These meeting rooms could have different facilities to make interactions smoother, efficient, and more productive. Right from simple white board with markers to different presentation devices come handy to make the collaboration more effective. With advent of digital technologies, these meeting rooms have become smarter with a number of advanced facilities like smart boards, intelligent mics, and language translation supports. Slowly with expansion and globalization of businesses, the need for distant, cross-boundary, and multi-lingual communication became very evident. This brought different distant communication and interaction devices into picture. With teleconferencing and video meeting facilities, these co-working places slowly expelled the physical boundary restrictions and even to some extent the cap on number of participants. AI created possibilities to further it. What AI has been doing to this communication? and how intelligent platforms helped to transform communication? Are interesting things to look at. Further, how AI and allied technologies

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_5

transformed co-working places and also created many new businesses possibilities is the topic of discussion of this chapter.

5.1 On the Path of Embedding Artificial Intelligence into Business

Intelligence is at the heart of modern business innovation. The businesses are expected to learn while performing different activities and dealing with different customers. They need to respond intelligently to business queries, show the best routes, and interact with customers in precise and sharper ways. They need to take timely and the best possible decisions. This is not always possible for a single person. Hence, typically business teams with different expertise need to come together. Intelligence is the most commonly used term that starved for definition. Right from behaving like humans to exhibiting mental keenness, it has taken many abstract explanations and myriad definitions. On the path of definitions, it has come across multiple branches and techniques to make it the most comprehensive study stream. "Machines exhibiting human like behavior" is somewhat very well and universally accepted definition of AI. But intelligence is not about isolation and so is learning. Humans learn in association with environment and most importantly in association with other human-beings. As intelligence is more human centric, to develop any AI system it needs to look at human way of learning. Hence, AI started to look into human psychology and objective responses related to brain structures. Additionally, it gone beyond humans and started to look for sources of intelligence across other living organisms, natural evolutionary processes, and different changing and responsive artifacts. That broadened the scope and application horizons of AI. Bio-inspired actions converged to novel models when combined with proven statistical and mathematical techniques. Anyway, evolution along with goal-driven approaches remained the key aspects of the whole process. Interactions with other living and non-living organisms are understandably an important part of the whole process. In all this tussle, the definition of intelligence has taken multiple shapes and has to look for the context, co-operation, and evolution as the key aspects of intelligence to respond to changing scenarios in smarter and sharper ways. It remains a debatable question where intelligence can be termed as a temporal variable. No doubt, it has pace and time as two key components. Considering all these complex unfolding relationships, we can define AI as:

Such a behavior and pace of responses along with co-operated efforts in the given context by a machine or a group of machines could be termed as intelligent if the same or very similar behavior exhibited by humans with similar pace, and in a very similar, context is generally accepted as an intelligent.

Any way there could be more details to definition—like who accept it as intelligence?—which population should be considered for voting and evaluation?—could it be fuzzy or crisp? Whether action is classified in binary way as intelligent and not

intelligent? We will deal with these aspects as we move ahead with more details in this chapter.

5.2 Artificial Intelligence and Collaboration

The focus of this chapter is on intelligent collaboration and after some discussion about AI we will elaborate regarding role of AI in collaborative actions. So let us take a look at one more aspect of AI–AI primarily defined as a system that has ability to learn, capture context, and understand goals to exhibit goal directed optimal and rational behavior in the given context. Since collaboration and co-working is a key aspect of different projects, let us look at how AI has transformed or would transform co-working.

AI in fact is not a technology but expected behavior which could use different technologies to exhibit human like behavior which is widely believed as intelligent. The facets of intelligence range from right obvious selection to goal orientation and timely response in some complex scenario. It has common-sense, rationality, and social aspect with a purpose at heart. Hence, while co-working—the idea is to use of AI to facilitate co-working through intelligent pointers and even making co-working possible in heterogeneous space. The objective of co-working is enabling decision-making—rather goal-driven intelligent decision-making.

Thus, in case of AI, it begins with simple rule-based systems and systems those can remember and retrieve timely answers to queries to help participants working on a problem together. These information retrieval and question answering systems came a long way. The retrieval of the most relevant answer to a given query and ranking the answers with reference to query and context of the project are key to any information retrieval system when we look at it from collaborative perspective. It involves classification of answers in to relevant and non-relevant sets to reduce the information overload and overheads. The answers to queries could be descriptive—when we are looking at multiple ranked outcomes, it is typically referred to as ranked retrieval but when we are looking at a one specific answer, it is rather question answering systems. It may involve simple retrieval models or at times very complex deep large language models. Intelligent business innovation through co-working strives to embed these learning, retrievals, technologies assessing learning, and intelligence opportunities in co-operative scenarios with reference to business objectives. Digital business innovation comes with change in trends and accepting them across the organization effectively to give organization a competitive and most importantly business coordination edge through co-ordination and co-operation.

5.3 Meeting Room Collaboration to Digital and Intelligent Collaboration

Collaboration is definitely much more than working together and exchanging information. It brings together individuals (stake holders), different allied processes, cultural enriching responses, and complementary technologies. It seamlessly integrates them and delivers the experience which is not possible in absence of any of the rich interactions among entities those are part of the process. The contributors or participants typically have project or goal at the center. When digital means are used to improve the interactions and establishing associations among different entities the pace, accountability and tracking may improve. Sometimes, it may come at the cost of effectiveness. Additionally, digital means help to improve the efficiency of information becoming available and getting exchanged. But there is need to track security and effectiveness. The communication and interaction improvements contribute to enhancement in overall individual and business productivity leading to improvement in pace of decision-making. The intelligent collaborative technology intends to allow people to share information and relevant resources naturally and efficiently, understanding their intentions and needs. This results in providing conducive environments to get the best out of collaboration. It is about intelligent tools, their strategic positioning, and effective use allowing peers to connect with intended counterparts timely and efficiently. Thus, the overall focus remains on improving the collaboration at work places.

The collaboration contributes to service innovation. The interesting ideas about digital collaboration capacity are confined by the ethnical, technical, and cultural boundaries. These capacities are expanded with service and workspace innovations. Typical components regarding collaboration capabilities are depicted in Fig. 5.1. In this case, digital collaboration capability of organization in association with changing technological landscape drives the process. Use and induction potential, realized potential resulted due to digital collaboration contributes to the realized use and impact. This further leads to product and service innovations.

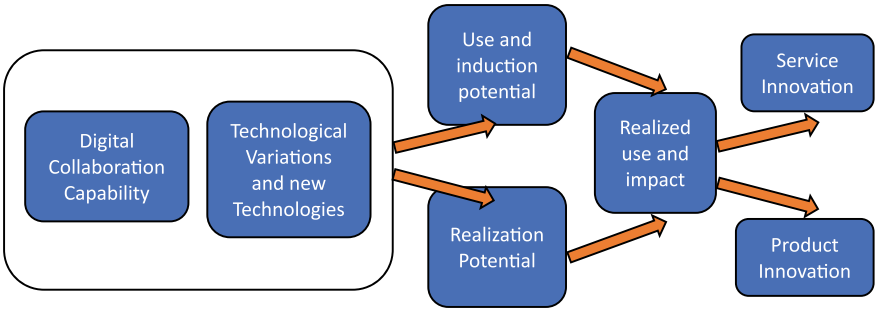


Fig. 5.1 Building and using capacity

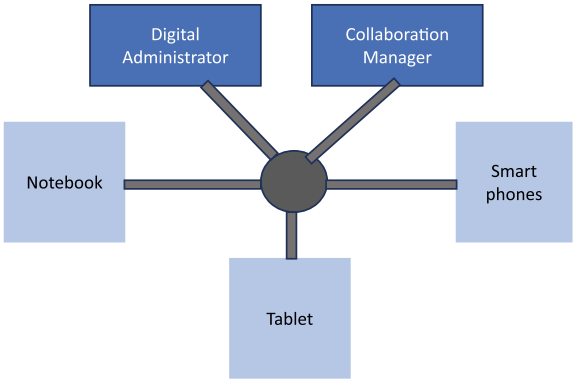


Fig. 5.2 Collaboration framework

Computer supported co-operative work (CSCW) focuses on techniques to capture essence of group activities. It began with the study about how different knowledge workers, specialist, scientist, and decision-makers work together and how they exchange information about group activity and arrive at certain conclusions. The same thing is true for computer engineers and developers to share their progress, activities, and impediments in order to overcome different limitations. Digital collaboration encompasses video conferencing, shared information repositories, collaborative editing, electronic meeting rooms (electronic co-working places), and co-operative authorship applications. The collaborative work environments have different facets and could be categorized into three types [1].

1. Electronic communication systems or tools.
2. Electronic conferencing systems or tools.
3. Collaborative management systems or tools.

A typical simplified digital collaboration framework is depicted in Fig. 5.2.

Initial systems: Case Study Z-Con [2]
(How Z-con used simple messaging to improve collaboration)

It was 2004-05—Business process outsourcing started taking up unexpected pace. Along with business outsourcing, many companies in the developed countries were looking for establishing development centers at some strategic low-cost locations. Even the ideas of project out sourcing and to some extend even the skilled job outsourcing were on the cards. The cost effectiveness—diverse thought process and addressing some local issues for broader penetration were trying to build foundation for new strategic initiatives of competitive paradigms. Organizations from different locations could sense this opportunity and started working on these lines. Z-con was a small company with most of their clients in US with the only development center based out of India. For Z-con, it was not commercially and logistically viable to have dedicated marketing team in USA to grab and retain customers. In this situation, founders Rahul and Vikas thought of managing and expanding customer base in USA from India. They

seamlessly managed the customer interactions using digital means. Those days video conferencing was not a viable option but there were simple messenger systems like Yahoo messenger. They used it very effectively along with normal telephonic calls. They developed digital communication lab to further enhance communication and to have further fruitful discussions with customers. From simple messaging systems to recent intelligent co-working, Z-con managed to work closely with their customers in USA and different countries without frequent visits of company executives to abroad. Over the period, they saved more than 20% cost without impacting customer acquisition and management.

Co-production of any specialized developmental or research project has always involvement of different technologies, skilled individuals, information resources, and wide range of expertise. In this case, these experts join hands to co-produce research questions and hypotheses. At every stage of hypothesis testing, there are very intense interactions. The knowledge management and knowledge augmentation further refine these research questions. There is mutual ownership of the project and shared accountability. Additionally, collaboration also deals with resource and funding access along with effective utilization of resources to solve the problem at hand. Figure 5.3 depicts collaborative research project components along with process of creation of hypothesis.

The simple messaging though effective in many cases comes with its own challenges and complexities due to limitations of them in conveying exact intent. Simple

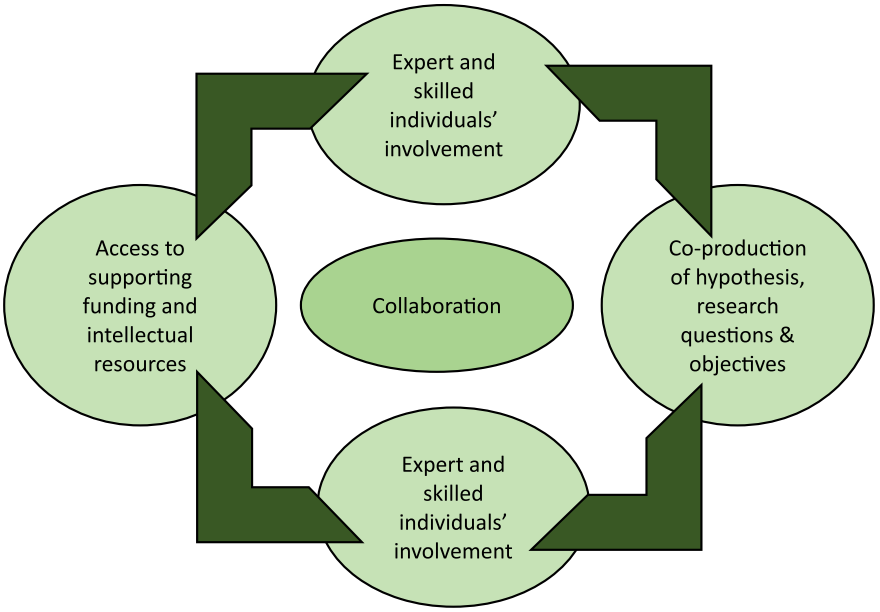


Fig. 5.3 Collaborative research project

messaging generally does not keep track of obvious contextual indicators like time, ordering, place, and scenario. That may result sometimes in inappropriate interpretations of messages and loss of crucial information. The team leads of different groups have given numerous examples of wrong interpretations of deadlines and even at times improper interpretations of product features that results in complicating the overall development scenario. It is more evident in case of cross-organizational, cross-border, and multi-lingual collaborations. Additionally, simple messaging for knowledge workers distributed across globe could create some sort of confusions in absence of proper contextualization, collation, ordering, and intelligence support. This led to the need of collaboration tools those can take care of these issues. The objectives of advanced artificial intelligence-based collaboration tools are to understand and decode communications among team members, provide them timely alerts, and simplify messages when there is ambiguity. These collaborative companions are expected to act as intelligent moderator.

Thus, digital collaboration goes beyond meeting and chat platforms. It encompasses the digital co-working places where efficient and effective collaboration is the prime objective. These places increase overall flexibility for the users and organizers. Those can contribute to flexibility in communication and ease in working for both employees and businesses. It allows employee to work from anywhere and even in some cases anytime. Flexi places, flexi time, and flexi work distribution are some of the evident benefits of these digital, virtual co-working places. Substantial reduction in overheads and improved efficiency result in saving time and financial resources. Typically, virtual digital workspaces are empowered with automation and self-regulating tools minimizing setup timings and freeing up individuals from the routine laborious tasks. Streamlining of routine tasks, intelligent organization of priorities along with timely reminding of actions contribute to further enhancement of efficiency.

For any project, it is important to stay connected. It is also key to know everyone else's contribution. The progress tracking and integration of different components leads to realization of big projects. Thus, intelligent shared project repositories are also supported by digital collaboration framework. Digital workspaces with numerous chat options, audio/video and technological conferencing, and use of file-sharing tools help teams to stay connected and work more efficiently together irrespective of locations. These tools include:

- Video/audio conferencing tools.
- File/data and information sharing tools.
- Co-editing tools.
- Intelligent interaction tools.
- Intelligent information extraction and summarization tools.
- Project management and scheduling tools.
- Question answering tools.

Collaboration is about coming together, exchanging relevant information, and enriching information with multiple viewpoints. The collaboration could have multiple facets. The collaboration could be physical collaboration where project

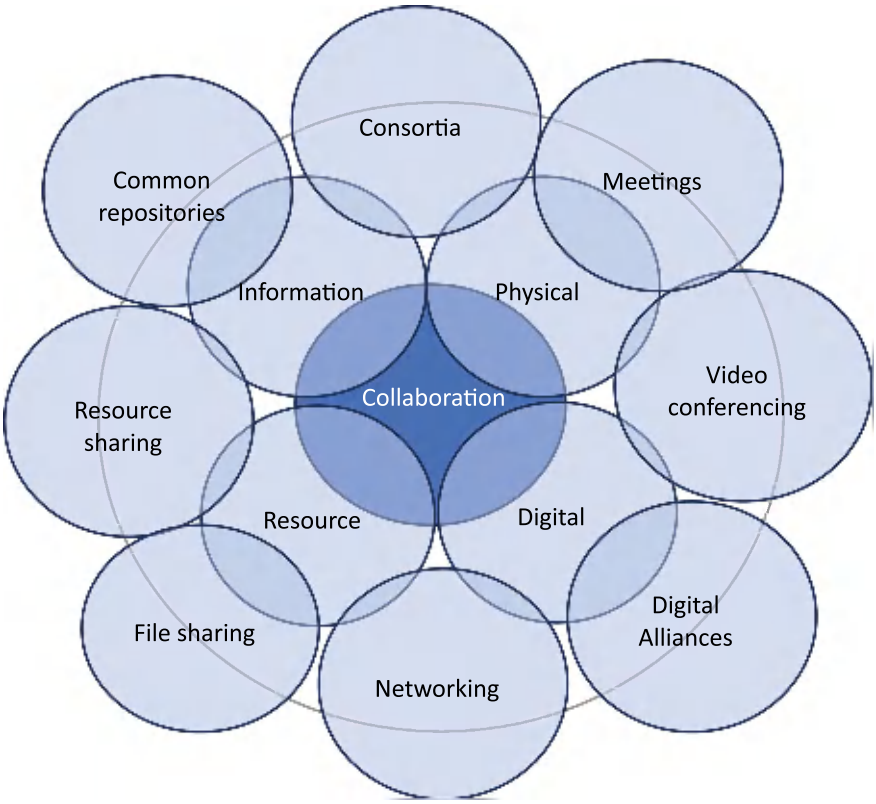


Fig. 5.4 Collaboration types

stakeholders meet and exchange viewpoints in person. In this physical collaboration—exchange of information takes place in different ways such as exchange of views using speech, gesture, or text format. Data or information collaboration is focused on sharing the relevant data, information as well as associated documents in the given context. In case of digital collaboration, the exchanges of information and viewpoints take place in digital format. Figure 5.4 depicts the broad overview of collaboration highlighting digital and intelligent aspects.

5.4 Information Retrieval and Intelligent Digital Collaboration

Digital collaboration spaces could be referred as the place for common expression on digital platform. These spaces go beyond simple meeting places by looking at security and privacy setting, automatic summarizers, timely alerting, and ability to

take relevant notes. Understanding the confidentiality of information and making the controlled availability of the reports, the platforms offer end-to-end encryption and other security mechanisms. The summarizers are also needed to understand broad objectives of the project, present scenario of the project, similar projects at hand. It also provides alerts regarding deadlines of the active projects. Thus, they are equipped with project repositories, information retrieval, and offering aid to participants.

5.5 Question Answering and Virtual Collaboration

Virtual and digital collaboration enable employees to communicate quickly and effectively in order to complete tasks faster and in the most effective ways. Knowledge repositories could be at the backend of these virtual collaboration frameworks. The system keeps learning through interactions among participants and keeps updating the knowledge base to generate relevant knowledge pointers. Thus, it captures the context for the ongoing discussion/meeting instance. Digital administrator and collaborator quickly answer the questions related to meeting references, past events, social/business, and compliance guidelines. It could also keep track of participation and comments and suggestions made by participants. This helps the executives to focus on other details. It can rearticulate the thoughts for distant participants and provide summaries. Cross-lingual contextual representations deliver holistic summary and action guidelines. Digital or intelligent business collaborations and such platforms need to follow certain collaboration guidelines and principles.

1. Balancing between individual benefits, group/sub-group benefits, and overall corporate benefits.
2. Charting out digital as well as overall business strategies before getting into technology traps.
3. Creating forums and avenues to listen voices of employer and employees. It includes transformation and re-articulation and holistic representation of voices.
4. Tracking thought ways and getting out of the way through knowledge management.
5. Use of digital collaboration to mine relevant examples, ranking these examples and creating opportunities to learn from examples.
6. Digital repositories and digital learning remain different from actual job activities—Thus, another guideline is to make these digital learning and digital learning pointers part of flow of work and integrate them seamlessly.
7. The digital collaboration is expected to create supportive environment for collaboration. This is typically done through understanding the leverage points for explorative action coherence.
8. Digital platforms and digital collaboration systems can measure collaboration time, active interaction time, and participation index. Further, intelligent collaboration platforms can provide some pointers helping to get insights about effectiveness of collaboration by determining interaction index or collaboration

index. These pointers act as key to portray the overall picture the way interactions progressed. Thus, intelligent platforms help to measure different activities, direct and indirect parameters—learn from them and subsequently derive the relevant collaborative, efficiency, and effectiveness indicators. These measured parameters could act as a basis for strategic actions.

9. Collaboration is not a onetime event. It is a continuous process. Organizations and management need to work on collaboration and associations. This increases the overall responsibility while using digital co-working places. The continuous learning and perseverance across actions is core to digital collaborations.
10. The conversations, project, and even relationships evolve with additional exposures and interactions. The changing dynamic scenarios create new opportunities while making some of the previous parameters obsolete. The adapting and evolving through digital insights and collaborative insights help in creating platform to deal with new challenges more effectively and efficiently. It additionally creates avenues for employee and customer collaborations.
11. Digital work places may result in compartmentality and many at times result in missing personal interactions and meetings. It is good idea to create such opportunities to strike the balance.

Figure 5.5 depicts principles and guidelines for digital collaboration.

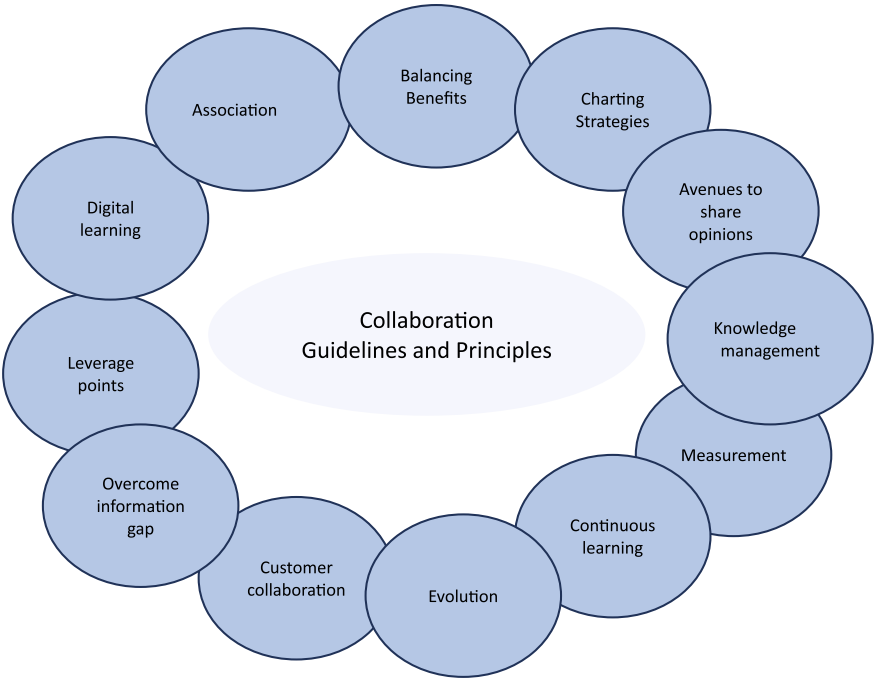


Fig. 5.5 Collaboration guidelines

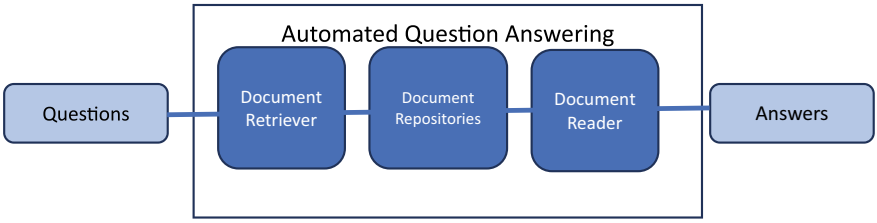


Fig. 5.6 Automated question answering

While focusing on above guidelines, the question answering or generative modeling helps to make stakeholder understand the context. Here, questions are generated with reference to the project at hand. The answers are generated not only using the project-related documents and records but also using the conversations, meeting notes and even experts' opinions. These answers and temporal inputs are used to refined the context. The proactive questioning on the other hand tries to generate expected questions and possible answers for every participant. Figure 5.6 depicts automated Q&A basic framework. It can use generative models to get different perspectives regarding queries related to project. But the measurement and evaluation components should make sure that the hallucination in this case should be taken care of.

5.6 Cross-Organizational, Cross-Border Collaboration—Working from Home and More

Collaboration and working on certain project are not simply a communication problem. Rather, it is a cultural problem. When two different teams work together, there are challenges regarding cultural alignment, linguistic understanding, and perceived expectations. The issue is further aggravated in case of cross-cultural and cross-border collaboration. It is absolutely necessary to have shared values, shared goals, and shared principles among the teams. It is interesting to imbibe these shared values and goals at virtual work places.

Rajiv Nashikkar (former vice president of IDeaS) who had been working with teams in India, USA, and Europe mentioned that the use and release of accurate information, digital maturity, and adherence to guidelines can help create a platform for effective collaboration.

Embedding emotional and conceptual indicators into virtual work places is an interesting approach toward it. When you become a part of such work places, the color themes, messaging, and even the interfaces connect you to the theme of activity. Tushar—Practice and AI head at Tech Mahindra—believes that taking specific meetings in certain meeting rooms help to convey messages and align participants and

stakeholders. The same is true in case of virtual co-working places. The intelligent meeting rooms with colors of UI and certain specific features aligned with the objectives can convey appropriate messages effectively. It is great idea to have these interfaces made very task and goal specific rather than personalized. Since co-working places have team and project objective at the center, the personalization for such task differs in many ways.

Mahesh who has been working from home for last four year thinks that personalized screens are less effective and meeting specific common themes could really aligned participants creating desired impact. Intelligent co-working places can generate meeting themes based on participants and goals. The ideas like emotional bonding, goal imbibing through these workplaces create next level of associations among users.

At the end of the day, it is about how to connect? It is rather about connecting with peers, connecting with activities and the goal and connecting with other participants and organizations. Any team member is expected understand the context and may need to have the holistic picture. Thus, when there are barriers like different organizations, different countries, or different languages, these co-working places need to provide platforms that can help in overcoming these barriers. Following different approaches are used by digital virtual co-working places to counter such scenarios.

- Information normalization through multi-perspective contextual assessment and providing it in the context of long term and short-term project goals.
- Use of common symbols and supporting translation mechanisms.
- Associative color and interfacing mechanisms to connect.
- Focused interactions with summarization, topic detection support with timely suggestions during interactions.
- Exchange of understood summaries and verifications through check lists.
- Progress and interaction tracking.

Co-working components include information and communication components. There are cloud-based virtual work spaces where the storage, tracking, and information management is controlled with cloud infrastructure. There is even virtual desktop infrastructure. Many companies are providing different virtual workspaces for companies to allow employees to work together irrespective of their location. The popular names of packages in this domain include Knock, Zoho Projects, Bluescapes, focusmate, Bit.ai, Tandem, Teamflow, Walkabout workspaces, Sococo, and Mural. These workspaces are designed with specific objectives in mind and come with their own advantages and disadvantages. While some of them are focused on enhancing productivity, others have features limited to video conferencing and screen sharing. Qube more focused on flexible work arrangements. In case of other software, time tracking, team tracking, to do list, and project management functionalities are given more focus.

5.7 Intelligent Business Transformation Through Co-working

For a company, the cost of infrastructure was one of the killing factors. Though to minimize it, they opened a few off shore development centers in Belarus and India. That definitely reduced the infrastructure and development cost to some extent but it still productivity was one of the major factors limiting the organizational success. On top of that after 2020, many organizations started promoting work from home and there was no option for the company but to follow the trend. The distributed teams, different cultures, language barriers were acting as frictional forces in the progress of project. The overall scenario was very gloomy as with covid and work from home scenarios the production cost remains almost same but efficiency hit to a low point. In this scenario, CEO of the company wanted to bring the profits on track and take company to positive reinforcement loop. There was no option to improve the efficiency of the company. The first step came in the form of getting rid of underperformers. To achieve this, they put in place—the intelligent tracking system. This initiative was rewarding but did not overcome the major issues regarding cost and productivity. This led to use of hybrid co-working and also integrating resource sharing components with traditional co-working. The company used existing co-working platforms effectively. The company had healthcare products and was working closely with doctors. After covid, it became exceedingly difficult to have discussion with healthcare workers. In this situation, they not only created co-working places for interaction but also educated doctors and other stake holders to use it effectively. With these interactions, the company created new opportunities to interact with customers during difficult period of 2020 and 2021.

Virtual and augmented reality for co-working places
MOGIC learning management system—transformation through technological impetus

Mogic helped organizations to transform their business through intelligent LMS and co-working scenarios. Mogic has been working on providing LMS and training services. In very beginning, the objective was confined to keeping customers engaged and motivated to use their LMS system. Additionally, it was focused on directing customers to use different functionalities of LMS effectively. With many customers on board and getting interested in different functionalities of LMS, Mogic needed to reinvent LMS to expand customer base. The focus was on helping customers to take their business on forefront with Mogic partnership. With this in mind team, Mogic learnt more about customer needs, additional functionalities to create competitive edge. The initial attempts were to have personalized LMS for organizations bore fruits in the form of improved knowledge dissemination through their platforms. The functionalities like meeting specific interaction spaces and task-specific resource placement worked well for mid-size organizations. Progressive alerts, active interpretations, and need-based summarization helped Mogic to transform their customers from over

resource under production scenarios to optimal resource—improved production organizations. It also transformed fixed timing and place bound companies to lean, flexi timing and highly interactive—knowledge-rich entities. The concept of AW-AT FC—i.e., anywhere, anytime focused co-working improved efficiency and reduced the cost. Mogic has plans to further enhance this co-working scenario by empowering with AR and VR. The cost definitely is going to be the key factor in their further enhancements. But Mogic with their co-working partnerships moving ahead on the broader co-working and learning management system landscapes.

There are a number of activities and services those need to be offered by any co-working place. Digital virtual co-working places are not exceptions to it. The co-working management involves managing activities, interaction in light of project goals. It includes facilitation of relationships at various levels and creating opportunities for participant to work together. It further looks at keeping track of these interactions in order to assess need for refining the goal and create pointes for next level of interactions. It also helps to keep track of progress. This further includes creating networking events—virtual or physical social events, formation of communities with reference to common interest and thinking beyond conceptual spaces. It has to make sure that communication is continuous and well directed through indicative reminders, making information available and providing communication progress maps for users.

From co-working management, it is key to know the members, manage memberships, restrict access, and handle intruders. The diverse plans as per organizational needs and handling of guests efficiently without compromising security and privacy aspects are very important. Additionally, membership aspects deal with access rights—like administrative rights, multi project rights and meeting initiation, summary access, and notification rights. The co-working place structures are built around these membership rights. Peer-to-peer communication, promotions through invitations, and security alert along with member activity are also important factors of membership management. The member project loyalty index is an important supporting part—here this index is calculated based on interactions and activities of member. Co-working places can be very well integrated with project management and scrum management tools to get the wholistic picture of projects and track behavioral aspects of members. When such integration is done efficiently, the co-working places could even suggest regarding member selection, meeting schedules, and meeting invitations. Third aspect regarding virtual co-working space management revolves around the space allocation—it includes memory, time slot, and member outrebound in case of failures. The co-working may demand certain additional tools for specific project space sharing, document sharing and code sharing. Providing and managing these facilities for seamless interactions demand smooth interfacing of it with resource sharing tools. Another important aspect of co-working is mentoring and educating stake holders. It involves mentoring and educating customers to know some customer focused details regarding the project and helping customers beforehand to use the proposed product or solution in an efficient way. It also involves peer

mentoring regarding the relevant aspects of project and also mentoring fresh members regarding security aspects, project-related aspects, and use of resources. There could be generalized mentoring rooms, personalized mentoring rooms, hands-on mentoring rooms, and project-specific mentoring rooms. The time bound interactive mentoring is supported with on demand mentoring. Figure 5.7 depicts the overall co-working management framework while Figure 5.8 depicts mentoring and education management in co-working spaces. It can have mentorship programs where the suitable mentor is suggested for fresh candidates. It further could have peer mentoring and activity-based mentoring sessions.

Customer mentoring could be project specific and may be specialized based on roles. These planforms could allow customers to share their insights and domain knowledge.

Summary: Future of co-working and challenges

Present virtual co-working techniques though give some mileage in terms of resource sharing and cost saving there are various issues with these existing approaches. These issues include absence of intelligent collaboration and information sharing. Here, intelligent collaboration refers to predictive actions, optimal information sharing,

Fig. 5.7 Co-working management

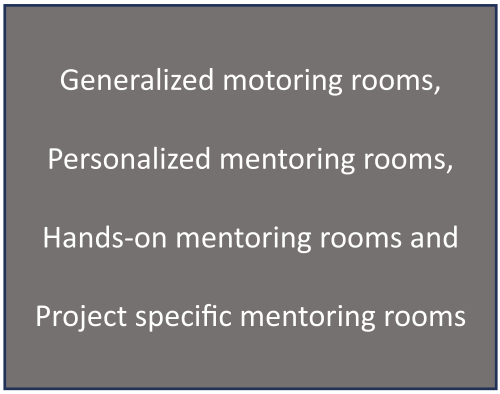


Fig. 5.8 Educational management in co-working spaces

intelligent action indicators, and smart summarization. It is also expected to look at security concerns by controlling access rights and information exposure. The possibilities of information breaches and proxy presence are minimized by authentication systems and behavioral analysis for all members present in co-working place. The distant working systems always come with efficiency challenges due to loss of information, language, and time zone-related issues. The loss of information further creates the complexities while implementing complex projects. In such scenarios, active information management, providing regular summaries and intelligent checks for understanding prove to be helpful.

Digital collaboration and distant project interactions face multiple challenges. First and foremost, challenge is the lack of motivation. The lack of personal interactions may lead to loss of interest and takes toll on project efficiency and quality. Secondly, many participants do not use the features of the facilities to fullest extent either due to lack of awareness or due to technological lethargy. This leads to inefficient communication. Thirdly there could be security and privacy concerns. Compromise on ethical aspects and misuse of information could be additional issues in case of digital collaboration. The future work in digital collaboration would definitely try to address these challenges. On the top of it, there is an opportunity to make it further intelligent—even looking at possibility of an intelligent companion or collaboration with machines.

Sometimes, communication becomes monotonous and reaches to a local maxima and no progress is observed. The future co-working places could identify such scenarios and recommend some changes in topics along with addition of external members. It could also include provide references to additional reading materials. Such Knowledge-based co-working places could enhance efficiency and productivity of groups working together. Anyway, digital co-working comes with its own challenges. Is it possible that over dependence on co-working infrastructure and recommendation would impact adversely on participants' creativity? Is it possible digital ways could lead to loosing of interest among participants? The drastic reduction in interactions in person can hamper some aspects of psychological development? Well, the possibilities cannot be denied. It is also important to look at in detail the ethical aspects of digital co-working. The rationality, sociability, and veracity at working environment along with just enough of digital co-working will definitely pave the new innovation way for the future. It will definitely support and nurture creativity aspects and play their role in digital better world.

References

1. Kay R (2004) Roots of digital collaboration. Computer World 38:41
2. Kulkarni P (2015) Knowledge innovation strategy. Bloomsbury

Chapter 6
Workforce Automation Increasing Role of AI in Work that Humans Can and Cannot Do

Automation isn't a recent phenomenon; it began with the Industrial Revolution in the eighteenth century when mechanization transformed manufacturing through inventions like the steam engine and assembly lines. As technology progressed, the twentieth century saw the advent of programmable machines, early computers, and software, which expanded automation into office and service sectors. Today, we've entered the age of AI in workforce automation, where advanced technologies such as artificial intelligence, machine learning, and robotics are increasingly capable of performing complex tasks and decision-making processes, revolutionizing how work is done across various industries.

6.1 Emergence of Computers in Work that Humans Performed

At the heart of AI is the digital technology that started with the emergence of computers in the 1950s and their adaptation by business. Early strategic business thinkers saw computers as transformative tools for enhancing workforce efficiency. In the early stages of computing, the focus was on leveraging technology to streamline operations, reduce manual labor, and improve accuracy. By automating routine and complex tasks through early, so-called, expert systems, industrial robots, and document processing technologies, businesses aimed to optimize productivity, minimize errors, and cut costs. Young generations probably do not remember the time when one had to call a human Telephone Operator, in order to make a call and the time of type-writers and how one had to get help from a typist to write even a one-page letter in formal type-setting characters. This strategic vision of using computers to augment human capabilities and automate repetitive processes laid the foundation

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_6

for the broader adoption of AI and advanced automation technologies that continue to reshape industries today.

It is interesting to observe the thought process of early adopters starting in early 1970s and the key application that grew in complexity with the gradual advances in the computer technology, which included advances in both hardware, software, as well as robotics.

Perhaps period between the 1970s and 1990s was indeed crucial for laying the groundwork for workforce automation, with significant advancements in both hardware and software.

During the period from 1970s through the 1990s, hardware development made profound strides that underpinned the rise of workforce automation. The introduction of microprocessors revolutionized computing by significantly enhancing processing power and reducing the size and cost of computers. This era saw the emergence of more powerful and affordable personal computers, which enabled broader access to computing technology.

Additionally, advancements in robotics during this period, such as the development and deployment of industrial robots, transformed manufacturing. These robots could perform complex and repetitive tasks with high precision, marking a significant leap in automating industrial processes and increasing production efficiency.

On the software side, this period was marked by significant innovations that expanded the capabilities and applications of computers in the workplace. The development of expert systems in the 1970s demonstrated how software could simulate human expertise and decision-making in specialized fields. In the 1980s and 1990s, the rise of interactive voice response (IVR) systems and early document processing software, including optical character recognition (OCR), showcased how software could automate customer service tasks and data entry. These advancements in software not only improved operational efficiency but also paved the way for more sophisticated AI applications, setting the stage for the extensive use of automation technologies in various sectors (Fig. 6.1).

The strategic areas that led the workforce enhancement included:

- Expert systems.
- Industrial robotics.
- Automated customer service.

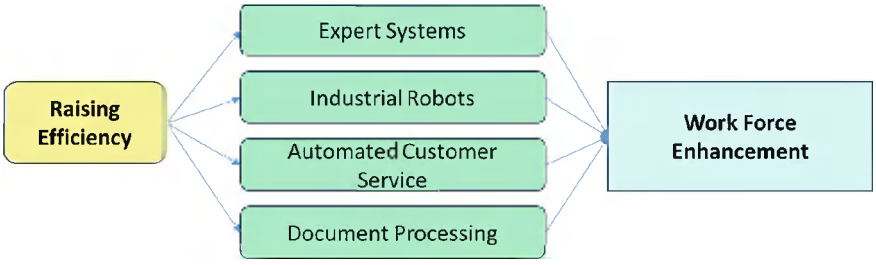


Fig. 6.1 Efficiency-raising software gave rise to workforce enhancement

- Document processing.

All started during 1970s to 1990s and we call them **workforce enhancement areas**. Following provides a more descriptive explanation and leading.

Expert Systems and Early AI Applications

In the 1970s and 1980s, the development of expert systems marked a significant milestone in AI. One of the pioneering examples was MYCIN, an early expert system designed for medical diagnosis [6]. MYCIN utilized a rule-based approach to simulate the decision-making of human experts, specifically in diagnosing bacterial infections and recommending antibiotics. This system demonstrated how early form of AI, the expert systems, could be used to replicate specialized human expertise and enhance decision-making processes.

Industrial Robots and Automation in Manufacturing

During the 1980s, industrial robots began to revolutionize manufacturing. A notable early example is Unimate, introduced in the 1960s and widely adopted in the 1980s. Unimate was used for tasks such as welding and material handling in automotive production lines. This automation significantly improved precision, efficiency, and safety in manufacturing processes by taking over repetitive and physically demanding tasks previously performed by human workers.

Automated Customer Service Solutions

The late 1980s and early 1990s saw the rise of interactive voice response (IVR) systems, which began automating customer service operations. These systems utilized basic AI algorithms to handle routine customer inquiries, route calls, and provide information, reducing the need for human operators. IVR technology laid the groundwork for more sophisticated customer service automation by enabling efficient and consistent handling of customer interactions.

Document Processing and Optical Character Recognition

In the 1990s, optical character recognition (OCR) technology became a significant advancement in automating document processing. OCR systems enabled machines to convert printed or handwritten text into digital format, streamlining tasks such as data entry, document archiving, and information retrieval. This automation greatly improved the efficiency and accuracy of handling large volumes of text-based data.

The implementation of expert systems, industrial robotics, automated customer service, and document processing are examples to show how innovative digital technologies had been instrumental in saving time, enhancing workforce efficiency, and cutting labor costs.

More specifically, expert systems have streamlined decision-making processes, enabling quicker resolutions and allowing employees to focus on higher-value tasks. Industrial robotics has automated repetitive and precision tasks, significantly speeding up production cycles and reducing the need for manual labor, which in turn lowers operational costs. Automated customer service has efficiently handled

routine inquiries, reducing the workload on human agents and allowing companies to manage larger volumes of customer interactions with fewer resources. And, document processing automation has drastically cut down the time required for managing paperwork, reducing errors and freeing up administrative staff to focus on more strategic activities. Collectively, these technologies have optimized operations, leading to greater productivity and cost savings across various industries.

Birth of Data-Driven Decision-Making

The benefit of using data as row material to achieve the said benefits is a strong rationale for what can be called **data-driven decision-making**. The drive to accumulate more data has been fueled by the recognition that the more data a company has, the better it can train its algorithms, improve its decision-making processes, and innovate in ways that were previously unimaginable. This pursuit of data has not only led to the age of big data but has also sparked innovations in data storage, processing, and analysis technologies, allowing companies to harness the full potential of the data they collect. Consequently, the accumulation and effective use of big data have become essential strategies for companies looking to stay ahead in an increasingly data-driven world.

Soon, the arrival of Internet and the technologies surrounding it gave a big boost in providing the infrastructure and connectivity needed for companies to gather vast amounts of information from a wide range of sources.

6.2 Impact of Internet, Social Media, and the Era of Big Data

The invention of the Internet in the 1990s, coupled with the proliferation of mobile phones, social media platforms, IoT devices, and advanced sensors, has fundamentally transformed how data is generated, collected, and utilized.

The proliferation of mobile phones, social media platforms, IoT devices, and advanced sensors fundamentally changed how data was generated and captured. Mobile phones, becoming nearly ubiquitous by the early 2000s, transformed into powerful devices capable of constantly collecting and transmitting data. Every call, message, app interaction, and location signal produced valuable information. Social media platforms amplified this by creating vast amounts of user-generated content. People began sharing photos, videos, posts, and comments, all of which became crucial sources of behavioral and contextual data. This surge in digital interaction was driven by billions of users worldwide, generating massive datasets daily.

At the same time, IoT devices and advanced sensors began capturing real-time data from the physical world. IoT devices—ranging from smart home devices and wearables to industrial sensors—were deployed to monitor environments, machines, and systems across industries. These devices generated constant streams of data,

providing detailed insights into everything from machine performance to environmental conditions. Advanced sensors in industrial applications, robotics, health care, and manufacturing added another layer by capturing precise information about processes and operations.

This unprecedented surge in data generation led to the need for storage and analysis, as businesses and organizations quickly recognized the potential of these large datasets. The term "**big data**" emerged to describe the challenges of storing, managing, and analyzing this flood of information. Organizations began to store these vast datasets because they realized the value in uncovering patterns, trends, and insights that could improve decision-making, optimize processes, and drive innovation. With the development of scalable storage technologies, such as cloud computing and distributed systems, it became feasible to store massive amounts of data, and this created a new era of data-driven innovation.

These technological innovations have collectively **ushered in the era of big data**, where vast amounts of information are continuously produced and captured from countless sources around the globe.

The Internet serves as the backbone of this data revolution, enabling seamless connectivity and communication, which allows data to be transmitted and stored on an unprecedented scale. Mobile phones and social media platforms, in particular, have amplified this effect, as billions of users generate a continuous stream of data through their interactions, preferences, and behaviors, all of which can be meticulously tracked and analyzed.

Over the last 30 years, data storage technologies have evolved significantly, leading to the development of both Structured Query Language (SQL) and NoSQL databases. SQL databases, like MySQL and PostgreSQL, excel at managing structured data with a focus on consistency and integrity, making them ideal for industries like finance and healthcare. NoSQL databases, which are non-relational, emerged to handle the unstructured and semi-structured data generated by the Internet, social media, and IoT. They offer greater flexibility and scalability for big data and distributed applications. For example, Cassandra, a highly scalable NoSQL database, was originally developed by Facebook to handle massive amounts of real-time data and later became an open-source project under the Apache Software Foundation.

This evolution, along with the rise of cloud storage and distributed systems, has enabled faster access to vast amounts of data.

This vast repository of data has become the fuel for advancements and innovations in machine learning algorithms, AI Chips and hardware, as well as deep learning and AI-driven automation.

As data accumulated, machine learning algorithms were increasingly leveraged to identify patterns, make predictions, and enhance decision-making processes across industries. The development of specialized AI Chips and hardware has further accelerated these advancements by providing the necessary computational power to process and analyze vast datasets at unprecedented speeds (Fig. 6.2).

At the heart of this transformation lies **deep learning** and AI-driven automation, which have enabled machines to not only learn from data but also to perform complex tasks autonomously. With the support of AI Chips and hardware, deep

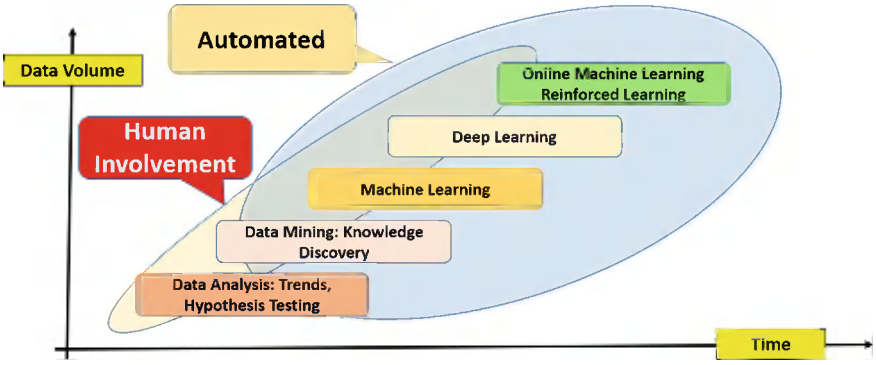


Fig. 6.2 Big data and automation of data analytics [11]

learning models can now handle immense volumes of data, driving significant progress in fields such as natural language processing, computer vision, and robotics. These technologies have not only transformed industries but also set the stage for continued innovation in AI and automation, pushing the boundaries of what machines can achieve and further solidifying the role of big data as the cornerstone of our increasingly data-driven world.

The emergence of big data has provided the massive volume of information essential for training AI and machine learning models. The availability of both structured and unstructured data has enabled algorithms to recognize patterns, enhance accuracy, and make data-driven predictions. This influx of data has created the ideal environment for advancing AI-driven automation, which is powered by three key technological pillars:

- **Machine Learning Algorithms**

With the exponential growth of data, traditional methods of analysis became insufficient. Machine learning algorithms have become crucial for processing big data, identifying meaningful patterns, and making real-time predictions. These algorithms allow systems to continuously learn and improve without human intervention, leading to progressively more intelligent and capable forms of automation. Whether in predictive maintenance or financial forecasting, machine learning enables automated systems to adapt and evolve over time.

- **AI Chips and Hardware**

The volume and complexity of big data demand significant computational power. The development of specialized AI Chips, such as graphics processing units (GPUs) and tensor processing units (TPUs), has been essential in accelerating the training and execution of machine learning models. These chips are designed for the massive parallel processing required to handle data-heavy AI tasks, making it possible to process and analyze vast amounts of data quickly and efficiently. As a result, AI Chips

have been a driving force behind real-time AI-driven automation across industries, from autonomous vehicles to advanced robotics.

- **Deep learning and AI-driven automation**

A subset of machine learning, deep learning leverages multi-layered neural networks to process unstructured data, such as images, audio, and text. With the rise of big data, deep learning models can now be trained on massive datasets, resulting in more accurate and sophisticated AI-driven automation systems. This technology underpins many advanced applications, such as image recognition in manufacturing, autonomous driving, natural language processing in customer service automation, and facial recognition in security systems.

Additionally, generative models, like Generative Adversarial Networks (GANs), which pit two neural networks against each other to generate realistic data such as images and transformers, including ChatGPT, enable machines to not only interpret but also generate new data, from realistic images to human-like text [4]. By enabling machines to interpret and generate complex data forms, deep learning has expanded the possibilities of automation to tasks previously thought to require human intelligence.

Together, these innovations have enabled businesses to harness big data more effectively, paving the way for AI-driven automation that can learn, adapt, and optimize processes with minimal human intervention.

Following Table 6.1 provides a brief explanation by addressing each of the four "workforce enhancement" areas and how they have advanced to the stage where we are now capable of creating noticeable impact in workforce automation, raising even fears among workers and attracting attention of global organizations, such as World Economic Forum and ILO (see the highlighted text box, shown after the Table, next).

As AI technologies continue to evolve, their integration into daily business operations will only expand, allowing for even more sophisticated automation, from routine tasks to decision-making processes. This not only leads to cost savings and improved efficiency but also frees up human workers to focus on more strategic and creative roles, fostering a more innovative and dynamic workforce.

When AI is used to automate tasks, it doesn't necessarily lead to redundancies, as the technology can also complement human labor when certain tasks are automated. Whether technological adoption leads to automation (job loss) or augmentation (job complementarity) depends on the centrality of the automated task to the occupation, how the technology is integrated into work processes and management's desire to retain humans to perform or oversee some of the tasks, despite automation's potential.

Table 6.1 Workforce enhancement models of the 1990s progressed to become workforce automation models at present

		Key technology area			
		Big data	Machine learning algorithms	AI Chips & hardware	Deep learning (DL) and workforce automation
Workforce enhancement areas	Expert systems	Real-time data drives dynamic decision-making	From static rules to learning systems	Enables real-time, automated decisions	Processes unstructured data autonomously
	Industrial robotics	Predictive maintenance and adaptive operations	Robots learn and optimize tasks	Enables high-speed, complex operations	Robots learn and perform visual tasks and decisions autonomously
	Automated customer service	Improving interaction	Self-learning systems automate complex customer tasks	Enables real-time customer service automation	NLP and DL handle complex interactions autonomously
	Document processing	Automates large-scale document analysis	Systems autonomously categorize and process content	Enables fast, real-time document workflows	Automates understanding of unstructured data

– International Labor Organization (ILO)

6.3 AI-Driven Automation

Building on the insights from the previous section, four key technological areas have played a pivotal role in advancing AI-driven workforce automation. These technologies, working in synergy, are reshaping industries by enabling increasingly sophisticated automation capabilities. The four critical pillars include:

- Big data.
- Machine learning algorithms.
- AI Chips and hardware.
- Deep learning and AI-driven automation.

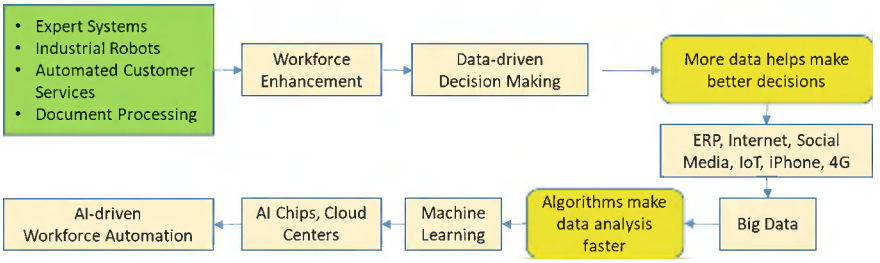


Fig. 6.3 Progress of workforce enhancement, from 1990s, toward AI-driven workforce automation

Earlier, Sect. 6.2 explored the emergence of computers and how innovative strategies developed from the 1970s to the 1990s to leverage computers for tasks traditionally handled by humans. Numerous applications emerged across various sectors—science, engineering, business, and government—several notable examples stood out for their role in enhancing workforce efficiency and productivity in areas requiring complex human involvement, among them key applications include:

- Expert systems.
- Industrial robotics.
- Automated customer service.
- Document processing.

As discussed in Sect. 6.1, these technologies were initially developed to augment human capabilities. However, with the advent of the Internet, social media, IoT, and other innovations, they have grown in complexity, driven by advancements in big data, machine learning, AI Chips, and deep learning. What once began as tools for workforce enhancement is now being evolved into fully autonomous systems, capable of handling complex tasks, continuously learning from data, and dramatically improving operational efficiency across industries.

Following diagram illustrates the rapid change that we have witnessed (Fig. 6.3):

As AI-driven technologies continue to advance, their impact on workforce automation is becoming increasingly evident across industries. The integration of AI into everyday operations is reshaping how businesses function, reducing reliance on manual labor, and driving efficiency at unprecedented scales.

AI-driven workforce automation can also be categorized into three stages:

- **Almost automated systems**: Where AI, robots, and advanced sensors handle nearly all tasks, requiring little to no human intervention. Examples include:
  - Autonomous vehicles: Self-driving cars and drones in transportation (e.g., **Tesla**)
  - Manufacturing: Fully automated assembly lines using robots, automated part inspections (e.g., Advanced vision sensors from **Keyence**)
  - Retail: Autonomous checkout systems (e.g., cashier-less stores like **Amazon Go**, **Uniqlo**'s autonomous checkout counters).

- **Largely automated systems:** AI reduces tedious, repetitive, or labor-intensive tasks, increasing efficiency and accuracy. Examples include
  - AI-assisted healthcare diagnostics, such as radiology scans, where AI helps identify anomalies but requires a medical professional to make final decisions
  - AI-driven customer services, where chatbots handle routine inquiries, delegating complex issues to human agents.
- **Partially automated systems**: AI assists in tasks that are too complex, time-consuming, or impossible for humans to do alone, but still require human oversight or decision-making. Examples include insurance fraud detection, where AI flags suspicious cases, or continuous security monitoring that detects cyber threats for human follow-up.

The transition between "almost automated," "largely automated", and "partially automated" systems is indeed dynamic. As new technologies like AI, machine learning, and sensors advance, they'll not only improve existing systems but also enable entirely new applications in all three areas. Table 6.1 highlights this using four workforce enhancement areas as examples.

Thus, the fluidity of advancements will likely blur the boundaries, creating a continuous loop of new applications at each level.

The success of AI-driven automation is prompting organizations of all kinds—businesses, government bodies, and institutions, both large and small, across the globe—to explore how they can adopt AI to enhance their operations. However, many find themselves facing many challenges of how to start, as they rush to implement AI solutions without fully understanding the strategies or infrastructure needed to harness its full potential.

Determining whether a task or process can be automated using AI requires a comprehensive understanding of the task or process in question. This often involves collaboration with IT staff or seeking expertise from external consultants, as discussed in Sect. 6.4. When considering AI, data emerges as one of the most critical components, serving as the foundation for any successful automation initiative [6–8].

The thinking process can be as follows.

Strategic thinking process to identify AI-appropriate tasks or processes.

1. **Define the task or the process and problem with it**
   Identify repetitive, data-intensive, or error-prone tasks that can benefit from automation. Focus on problems where consistency and speed are critical.
2. **Assess data availability and output clarity**
   Ensure the task has sufficient historical data or patterns for AI training, and that the expected outcomes are measurable and actionable.
3. **Evaluate feasibility and ROI**
   Analyze the frequency, scalability, and cost–benefit of automating the task. Prioritize tasks with high-impact potential and a clear return on investment.

4. **Prototype and refine**
   Start small with a pilot project to test AI capabilities on the task, measure results, and iterate before scaling across broader processes.

An example may further clarify this thinking process.

Assume an organization wants to explore if **customer support** process can be enhanced with AI.

Now, the thinking process is as follows:

- **Problem**: Long wait times for customers to get assistance.
- **Task analysis**: Frequently asked questions are repetitive and well-documented.
- **Data**: Customer queries and resolutions are logged in a structured format.
- **Feasibility**: Deploying an **AI chatbot** can reduce response times and free human agents for more complex queries.
- **Prototype**: Launch a chatbot for a specific product line and monitor customer satisfaction.
- **Iterate**: Expand the chatbot to other product lines after refinement.

The feasibility step mentions "AI chatbot." Major cloud providers like AWS, Google Cloud, Microsoft Azure, and others offer customizable, **ready-to-deploy chatbot services**. These services are designed to be user-friendly and flexible, allowing companies to integrate AI-powered chatbots into their operations with minimal technical expertise.

6.4 Challenges to AI-Driven Workforce Automation

As organizations look into to integrate AI into automate their operations and processes that that humans currently handle, they often encounter several key challenges. These include a strategic understanding of how AI fits within their strategic goals, the infrastructure needs to support advanced AI systems, including data, and the availability of skilled human resources capable of managing and maintaining these technologies. Without careful planning and a clear roadmap, companies risk implementing AI solutions that fail to deliver their full potential or become unsustainable in the long term. Three key areas that underscore these challenges are [1–3]:

1. **Strategic understanding**
   - **Define clear objectives**: Identify specific pain points where AI can add value (e.g., customer experience, cost reduction).
   - **AI roadmap**: Create a phased plan for AI integration, starting with small-scale pilots before full implementation.
2. **Infrastructure needs**

- **Data management**: AI needs high-quality data to function effectively. Establish systems for data collection, cleaning, and storage (e.g., cloud solutions).
- **AI hardware**: Invest in **AI Chips** (e.g., GPUs) for real-time processing and scalable computing power.
- **Automation technologies**: Adopt technologies like **RFID**, **IoT**, or **vision sensors** to automate workflows.

3. **Skilled human resources**

- **Technical expertise**: Hire or train data scientists, AI engineers, and system architects to manage and refine AI systems.
- **Cross-functional teams**: Blend technical and business teams to ensure AI aligns with organizational goals.
- **Training for non-tech staff**: Equip non-tech employees with skills to interact with AI systems, easing the transition and reducing resistance.

By combining business strategy, technology, data management, and process innovation, companies can address the challenges of AI-driven workforce automation while positioning themselves for long-term success.

New human skills will inevitably be required, especially to manage and operate in an environment where AI and human collaboration is key. This team approach fosters innovation and ensures that AI is applied in ways that are sustainable, scalable, and aligned with the company's overall strategic objectives.

As the complexity of AI deployments increases, strategic alliances with technical teams, whether internal or external, become crucial for organizations. These partnerships help fill knowledge gaps, provide scalability, mitigate risks, and enable faster AI adoption—all while ensuring that AI implementations are aligned with the company's strategic goals.

Often, when finding human skills to implement AI, three possibilities can happen:

1. Needed skills can be found internally.
2. The application would be strategic and transformative (e.g., first in the world), but need to form an alliance to deploy it.
3. Needed skills are not available internally. But, using AI may be strategically vital.

1. **Needed skills can be found internally**

Large companies have dedicated AI research teams, vast amounts of data, and cutting-edge infrastructure to continuously innovate and push the boundaries of AI-driven workforce automation. For example, **Facebook** uses AI to enhance content moderation, personalize news feeds, and drive advertising algorithms—an enduring task done by many human staff. **Tesla** is at the forefront of AI, thanks to highly skilled research teams, in the automotive sector, developing autonomous driving technologies that rely on deep learning and real-time data from millions of cars. **Amazon** has pioneered AI-driven logistics and supply chain automation, optimizing inventory management and fulfillment centers using machine learning algorithms and robotics

developed by their own highly skilled, said to be highly paid as well, technical staff. Their ability to tap into internal expertise and combine it with massive data sets and scalable cloud infrastructure enables these companies to stay ahead in AI-driven workforce automation.

Also, some startups use their own skills to launch innovative AI-driven workforce automation products, such as humanoid robots and cybersecurity systems. These startups are pushing the boundaries of what's possible in AI-driven automation, focusing on highly specialized niches and delivering innovative solutions with a relatively small but highly skilled workforce. Examples include: **Boston Dynamics**, a startup-turned-leader in humanoid and autonomous robotics. They've developed advanced AI-driven robots like Atlas that can perform complex tasks such as navigating uneven terrain and **Darktrace**, which used machine learning and AI algorithms to create systems that can autonomously detect and respond to cyber threats in real-time.

2. **The application is strategic and transformative but needs to form an alliance to deploy it to protect competitive edge**

Many non-IT companies, especially in service sectors, often find themselves with transformative digital ideas—such as using AI to automate processes that heavily rely on human labor. However, lacking the necessary technical expertise, they face challenges in turning these ideas into fully functional applications. To implement their ideas quickly, often ahead of competitors, they need to find reliable technology partners.

A prime example of such a strategic partnership is **Uniqlo**'s alliance with **ToshibaTec**. Uniqlo, a Japanese casual wear retailer, aimed to transform its checkout process and inventory management by adopting automated RFID-based systems (radio frequency identification). Lacking in-house expertise, Uniqlo partnered with ToshibaTec, who had the technical capability to implement this solution. Initially tested in GU stores in Tokyo, it was later rolled out across Uniqlo stores in Japan. This AI-driven workforce automation not only addressed labor shortages but also improved cost efficiency by streamlining both checkout and inventory processes [5].

Another example is **BMW**'s partnership with **Nvidia**, an AI Chip powerhouse. By utilizing Nvidia's Omniverse AI platform, which enables virtual simulation of factory operations, BMW developed and deployed autonomous robots to handle tasks such as material handling and assembly. These AI-powered robots have reduced downtime, improved efficiency, and allowed for high levels of customization, enabling BMW to produce complex, build-to-order cars with minimal human intervention [9, 10].

3. **Needed skills are not available internally**

For companies lacking in-house AI expertise, **partnering with established AI service providers** offers a practical and efficient path to integrating AI into their operations. These providers, such as OpenAI, Google Cloud AI, AWS AI, and Microsoft Azure, offer ready-to-use platforms and tools that cater to various business needs without requiring extensive technical skills. By leveraging these partnerships, organizations can access state-of-the-art AI capabilities like natural language processing,

predictive analytics, and computer vision. These solutions often come in the form of pretrained models, allowing companies to focus on deployment.

These providers not only offer scalable and ready-to-use AI tools but also provide staffing, to help companies implement and manage their AI projects effectively.

This option is quite popular in Japan due to shortage of technical workers. One example is Seven-Eleven Japan, which is the world's biggest convenience store operator. It had started an AI-driven initiative in collaboration with OpenAI, Google, and other companies to enhance their product planning processes. They've developed a cloud-based IT system that integrates generative AI technologies from these partners to analyze data from customer sales, product manufacturers, and social media. This system is designed to swiftly identify consumer trends and generate new product ideas, including text and image proposals. The implementation of this workforce automation is said to have made an 80% reduction in internal meetings within one department, and cut product planning time by up to 90%, reducing the timeline from as much as 10 months to just one.

6.5 Summary

The journey of workforce automation, from the advent of programmable machines to the current era of AI-driven innovation, illustrates human's unceasing quest for efficiency, creativity, and progress. With each technological leap, from early computers and software to the transformative power of the internet and big data, human ability to redefine work has grown exponentially. Today, artificial intelligence and robotics are not just tools but strategic enablers, capable of handling complex tasks and decision-making processes that were once the sole domain of human effort. These advancements have unlocked unprecedented opportunities for productivity and innovation across industries.

However, implementing AI-driven workforce automation can be challenging. Ethical considerations, job displacement, skill gaps, and the need for robust regulatory frameworks demand a balanced approach to adoption. Additionally, political and labor union reactions in many countries highlight concerns about job security and equitable treatment for workers, further complicating the path to widespread adoption. The ultimate success of workforce automation lies in its integration with human ingenuity, where AI augments rather than replaces human potential, ensuring both technological progress and social harmony [12].

References

1. Van Hie D (2024) The impact of AI-driven automation on workforce dynamics and skill requirements across industries. J Sustain Urban Futur 14(1):1–13

2. Olaniyi OO, Ezeugwa FA, Okatta C, Arigbabu AS, Joeaneke P (2024) Dynamics of the digital workforce: Assessing the interplay and impact of AI, automation, and employment policies. Autom, Employ Policies
3. Jarrahi MH, Askay D, Eshraghi A, Smith P (2023) Artificial intelligence and knowledge management: A partnership between human and AI. Bus Horiz 66(1):87–99
4. Saxena D, Cao J (2021) Generative adversarial networks (GANs) challenges, solutions, and future directions. ACM Computing Surveys (CSUR) 54(3):1–42
5. Nikkei (2015) Fast retailing to adopt smart tags for swift self-checkout. https://asia.nikkei.com/Business/Fast-Retailing-to-adopt-smart-tags-for-swift-self-checkout. Accessed 17 Apr 2024
6. Mainzer K, Mainzer K (2020) Systems become experts. Artificial intelligence-When do machines take over? pp 47–58
7. Van Der Aalst WM (2021) Hybrid Intelligence: to automate or not to automate, that is the question. Int J Inf Syst Proj Manag 9(2):5–20
8. Leyer M, Schneider S (2021) Decision augmentation and automation with artificial intelligence: Threat or opportunity for managers? Bus Horiz 64(5):711–724
9. Nvidia Driving new efficiencies in manufacturing logistics. https://www.nvidia.com/en-sg/autonomous-machines/embedded-systems/car-manufacturing-robotics/. Accessed on 23 Sep 2024.
10. BMW (2023) BMW group at NVIDIA GTC: Virtual production under way in future plant Debrecen. https://www.press.bmwgroup.com/global/article/detail/T0411467EN/bmw-group-at-nvidia-gtc:-virtual-production-under-way-in-future-plant-debrecen. Accessed on 23 Sep 2024
11. Rajasekera J (2023) Data modeling for productivity improvement, APO 2023. https://www.apo-elearning.org/enrol/index.php?id=191
12. Wright SA, Schultz AE (2018) The rising tide of artificial intelligence and business automation: Developing an ethical framework. Bus Horiz 61(6):823–832

Chapter 7
Intelligent Technologies: Generative AI and Enterprise LLM

Simple digital technologies result in automation and help in improving overall business processes. The digital maturity and strategies are necessary to cope up with continuous evolution of technologies. The advanced and intelligent technologies impact beyond simple automation and participate in different business processes. They contribute to evolution through digital partnerships. These technologies are embedded in business processes where some of the human functions are selectively replaced or augmented to the next level on the business canvas. This creates technological dilemma and organization needs to work closely with these technologies to selectively adapt them in alignment with their business vision and technological objectives. The advanced technologies could impact the organizations customer space as well as competitive landscape. It could convert non-customers into customers, competitors into business partners and open up new market places. It is mostly about building sustainable digital business and society to augment value delivered.

On one side, while the advanced communication and mobile technologies change the way businesses and products reach to customers, AI and intelligent technologies contribute to develop novel sales executives and buying companions. It is achieved with unprecedented personalization for the customers. We could look at it from different technological perspectives. Looking from the searching and information retrieval perspectives—AI contributes to expand the action space and solution space to unfold previously unreachable states or creates new paths to reach some of the existing states. These new and intermediate states created through digital means help customers to select new easier actions and even in attainment of better goal states.

Thus, there is a change in communication, interaction, and consumption models and hence at times poses need for skill enhancements. The remote consumptions with highly distributed networks changed the infrastructural and delivery paradigms. The information is exploited for better decision-making, resulting in transformation in the roles of different executives, allied activities, and concerned departments. Sales executives are graduated to the sales facilitators, production executive became process

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_7

associators, and personal managers have to take an additional role of digital enablers. Additionally, new roles like chief intelligent information officers and chief digital business transformation evolved. This change in roles, processes, and consumption of information further made it necessary to bring context-specific regulatory changes and ethical moderation along with transformational guidelines. The tools and applications those were looked as threats initially subsequently became inherent part of processes needing to reposition the consumption perspectives and amendments in regulations. Probably, a digital monitor or intelligent moderator for these tools and processes is the way to proceed. The use of these tools made it necessary to change regulations along with ethical guidelines. Need of technology development for ethical use of advanced technologies to aid these ethical monitors is necessary.

This chapter aims to look at advanced technologies, their roles in digital transformation, and challenges posed by these technologies. We will also explore technology-specific impacts of digital transformation in case of some human-driven, knowledge-intensive, and creativity-founded industries. Embedding digitized knowledge into organizational practices streamlines the operations, and it becomes a strategic production factor [1]. Thus, different technologies converge on the competitive and utility landscape to create pointers for new regulatory policies and often indicators for need of timely refinement of the same. In this chapter, we will go through different technologies and their role in transformation along with possible impacts.

7.1 Intelligent Digital Evolution

Automation and introduction of technologies into processes can be marked as a first major milestone of business transformations. The focus on pace and reduction of errors made it necessary to have immaculate processes in place. This led to the efforts of process automation. The process automation and workforce automation expanded the reach for organizations and contributed to answer some of the brooding questions related to scalability, error reduction, and consistency. The simple processes became efficient, and manual interventions were minimized in repetitive tasks. The intelligent business automation gone to the next level where basic artificial intelligence technologies came handy to build intelligent agents typically using rule-based or table-driven systems. These systems empowered initial automation efforts with intelligent decision-making and automated information processing. The ability of learning in these systems is more expert driven and confined to hand-crafted rules limiting their expansion beyond the limited predefined tasks and for some specific applications. Handling human-centric scenarios and complex ambiguous and context-driven tasks was a bit challenging and was far from reach for these initial technologies. Handicapped with very limited generalization, these technologies were constrained and have limited applicability. It has always been learning—rather continuous learning in dynamic scenarios, handling new scenarios and coping up with uncertainties are necessary for expansion of applicability. Thus, decoding context irrespective of ambiguity and handling dynamic scenarios were the challenges in front of AI

and learning technologies. Advanced technologies try to crack these walls to invade the most needed learning abilities. The learning abilities, handling and using the large database effectively, and ability to mix and match evolutionary, generative, and discriminative modeling created new routes for organizations to revise their strategies. The new learning technologies create question marks—whether to use those or not? Is human element missing or not? Is it attacking on creativity landscape too? Is it creating sustainable digital society? Is digital interference going beyond bearable levels? And most importantly, is our society at risk due to these technologies? These questions created a lot of confusion, and DBI became more challenging than ever. Taking into account these challenges, in this chapter, we will like to:

- Study advanced AI and learning paradigms from technological and enterprise perspective.
- Look at some case studies of digital business innovation from this advanced technology perspective.
- Deliberate on possibilities for sustainable digital society with minimal intervention.
- Ethical and regularity concerns while taking this leap and expanding application horizons.
- Matching up with cultural and social progress to look at this invasion from business-driven perspective.

Let us begin discussion with some advanced technologies and try to connect the dots in digital transformation advancing to intelligent business transformation. We will also take a look at different businesses and the transformation in the way they have been delivering the value.

7.2 Advanced Learning Technologies

At the very basic level, learning paradigms are classified into supervised, unsupervised, and semi-supervised method-based, where presence of labels decides the learning approach. There are other paradigms of learning developed with reference to human ways of learning and problem solving. These learning paradigms are divided into the following approaches.

1. Evolutionary learning.
2. Exploratory learning.
3. Associative learning.
4. Discriminative learning.
5. Bio-inspired learning and connectionist paradigms.
6. Generative learning.

The evolutionary learning paradigm is inspired from the evolution of living organisms. The basic genetic algorithm strives to produce fitter off-springs with multiple genetic operators. It repeatedly evaluates comparative fitness of the population for

the given environment with addition of newly generated candidates. The repeated application of this process leads to better candidate generation for the existing environment. The formation of genetic operators and fitness functions for evaluation purpose are main pillars of this system. The evolutionary AI can be combined with different approaches and can have multiple variants to overcome typical issues of time complexity and getting trapped at local optima. Additionally, evolutionary models focus on producing better outcome to deal with adversities. It typically looks at the learning from fitness improvement perspective to improve chances of survival. The obvious hypothesis is that "there is need to improve fitness in order to increase chances of survival." The fitness has a very broad definition. It is driven by environmental conditions or specific problem definition. The high fitness in a particular scenario may not always corresponds to fitness in the new changing scenario or in case of new problem. While product, processes, and species are trying to achieve the fitness—they need to keep the track of the changing environment and current problem definitions. The fitness is measured by fitness function, and evolution typically results through genetic or evolutionary operators. These operators work toward generating the new population to increase diversity and get the new combination of features to generate species with different sets of properties. The theory evolved based on natural evolution—but gone through many alterations. In artificial evolution, the memory of the system could play a major role. In this case, past environmental conditions could be referred while evolution. The dynamic and changing fitness functions could give system the strength to deal with the changing environment. In artificial evolution, there could be different evolutionary operators, and multiple variants of cross-over and mutation.

On the other hand, exploratory paradigm is basically inspired from the human ways of exploring the unknown territory with the existing knowledge base and trying out the best possible solutions with continuous learning from the responses of the environment. The best learned guess is tried out in the hunt of the success. This learning helps to improve the next possible actions. This learning based on rewards and penalties is also referred to as reinforcement learning. The reinforcement learning paradigm can be partially build on different basic learning paradigms to makes sure that exploration continues in spite of limited knowledge about the problem at hand. It helps in dealing with unknown scenarios or scenarios with very limited knowledge—with balancing between exploitation of the known facts (acquired knowledge) and exploration with reward-based experimentation. The maximization of rewards leads to the success or exit criteria.

Associative learning paradigms are inspired from direct and indirect associations among data points. These associations are established in the form of patterns. These associations even lead to decode performance and behaviors of the groups. It tries to make effective use of associations and togetherness of occurrences. Right from simple market basket analysis, a priori and multi-level a priori algorithms, the techniques like swarm intelligence and ant colony algorithms work on associative way of learning.

The wide range of learning approaches those that are inspired from the way living organisms learn and different biological models operate are referred to as bio-inspired learning models. These techniques come under the umbrella of bio-inspired

machine learning. Apart from evolutionary learning inspired from natural selection, the techniques derived from immune systems and behaviors of living organisms come under bio-inspired ML.

Additionally, generative and discriminative paradigms are based strongly on probabilistic approaches, but they look at the problem from two completely different perspectives [2]. Discriminative models are goal driven and play within the data boundaries strongly fenced with by available factual data and mappings. On the other hand, generative models try to break these data boundaries and more driven by behavior or probabilistic exemplification of the expected outcome. Discriminative models provide outcomes from available dataset while generative generates the outcome with reference to this available dataset understanding patterns and behaviors. Thus, generative model learns to generate new data sample with similar behavior and characteristics. In short, generative models generate new data instances while discriminative models differentiate between available data instances. Though both approaches use probability distribution, the difference between them is how this probability distribution is estimated. Generative models aim to estimate the probability distribution over the input given the category label. Discriminative models find a direct mapping between inputs and category labels.

The evolution, exploration, generation, and reinforcement along with connectionism build the platform for the modern learning systems and vouch to bring digital, intelligent, and creative business transformation. Every learning model has something to offer in order to embed intelligence into system. It is the combination of these paradigms—which has many things to offer and converge to problem solutions that could rather mimic human learning and at times surpass human learning with ability to remember and process huge amount of data. These combinations of approaches create avenues to transform and reposition business and business processes. One of the major remaining hurdles is to cope with uncertainty.

7.3 AI and Machine Learning

The neural models and statistical learning models work on the data. In case of supervised learning, labeled data is used for learning. The larger number of samples helps to derive models those could represent the generalized behavior—that help is classifying and solving similar problems and negotiates with scenarios those are new but have roots in some known problems. In case of neural networks, the activation functions bring the most required nonlinearity and make sure that the particular set of neurons are activated to get the most appropriate solution, or most appropriate label. Deep learning uses multiple layers of neurons to improve the flexibility and advance to the higher level of generalization—where each layer in a way tries to represent learning of certain simple to complex features. In a way, they represent the extent of presence of some behavioral patterns in the given data (text, image, or scenario). In case of Convolutional Neural Network (CNN), initial layers try to find simple features (those could be the building blocks of the complex features),

and as one moves to the output layer, more complex features are evaluated, which contribute to pretrained classifiers contributing to more efficient classification. The large datasets are used for training neural networks, and then, they are fine tuned for specific or desired task. The use of pretrained models can save time and computational resources. While CNN works on percept—recurrent neural network (RNN) offers memory to look at the continuation and patterns—to accommodate a sort of percept sequence [3]. Recurrent neural networks (RNNs) have the ability to selectively pass information across sequence steps, while processing sequential data one element at a time. These models, when take into account short-term and long-term memory with self-feedback, it is called Long Short-Term Memory (LSTM). An LSTM neural network is a type of recurrent neural network that can remember information for a long time and apply that stored data for future calculations.

7.4 Types of Machine Learning and Addressing Business Needs

Digitization and business evolution are built on decision-making algorithms and automation. The data is the vehicle to explore the world for machines and became the torch light for business decision-making. The decision-makers' roles are elevated to next level where initial insights and interesting patterns are already provided to them. Big data analytics further allows collection, processing, handling, and exploration of astronomical volumes of heterogeneous data received at different velocities where structures and input sources simply keep changing. Distributed computing, parallel computing, cloud computing along with edge computing are transforming the way data is brought into action for the targeted applications. It has revolutionized how data is being processed by and transmitted from huge number of IoT devices, irrespective of locations. IoT devices keep on improving their capabilities to perform more than sensing. In business and industry scenarios, edge computing is especially effective to get the right device data in real-time or rather near time to deliver apt and better decisions and offering potential to further control through prescriptive and action mechanisms. Real-time is the one where immediate or instantaneous data processing is necessary. Near real-time processing is bit more flexible in timing and processes data with minimal delay. The issue of root cause analysis and finding the best action can be settled using machine leaning, empowered with huge data processing abilities.

Generative choosing is another interesting route of digital transformation. It approaches choice problem from different perspectives where rather than shortlisting based on available choices—machines generate different choices. These choices are generated based on attributes of available choices that are suitable and then connect to one of the choices, when asked specifically. It behaves like an artist or creator after assessing the buyer's requirements produces multiple options on those lines and ranks them for the buyer. It can even make one clear choice for him/her. This behavior helps in creating new and more relevant outcomes. The relevance of the

outcomes could be debated at some time as production uses the external information pointers and creates the options those may contain information beyond the available knowledge. It results in some issues regarding the credibility and trustworthiness. But the ability to generate new outcomes can help in digital transformation of the companies in creativity space. This could also be very important for the companies where variability and novelty could take a driving seat ahead of mere relevance. Generative models are typically probabilistic models where focus is on generating new candidates. The applications of it range from question answering, summarization, product features to creating new descriptions and can further contribute to the creative application space.

Dealing with uncertainty is always a challenge, and AI, reinforcement, and generative modeling offer some sort of resolve in this case. Something or some events those are not probabilistically evident or rather could not be described due to its unexpected nature contributes to uncertainty. It could even be represented in terms of very low information gain and high level of entropy. In such scenarios, the initial search space used for feature extrapolation acts as a bottleneck. Then, some approaches like hierarchical exploration, decoding time series, and variants of reinforcement could be used to overcome these limitations to some extent, but they come with their own price. Adapting these technologies into business processes has always been an interesting problem with many challenges. It could also be looked at technology that can augment human knowledge creation. The smart assistive technologies are empowered by generative AI and provide multiple routes. The role of it in transformation of business can come in the form of augmenting customer interactions, workspace knowledge enabler, and converging it to revenue generation and business value creation. Generative AI can result in strategic and competitive edge in terms of efficiency and operational effectiveness. Managing trust with generative AI remains a questionable strategic initiative and cannot be handled only on technology front. Looking generative AI as a holistic solution could have merits and demerits. Generative AI typically gets some adulterated or fabricated outcomes, because of use of external sources of data, resulting in outcomes those are not grounded on the facts. This behavior of GenAI is referred to as hallucination. The term is inspired from hallucination concept in psychology where human may start experiencing unreal or non-existing scenarios—typically due to psychotic behaviors. Seeing what does not exist and not-seeing what is clearly visible due to overlap of excessive imagination on the real life, could be termed as psychotic hallucination. In GenAI hallucination results due to inability to understand query, incomplete queries, external facts, and learning inadequacy. In human situation, this may have link to some past incidence in life or repeated occurrence of some unpleasant events. The linkage of triggering point to past incidence extrapolates the scenarios resulting in behavioral polarity or extremity. Hallucination in GenAI is an interesting problem, and there is need to balance between the creativity, generation, and factuality. The query control and filtering could be the initial solutions to this problem, but they have their own limitations. Thus, GenAI in digital transformation creates multiple opportunities and challenges.

Generative reinforcement learning could be an interesting area where the reinforcement learning tries out new paths resulting through GenAI. The paths are certified with reward maximization. These paths and outcomes are reinforced if those result in maximizing rewards. There could be multi-route selection and combination along with exploration to reinforce the best one. The merging of routes can help in getting better and relevant sequence of actions. Multiple goal states with multiple routes make GenAI an interesting approach for producing multiple compelling options, especially in creative and human-centric disciplines.

7.5 Intelligent Recommendation and Transformation in Product Navigation Space

Recommendation systems have evolved with intelligent technologies. The product navigation and advertisement space transformed into more interactive, personalized, and unconventional associative companions. Personalization reached to the next level. The advertisements and recommendations matured to personalized advertisements and took shapes of personalized recommender systems. Personalized recommendation based on collaborative filtering, content-based filtering, hybrid approaches, and knowledge-based approaches allowed organizations to target customers with right products and reducing the information overload for customers. Machine learning approaches to classify customers and understanding their behaviors came handy in this process.

The predictive recommendations can look at futuristic needs of customers and prescriptive recommendations try to dissect it to understand reasonings and meta-reasonings for comprehensive insights. The recommendations and summarizations are mutually linked in many ways and offer machines to get valuable insights from textual data. Text has always been a prime way of exchange of information. Thus, getting these pointers from text through learning from textual data decodes the complexity through contextual association.

7.5.1 Predictive and Prescriptive Summarization

Text helps to produce pointers for contextual corrections in understanding trends. It could even help us to deal with uncertainties those could not be captured in a typical time-series numeric data. While calibrating textual impact and quantifying it to calibrate trend change are a challenging affair—it could be embedded into the representations and at times adjusting numbers to streamline decision-making. The predictive summarization tries to summarize futuristic impact and possibilities. It creates the foundation for decision-making. The predictions could come through numerical pattern as well as textual insights—those come through predictive multi-document

and multi-pattern summarization. The present trends, domain-specific sentiments, and past historical behaviors are used to detect the future. The hypothesis is that the patterns keep on repeating to give insights for the future. There could be some changes with the change in the environment. These changes are accommodated with reinforcement and exploratory learning, pointers hidden in unstructured data associated with the target prediction. Predictive summarization tries to describe the future events textually with reference to problem at hand. It could use generative as well as discriminative modeling [4]. These textual pointers could be sourced from social media, public websites, bulletin boards or could even be crowd-sourced with some special initiatives in such a way that there could be multiple sources and number of candidates providing these necessary inputs. The candidates could either compete or they may be compared to decide the top ranked pointers and these pointers help us to fine tune the predictive summaries. There could be (a) short-term predicative summaries, (B) mid-term predictive summaries, and (C) long-term predictive summaries. These summaries could be represented as a vector with direction and change in value or could be represented as textual description. While predictive summarization focuses on how the future will look like, prescriptive summarization looks at initiatives so that the issues arising in future could be overcome. It can represent generalized representations of these initiatives. In case of generative modeling, various initiatives are generated on the top of possible directives for these initiatives. These initiatives are ranked to select the most appropriate set of prescriptive summarizations. Organizations could develop their business and sales strategies based on these predictive summarization pointers. The core advantage of predicative summarization is that it could portray the futuristic behavior while prescriptive summarization could inform number of initiatives for improvements. These prescriptions are ranked specific to business scenario, and as there is change in environment, these initiatives or strategic actions are re-ranked to correct the course of action. While long-term summarizations help in decision-making related to long-term strategies like market expansion, new futuristic product launch, long-term pricing strategy, and organization positioning after certain number of years, the short-term predictive summarization helps in looking for pointers for immediate corrections. It includes the short-term pricing strategy, immediate financial measures, quick decisions about certain market initiatives. Whether there is a strategy regarding product positioning or a promotion related initiatives—prescriptive summarization and prescriptive learning contribute to provide most necessary directives. Thus, different modern technologies are converging to help organizations to create greater value, reach close to their customer, and offer continuous support. Additionally, they are helping organizations to understand how to generate, accumulate, and process information. This leads to newer ways to use this information toward organizational vision. Let us explore cloud and edge computing roles in digital transformation in the next section.

7.6 Cloud and Edge Computing in Digital Transformation

Cloud computing offered the most needed decentralization, fault tolerance, and higher computing power to meet the need of advanced computing. Cloud computing allows the use of different computing and computing-related services like providing software development platforms, storage, servers, and others through internet connectivity to achieve scalability and provide higher processing power. The cloud services could offer platform as a service, software as a service, and infrastructure as a service. The cloud platform could have different deployment models like community cloud, private cloud, public cloud, and hybrid cloud. It offers different benefits like reliability, maintenance by cloud providers, mobile accessibility, and cost saving. Thus, it could transform different distributed business models with higher connectivity. It has transformed many small and medium businesses with rich infrastructure and storage. The major limitations of cloud in many cases are latency and privacy aspects. Edge computing overcomes some of these limitations.

7.7 Edge Computing

Edge computing could play defining role in the evolution of generative AI and generalized AI for different businesses. It can improve performance of AI-driven applications. The digital transformation is also about running the things at the speed of life—or even at times providing decisions ahead of that pace. Any real-time critical application cannot wait for a response after sending a query. It could be about a complex surgery or even an autonomous car. The need definitely is to have seamless integration of intelligence, data analysis, predictive insights, and top of the situation decision-making. On top of the situation decision-making, it should be available without propagation delay. That is the reason all these must stay at the edge. In short, edge computing is a paradigm, where in case of distributed computing, data is stored close to physical location. Thus, the most important aspect of it is low latency and real-time experience and can be looked as unlocking data assets in real-time. It also helps in countering bandwidth challenges in case automation, providing applications, data, and computing power at the edge of internet or close to physical location results in various technological and usability advantages. Edge computing enables business transformation through higher credibility because of security and privacy by keeping sensitive data locally. It further reduces the time required to produce results, empowering real-time businesses. It optimizes communication to cloud and also ensures higher connectivity despite of network failures. Thus, handling local dependencies in better way, it opens up new automation possibilities. This transformation can be more evident in case of resource challenged environments, field operations, etc., where portability is the demand of situation.

7.7.1 Edge Computing Basics

The data in health care and similar domains could be time critical. In case of many real-life systems, it is important to have high fault tolerance and timely delivery of decisions. Also, in case of remote locations, there is need to have processing and data close to the action. In short, an edge is a special-purpose piece of software and hardware that also has computing capacity that is integrated into that device. Let us take a close look at edge devices. Here edge node can be referred to as edge device or edge server, on which edge computing is performed. Further, edge cluster is rather a computing device located close to remote operation location like bank, factory, or store. Additionally, there is an edge gateway that can perform protocol translation and network functions.

Edge computing thus creates efficient and improved ways for industries and business where processing at the operational location is the key. It maximizes efficiency, improves safety, and automates business processes through ensured and timely availability. Thus, it provides timely actionable business intelligence and transforms manufacturing and services. Also, it enables agile business ecosystem where efficiency, pace, productivity, and manageability create foundation for autonomy. Edge computing improves responsiveness, leading to reduced operating cost, workflow automation, and timely decision-making. It has contributed to energy efficiency and made new business models feasible. This effectively transforms customer experience to the next level of personalization, transforming the businesses models and making new business models with higher localization possible (Fig. 7.1).

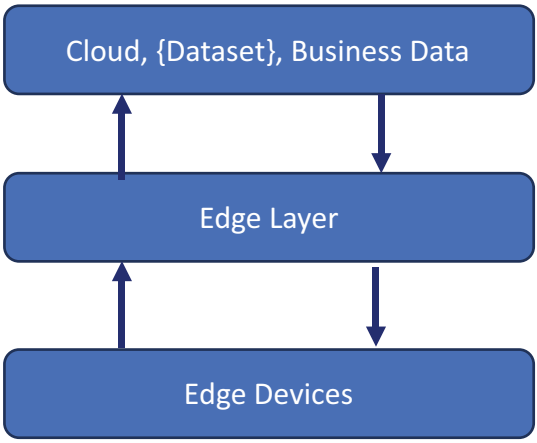


Fig. 7.1 Edge computing

7.7.2 Edge Computing Architecture

Edge could be thought of as an extension to the cloud whereby rather than relying on cloud, and it goes close to source of data and operation facility. The number of IoT devices with sensors is producing that data which the edge analyzes. There are different layers in edge computing architecture. The three basic parts are edge devices, edge layers, and cloud. Edge devices are on-premises active devices like cameras, sensors, and different physical devices. They are responsible for gathering and transmitting data. They do have additional processing power to perform ancillary activities. There are application and network layer as a part of local edge.

The key components of edge ecosystem are:

1. Cloud: There could be a public or private cloud. These clouds work as repositories and could host applications. Apart from workload interactions, cloud could be source and destination for data required by other nodes.
2. Edge Device: It is device with compute capacity that is integrated into device.
3. Edge Node: Is a generic way of referring to edge device or server responsible for edge computing.
4. Edge Server: A computing unit is located at operation facility and is used to run enterprise application workloads.
5. Edge Gateway: It's an edge server that performs network functions apart from hosting enterprise applications.

7.7.3 Edge Computing Applications and Business Transformation

The applications like device management, data aggregation, device diagnostics and forensic, performance management, security, and authentication could be made more effective with edge computing. Additionally, there could be different security-related applications including authentication, analysis, alarms. There are additional applications of edge computing in priority messaging in case of accidents, transportation issues, health, and safety-related alerts. There are different verticals and businesses where edge computing plays a vital role in digital transformation like manufacturing through improved operations and safety, telecommunication through performance optimization, and improved customer experience. Additionally, in other sectors like healthcare through pace and security, media and entertainment through effective use of content library and personalization edge computing transformed businesses. Different companies like *Amazon*, *Netflix*, and *Philips* are using edge computing in some or other form for different verticals.

7.8 Creative Collaborative Learning

The transformation and evolution are happening through machine–human collaboration and through evolving different human–machine relationships. The independent machines could be used more for automation, while machines can support humans to take automation to the next level. It leads to collaborative participation taking to amazing expansion of range of applications. The machine involvement and transformation in creative space have been changing the dimensions of creativity aspects. The machines participating with humans in creative embarkation could be possible in different roles. The ideas of creative humans get with machine ideas, and selective evolution takes place with hybrid fitness. The process evolves to several interesting patterns qualifying to minimal acceptance criteria. The creative collaborative evolution leads to the representative probabilistic patterns, contributing to generation of new artifacts around the pattern driven themes.

The future transformation will increase and improve participation of such machines. That makes it necessary to evaluate the contributions, look at authenticity when claimed and technological vehicles for regulations. Dr. Shaila Apte—a professor and innovator from Pune—worked extensively on audio signals and intelligent audio signal modulation to help organizations working in these domains.

The recent decade is marked by generative and evolutionary mechanisms encroaching the creativity spheres. This created opportunities for multitude of combinations and generations of associative creative artifacts. This encroachment started questioning the authenticity—creating issues like dubious ownerships, digital fakes, leading to security concerns. The barriers are broken, and utility is cramped. Dr. Shaila Apte's *Anubhuti Solutions* from Pune, India, is working in this space to help digital transformations. She had developed six products for audio forensic to help organizations for speaker verification with greater accuracy, audio segregator helping to dissect the combinations, and other products focusing on mixing, correction, and authentication. It is interesting to see the role of these products in empowering different organizations. The creation of new artifacts with generative AI and computer-assisted mechanisms suffers from hallucination and number of issues with reference to authentication. *Anubhuti solutions* is helping several organizations to clear this last mile for the organizations. Thus, it is helping organizations to transform the intelligent AI-empowered creative space. It basically helped to create more variations with the AI-assisted mechanisms and AI-based creativity helping tools. Further, it helps organizations to create multiple creative artifacts for the purpose without human interventions. Most importantly, it helped humans and machines to co-create creative and innovative outcomes. Started with a small set-up and with one trainee student, the company expanded to become backbone for over a dozen social and business organization transforming investigation space, creative space, and digital forensic space.

7.9 Generative Paradigm and Enterprise LLM

Discriminative paradigm focuses on division of sample space with the objectives of identification and classification. It tries to define a clear boundary in the data space to tell what is what and what not. This approach typically focuses on finding those discriminative boundaries. On the other hand, generative approach looks at the problem from other perspective. Here, the focus is on knowing the behavior that gives the most necessary understanding of higher representation in encompassing space. The advancement in neural and connectionist systems along with revolution in computing led to deep learning and resulted in wide business applications in text, image, and natural language. Generative paradigm development is further fueled by advances in these deep learning techniques. It led to the development of deep generative models (DGMs), which made it possible to generate new content and artifacts based on existing data, creating a variety of new possibilities for AI business applications [5]. In short, generative AI (GenAI) is a subset of artificial intelligence focused on understanding the key behavioral aspects and based on that generating new data points, artifacts, and content, such as images, text, or music, that closely resembles the way human being with understanding of the basic concepts would have created it. It has foundation of joint probabilistic and likelihood techniques [6]. A typical taxonomy and relationships among different AI disciplines and their association with GenAI are depicted in Fig. 7.2.

GenAI uses joint probabilities and statistical foundation to learn high-dimensional probability distributions from the available finite training dataset and generate similar but new samples [7]. Thus, the traditional applications of looking at the decision

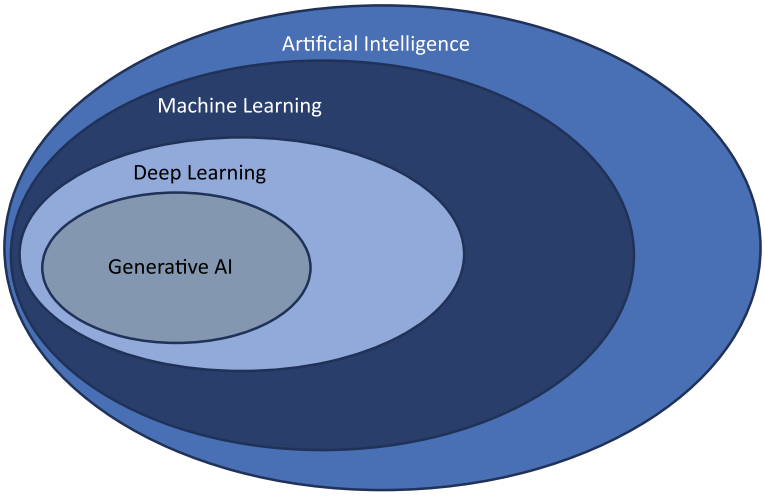


Fig. 7.2 AI disciplines and GenAI

boundaries are now looked at from the perspective of holistic and probabilistic generation of new data. Hence, detecting the unique properties and underlining structure along with probabilistic distributions drive the whole show. The interface for the application interacts with the core GenAI models. Here, the pointers or rather prompts enable the interactions and engage with users using NLP. Thus, it helps in generation of desired textual, image, or musical artifacts. It could use either textual prompt or prompts based on input image. There are different core models like Generative Adversarial Network (GAN), variational autoencoder (VAE), transformers, latent diffusion model (LDM) on which DeepGenAI models are build. The Generative Adversarial Networks are based on concept of two competing neural networks, namely generator and discriminator. As the name suggests, generator network generates data samples rather realistic data samples, while discriminator finds out differences or separates generated ones from the real samples. These two neural networks are trained to compete until discriminator fails to separate real and generated samples. Thus, generator improves its generation capabilities over time leading to very high-quality output making GAN applicable in case of complex tasks like image generation, NLP, and object detection.

The variational autoencoder is an interesting way of generation where a neural network is used to encode compressed input data into a lower-dimensional latent space and then decode the data by reconstructing the original data from the latent space [8]. It can thus generate new data points or artifacts similar to the original data distribution.

The transformer models have neural network architecture that uses self-attention mechanisms to identify and learn long-range dependencies in the data, mostly necessary in large language tasks. It is used as a platform to build Generative Pretrained transformers (GPTs) often referred to as large language models (LLMs). Most importantly, LLM models are trained on vast amount of data. These training techniques involve splitting the workload across multiple machines. Further, LLM has created avenues and solid platform to develop conversational AI tools. Hence LLMs are the driving force for enterprise revolution through its ability to generate text, creative writing, and programming. Latent diffusion models use the concepts of denoising score matching and contrastive divergence for the data generation [9]. Starting with simple initial distribution, it uses noise reduction with predefined diffusion. Figure 7.3 depicts working of GenAI.

Generative AI models have wider scope and exhibit different strengths for variety of applications. It utilizes different statistical and computational techniques and can work across wide range of applications. It includes generation of different intellectual textual artifacts, codes, audio and video products. One of the major parts of it is large language models (LLMs) capable of generating novel text from textual prompts. It could be viewed as a probabilistic model that is predicting the next word coupled with the occurrence of initial word set. They are typical conditional probability models where completion or next occurrence is conditioned on initial set of words. Thus, prompts and context window produce the outcome. Crafting prompt artistically and aptly is the key to produce coherent and interesting responses.

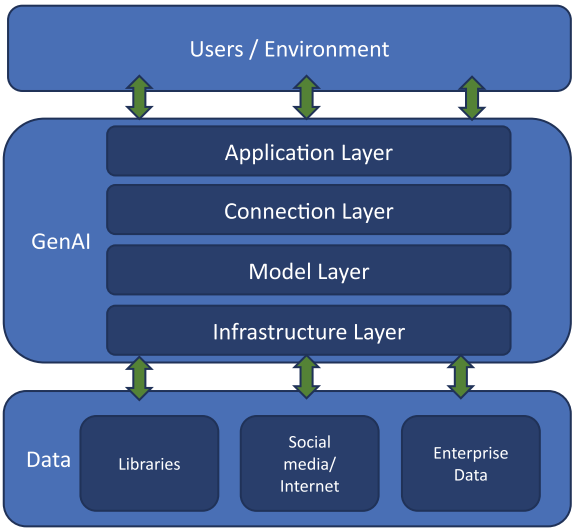


Fig. 7.3 GenAI

Thus, LLM augmented natural language processing to the next level. Enterprise large language models (LLMs) are transforming the business landscape by offering advanced capabilities in natural language processing. These models, when integrated with genetic machine learning, can achieve unparalleled performance and adaptability, catering to specific enterprise needs. These have been contributing to the business transformation. In an enterprise context, LLMs enhance operational efficiency, personalize customer interactions, and support complex decision-making processes. Generative AI has wide range of application resulting in revolutionizing enterprises in different domains like health care, education, manufacturing through generation of text, image, video, code, sound. GenAI-based systems' architecture typically has four major component layers, viz. infrastructure layer, model layer, connection layer, and application layer.

Application layer is close to domain-specific application and utilizes either own GenAI pipeline or exploits third-party GenAI API in the context of the application. The model resides at the model layer. It could be general purpose or customized. Connection layer is responsible for connection between model and application. The infrastructure layer is about platform and technical infrastructure like hardware and cloud planforms. This layer is responsible for GenAI training and inferencing. It also has orchestration and monitoring components.

Prompt Engineering

A system's responses depend on the questions and their articulations. This is very true even in case of GenAI. Prompt engineering is about providing the prompts to derive the best answers. The questions including example answers help to provide apt answers. Prompt engineering aims to improve quality of GenAI answers through effective prompting. Prompts could be single prompt—deterministic or anticipatory.

In other cases, it could even be ensemble prompts where set of different prompts leads to answers. In the Chain of Thought (CoT) prompts, it guides LLMs to come up with answers which is systematic step-by-step way where information is associated to generate the best possible response. Improving clarity, creativity, and relevance is the major objective of prompt engineering.

7.10 Challenges for GenAI-Based Systems

The typical challenges in GenAI systems include bias due to data-driven approaches, hallucination due to external data impact, AI explainability issues, and societal impact. It is key to understand these issues and work on mitigating them. Data bias gets inducted during training phase and could lead to improper results when training data has problems or certain bias. Non-representative data and incorrect labeling are some of the prominent reasons of bias. Inherent unpredictability of GenAI models brings the questions regarding explainability. Further, external data reference and dataset selection errors lead to hallucination where wrong outcomes are presented confidently. Additionally, apart from risk of misinformation, it also raises different societal concerns like energy issues, impact on creativity domains, and fear of employees losing their jobs. This definitely makes it necessary to have clear guideline on usage, data selection disciplines, and overall re-evaluating the legal and technical framework.

7.10.1 Business Impact of Enterprise LLM

Many businesses incorporated LLM in their business processes. It also became major platform to develop tools to enable interactions of users with the systems. In recent years, a few enterprise companies are trying to use open-source-based customer support and code generation applications to interact with their own custom code, typically with open-model LLMs. This aims to enhanced customer interactions in case of different organizations like *Walmart, Spotify, Wells Fargo*, and even *Grammy awards* [10].

7.10.2 LLM Use Cases for Enterprises

LLMs can be used to increase productivity and business value for different businesses. Some examples of such applications of LLM include intelligent automated marketing, customer support, data analytics, etc. It can further be used for personalization and recommendation and application development across different verticals. Let us take a brief overview of some of the prominent applications. LLM helps in

enhancing customer support by not only automating the routine customer inquiries but also by providing highly personalized responses and streamlines the support process. These models are leveraged to engage customers conversationally and interactively to deliver customer satisfaction, higher efficiency, and improved response time.

Another major area is marketing, where by helping to generate tailored and highly personalized marketing contents and optimization of marketing workflows, LLMs are contributing to transform the marketing. It can forecast customer behaviors and actions to take marketing tactics to altogether different level. Thus, LLMs empower marketing automation to deliver value through impactful marketing campaigns resulting in higher conversion rates. Additionally, strategic planning could be enhanced by integrating LLMs into business analytics and allied processes through analysis of data in natural language and decoding the patterns like never before. LLMs can help in empowering development teams and programmers to deliver robust and immaculate code and efficient debugging pointers by embedding LLMs into application development workflows.

The impactful induction of LLMs in business workflows along with wide use cases contributing to business transformation has created new landmarks in intelligent business innovation. However, going ahead with integrating LLMs into their business processes, it is necessary to be looked at feasibility and ethical aspects of the whole process. Technologies always bring different ethical challenges and side effects with it. Ignoring the human element in transformation process could prove to be very costly for enterprises.

7.11 Technological Side Effects and Ethical Concerns

The participation of AI technologies in decision-making is increasing with enhanced and interactive abilities of AI especially empowered by advanced technologies. The decision support systems are transformed to decision systems and further into decision companions—then the management roles are changed with additional digital pointers at their disposal. The advanced technologies have strong learning, cognitive, and interaction components. Though it is looking all fair, there are number of issues faced in this transformation process. The nature of these issues faced by small, medium, and large organizations is different. We divide these issues into following three basic types:

1. Issues Faced by Small Organizations or Startups

Small organizations find it difficult to develop such infrastructure on open-source resources. On the other hand, they find the readymade tools expensive and also a threat to the privacy of the organization. All data hungry systems pose a serious threat, and coping up with this challenge is a major issue faced by these organizations.

2. Issues Faced by Mid-Size Organizations

Mid-size organizations are going through technology adaptation dilemma. On the one hand, they need to cope with changing technological scenarios, while on the other hand, they need to retain their initial strategic positioning.

3. Issues Faced by Large and Distributed Organization

Large and distributed organizations have dire need to change the traditional ways and adapt new technologies. This demands a very high agility. Most of the big organizations are facing issues due to lack of staff agility and managing the transformation in positive way.

7.11.1 Classification of the Issues Based on the Problems into Following Types

1. Digital Distraction: Advanced technological pace distracting the enterprises from their core objectives.
2. Digital Addiction: Too much technological addiction can lead to overdoing things and reducing the necessary human touch which is core part of many businesses.
3. Digital Interference: The digital interference may lead to digital stress among customers and employees. The pace of transformation could be the major reason for the same.
4. Thinking Constraints with Digital Boundaries: In spite of very human-like conversational tools, there are boundaries separating human activities and digital world.

Additionally, there are many ethical issues in digital transformation. We classify these issues into three basic types.

1. Ethical and regulatory issues in preadaptation of digital technologies.
2. The above issues during digital transformation.
3. The above issues during later stages or post digital transformation.

Moreover, there are two types of issues—some focus on creativity aspects, while other focus on the ownership aspects:

1. Who is the owner of creative digital, new digital or any digital artifact, article or outcome?
2. Who is responsible for digital outcomes and their side effects?
3. Copy rights and ownerships of intellectual property issue.
4. Responsibility in case of critical tasks (like health, accident, ownership, and political issues).
5. Co-operative task and how to handle AI–human combined tasks in terms of responsibilities and critical issues.

This component can help organization to combat digital addiction and techno side effects. The digital addiction results in the use of technologies without realizing

its side effects. Technologies keep their marks on cultural and financial future. The holistic intelligent systems can help to resolve this issue. We refer it as intelligence for controlled intelligence and mature business participation. It also helps organization to combat techno or digital distraction by providing digital detox.

7.11.2 Organizational Digital-Techno Distraction

In many cases, the organizational strategies are built around technologies and technologies distract organization from the core values and business objectives. The digital distraction may result in wrong technology selection and at times compromising some of the core values or even business objectives. Digital distraction impacts in a number of ways:

1. Technologies start driving the management.
2. The skills are confused with efficiency.
3. Biased Success Matrices: Cultural vectors in the success matrices are diluted.

To overcome digital distraction advanced learning technologies could come handy:

1. Detecting Minimal Technology Requirements for the Specific Task: It could also be referred as minimalism.
2. Creating an intermediate milestone.
3. Digital Interactions to Overcome Digital Distraction: It may include alarms, digital path finders.

7.12 Summary

Applying advanced techniques and machine learning algorithms to address business needs is at the center of the digital business innovation. The learning algorithms are selected with reference to business needs. The simple applications are where percept sequence is not necessary, but simple percept is enough. In such cases techniques like decision tree could meet the required intelligence need. But the complexities increase with increasing heterogeneity and volume of data. It demands advanced learning techniques where context and changing scenarios pose need of learning with environment. The advanced learning, storage, and computing technologies converge to transform businesses. The transformation results in business pace, quantum, and reachability. It results in changing the way the business is done and makes new business models possible. Integrating GenAI in business process creates multiple avenues to improve higher business value. The impactful and innovative induction of LLMs in business workflows along with wide use cases contributing to business transformation has created new landmarks in intelligent business innovation. However, going ahead with integrating LLMs into their business processes, it is

necessary to be looked at feasibility and ethical aspects of the whole process. Technologies always bring different ethical challenges and side effects with it. Ignoring the human element in transformation process could prove to be very costly for enterprises. LLMs can change the way enterprises approach overall business. It mainly changed the way businesses undertake customer interactions, content generation, and strategic decision-making.

References

1. Kulkarni P (2010) PK Chande. Oxford University Press, IT Strategy
2. Hsu A, Griffiths T. https://cocosci.princeton.edu/tom/papers/discgencat.pdf
3. Lipton ZC, Berkowitz J, Elkan C A critical review of recurrent neural networks for sequence learning. https://arxiv.org/pdf/1506.00019
4. Murataly, Rei, Raja, Kulkarni P (2024) A survey of automatic text summarization systems, applications, challenges, and future trends. Int J Comput Appl 186:8–15. https://doi.org/10.5120/ijca2024923672
5. Tomczak JM (2022) Deep generative modelling. Springer International Publishing. https://doi.org/10.1007/978-3-030-93158-2
6. Gupta P, Ding B, Guan C, Ding D (2024) Generative AI: A systematic review using topic modelling techniques. Data Inf Manag 8(2). https://doi.org/10.1016/j.dim.2024.100066
7. Ruthotto L, Haber E (2021) An introduction to deep generative modelling. GAMM-Mitteilungen, 44(2):e202100008. https://doi.org/10.1002/gamm.202100008
8. Kingma DP, Mohamed S, Jimenez Rezende D, Welling M (2014) Semi-supervised learning with deep generative models. In: Ghahramani Z, Welling M, Cortes C, Lawrence N, Weinberger KQ (eds) Advances in neural information processing systems, vol 27. Curran Associates, Inc
9. Rombach R, Blattmann A, Lorenz D, Esser P, Ommer B (2022) High-resolution image synthesis with latent diffusion models. In: 2022 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR). IEEE, pp 10674–10685. https://doi.org/10.1109/CVPR52688.2022.01042
10. https://people.scs.carleton.ca/~bertossi/Lille24/HowEnterprisesAreUsingOpenSourceLLMs16ExamplesVentureBeat.pdf

Chapter 8
Digital Innovation Leadership Sustainable Business Through Digital Innovation

Digital Innovation Leadership is the capacity to initiate, cultivate, and scale transformative digital ideas that drive sustainable business growth. It starts with a visionary concept—a smart digital solution—that addresses unmet needs or improves existing processes. Leaders in this space foster a culture of continuous innovation, strategically leveraging emerging digital technologies and innovations to shape that initial idea into a scalable, competitive advantage. They carefully build and adapt their organizations' combined expertise, integrating existing strengths with newly recruited skills to ensure that each innovation aligns with business goals, enhances customer experiences, and positions the organization for future technological advancements.

8.1 Innovation Light Bulb

Digital Innovation Leadership goes beyond traditional concepts of leadership or even innovation, representing a unique synthesis that is distinct in its scope and impact. Unlike general leadership, which focuses on guiding teams toward achieving goals, or traditional innovation, which emphasizes creative solutions to problems, Digital Innovation Leadership specifically addresses the use of digital tools and technologies to drive transformation. It involves a deep understanding of emerging digital possibilities and a strategic vision for integrating and scaling these technologies to create long-term value within an organization or industry.

Too often, though, it's also seen that Digital Innovation Leadership starts with a single individual who seizes a unique digital opportunity to create change, often without any formal organization at the outset. Leaders like Michael Dell, Steve Jobs, and Bill Gates each began with a powerful vision for how technology could reshape the world, building on ideas that initially took shape in dorm rooms, garages, and small labs. These early-stage digital leaders demonstrate how transformative impact

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_8

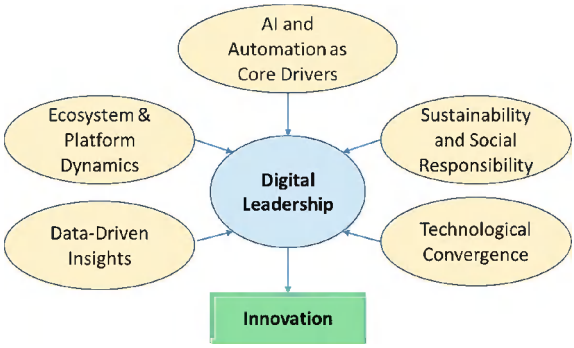


Fig. 8.1 "**Digital Triggers**" that drive digital innovations

can begin with one person and an innovative idea—before scaling into an organization or even an industry-wide movement. This entrepreneurial aspect of Digital Innovation Leadership highlights its roots in resourcefulness and vision, where a single idea grows to redefine entire markets.

What sets Digital Innovation Leadership apart is its proactive approach to technology-driven change, where leaders are not just adopters of innovation but pioneers who reshape business models, processes, and customer experiences around digital advancements. Leaders in this domain navigate complex digital ecosystems, leverage data-driven insights, and focus on scalability and adaptability. Unlike past innovation leaders who operated within largely static or linear frameworks, today's digital leaders work in dynamic, interconnected environments, where rapid iteration, agility, and constant adaptation to technological shifts are essential.

There is considerable literature addressing the strategic side of digital innovations. For example, in Lynda M. Applegate's Corporate Information Strategy and Management [1] discussions on how external forces such as technological advancements, regulatory changes, and competitive pressures drive organizations to innovate and adapt their information strategies. Among other works, noteworthy are [2–4] (Fig. 8.1).

However, the recent explosion of data-driven innovations and AI had changed the course of digital landscape and had created a need to re-examine Digital Innovation Leadership centering it around what can be called five "**Digital Triggers**."

- Data-driven insights.
- Ecosystem and platform dynamics.
- AI and automation as core drivers.
- Sustainability and social responsibility.
- Technological convergence.

A comprehensive understanding of each of these triggers is essential for organizations aiming to undertake their own **Digital Transformation** (DX) initiatives. By focusing on these triggers, companies can make strategic use of process innovation, data or AI-driven advances, and digitization grounded in hardware innovation to drive impactful and lasting change.

8.2 Data-Driven Insights: Extracting Value from Big Data to Transform Business

In the era of Big Data, businesses generate and collect massive amounts of information, from traditional structured datasets—like sales figures and customer demographics—to a vast array of unstructured data, such as social media posts, images, video feeds, and basically any piece customer reviews. The sheer volume and variety of this data, often referred to as Big Data, presented both a challenge and an opportunity. Visionary leaders saw the potential within these complex datasets to uncover hidden patterns, predict trends, and create efficiencies that would transform industries.

Data-driven insights have evolved from simply analyzing numbers to **extracting value** from complex and diverse datasets. Leaders today use advanced tools like machine learning, predictive analytics, and NLP to uncover patterns, improve efficiency, and even create new business models. In this way, data-driven insights have become a cornerstone of Digital Innovation Leadership, enabling companies to transform raw information into actionable, impactful strategies.

Much case studies on various strategies to identify how would an innovative leader think about the potential hidden value in data are found in literature; as well as books [5–7].

The tested ideas can be summarized in a diagram as Fig. 8.2. There are several strategies for identifying "hidden" potential in data that might lead to new business ideas.

This figure shows two paths to Data-driven Innovation.

1. One is to start with a valuable niche dataset to focus on while assessing the relevance, accessibility, and scalability by adding new data and customer feedback (feedback-driven refinement); this can then be a data-driven innovation.

    - **Facebook**: Started with a small dataset of college students' personal information and interactions, which evolved into a massive ecosystem of user-generated data driving content recommendations, advertising, and social connections.

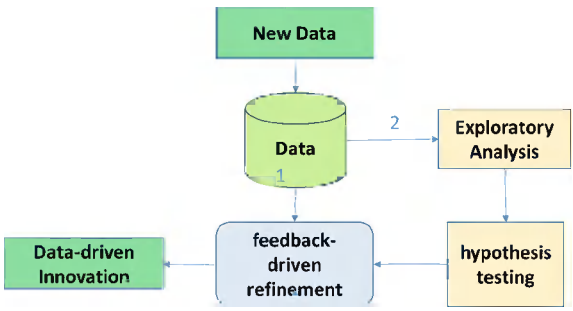


Fig. 8.2 Key steps of coming up with **data-driven innovation cycle**

- **Amazon Books**: Began with book data and created mechanisms like recommendations, reviews, and personalization, eventually scaling into a multi-industry e-commerce leader.

This approach is good if one is thinking of innovating to a niche market. When Gojek was launched in Indonesia, in 2010, it adopted a niche dataset approach to data-driven innovation. Initially, Gojek focused on a specific dataset: transportation requests from customers seeking motorcycle taxi (Gojek) services. By analyzing this data, Gojek optimized ride allocations, improved service efficiency, and enhanced user experience. Over time, Gojek expanded its services to include food delivery, payments, and more, continually refining its offerings based on user feedback and data analysis. This strategy allowed Gojek to scale effectively while maintaining a strong focus on customer needs.

2. Other is starting with a dataset which may have value hidden due to its massive scale and complexity. Big data has created many opportunities for this as one could also focus on hidden values in unstructured data—images, sound, sensor data, emotional expressions, etc., and then using various analytical tools, such as machine learning, AI, NLP, and LLM to analyze (exploratory analysis) and test if something strategic or hidden can be identified. This can then be enhanced with customer feedback (feedback-driven refinement) and new data, which can then be another data-driven innovation.

    - **ChatGPT**: Combines massive datasets (internet-scale text) with AI mechanisms (transformer models) to provide human-like responses, generating value through interaction.
    - **Google Search**: Uses big data (web crawling) and machine learning algorithms to make information easily accessible, while continuously learning from user interactions (clicks, queries)

This second approach of starting with a massive strategic dataset cannot be done without having a sizable funding source. But, in case of ChatGPT, its founder OpenAI started as a research organization focusing on publicly available data, but received initial funding many wealthy entrepreneurs, such as Elon Musk and Peter Thiel, co-founder of PayPal.

8.3 Ecosystem and Platform Dynamics

A digital ecosystem refers to a network of interdependent entities—businesses, developers, customers, and partners, such as payment systems and logistic providers—that collectively interact to create, share, and deliver value to each other. The sheer interdependence and its success in attracting consumers are the core "**platform**" that provides the infrastructure to bind them all together by facilitating seamless collaboration and value, which in turn may also provide efficiencies as well.

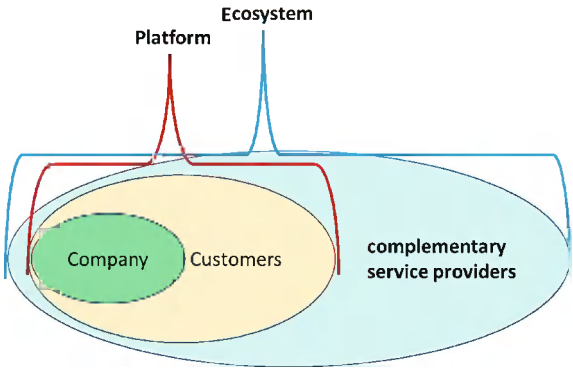


Fig. 8.3 How an innovative **company** becomes a platform and then grow to become an **Ecosystem**

Think about the most dominant players in the internet—Google, Facebook, Amazon, and Microsoft, perhaps, depending on the geographic location could also be one of the most dominant digital players in the locality, such as Alibaba, Tencent, in China, Flipkart, in India, Gojek, in Indonesia. All of them started with an "initial" business based on an "innovation" developed by respective company founders.

With the growth of computer usage and the Internet, those companies grew and attracted a huge mass of connected **customers** and, thereby, formed so-called "**platforms**." The interdependent "**ecosystems**" developed out of those platforms by attracting other "**complementary service providers**," such as payment systems, software developers, and logistic providers to the huge mass of customers frequenting the platform. How the gradual growth of a company whose innovation to provide a market need became a platform, and whose huge customer base attracted various service or product providers to make an ecosystem is illustrated in Fig. 8.3.

By leveraging platform dynamics, businesses can innovate not only by creating standalone products but also by unlocking new opportunities for partners and users to co-create value. As highlighted in Chris Anderson's book **The Long Tail**, platforms enable businesses to thrive by catering not just to mainstream demand but also to niche markets, leveraging the "**tail**" of less-popular offerings that collectively drive substantial value within ecosystems [8], somewhat less-popular offerings are by companies at the periphery of the ecosystem shown in Fig. 8.3. Companies that get on the platform to tap into its growing popularity may be at the periphery of the ecosystem at the beginning.

How a motorcycle ride-hailing startup, launched in Indonesia in 2010, suddenly grew to a platform offering logistics, payment system, food and shopping, business advices, which has now become an ecosystem, which according to a study, contributing 1–2% of the Indonesia's GDP, provides an excellent example of how an ecosystem develops [9, 10, 13]. In 2019, Gojek was listed among Fortune's top-20 list of organizations which changed the world [11].

In 2010, Gojek started a motorbike hailing service with 20 motorbike drivers. Gojek users expanded wildly after it launched Gojek mobile app, which in 2 years saw 30 million downloads and expanding to connect thousands of motorbike drivers.

It also partnered with Singapore's DBS bank to add payment system GoPay. Soon, restaurants across joined Gojek platform to expand its GoFood segment. At present one can see its platform creating and ecosystem by bringing Taxi companies, restaurants (GoFood), shops of all kinds (GoShop), and many more. Gojek also created programs to connect Indonesia's Micro, Small, and Medium Enterprises (MSMEs) [12].

Table 8.1 provides a clear view of how each company's core platform serves as the foundation for its broader ecosystem. It also highlights the geographic diversity and strategies companies used to scale up into ecosystems.

Digital ecosystems and respective platforms offer many opportunities for digital innovation, in a way very similar to a metaphor of a forest ecosystem where some trees grow big and start making its own impact to nurture the forest further.

Anchor, is a free podcasting platform, which found a fertile ground by finding a spot to fit into well-established Spotify music streaming platform and became very successful business providing good learning about strategic use of platforms and ecosystems to show Digital Innovation Leadership.

Table 8.1 Well-known platforms and ecosystems dominant in different geographic regions

Company	Dominant country/region	Core platform	Ecosystem
Amazon	USA Globe	AWS (Amazon Web Services)	E-commerce marketplace, Amazon Web Services (AWS), Prime Video, Kindle, Alexa
Facebook	USA Globe	Facebook Social Platform	Social media platforms (Facebook, Instagram, WhatsApp), Oculus VR, Facebook Marketplace
Alibaba	China	Taobao/Tmall E-commerce	E-commerce platforms (Taobao, Tmall), Alipay, Alibaba Cloud, AliExpress
Tencent	China	WeChat	WeChat super-app, QQ, Tencent Games, Tencent Cloud, WeChat Pay
Flipkart	India	Flipkart E-commerce	E-commerce marketplace, PhonePe (digital payments), Myntra (fashion retail)
Rakuten	Japan	Rakuten E-commerce	E-commerce marketplace, Rakuten Bank, Rakuten Card, Viber (messaging), Rakuten TV
Gojek	Indonesia	Gojek Super-App	Super-app offering ride-hailing, food delivery, payments (GoPay), logistics

Generalizing Anchor's journey with Spotify provides a clear strategy to create digital innovation by strategically finding a growing ecosystem and its platforms.

To succeed within a platform or ecosystem, businesses must first identify one that aligns with their core strengths. This alignment enables them to leverage their unique capabilities—in technical expertise, product offerings, or user engagement strategies—to fill gaps or enhance the ecosystem's value. For instance, Anchor's strength in simplifying podcast creation made it an ideal fit for Spotify's music streaming platform, which was seeking to expand into podcasting. By identifying and integrating into a complementary ecosystem, companies can maximize their impact and establish leadership [14].

Key three steps for success are:

- **Strategic Fit**: The importance of choosing a platform that complements the company's strengths.
- **Mutual Value**: How this alignment benefits both the platform and the company.
- **Actionable Strategies**: The need to assess platform dynamics to identify opportunities and convert them to monetizing or customer growth strategies.

Strategic fit, perhaps, is the most challenging task, which starts with finding an ecosystem and becoming familiar with its platform by using the business's own core strengths; the best way to do it is exploring and finding spots which can be enhanced or replaced with a new digital "design"—keep in mind the "design thinking" that Steve Jobs mastered. This ensures that the company can seamlessly integrate while addressing specific gaps or adding unique value, in terms of add-in type tools. By focusing on complementary opportunities, businesses can create synergy with the platform, maximizing its impact and accelerating own growth.

Integrating into a platform isn't just about fitting in—it's about creating **mutual value**. Businesses that address gaps or enhance offerings strengthen the platform while positioning themselves as key contributors. This reciprocity builds a foundation for long-term success, collaboration, and potential to be a leader in the ecosystem and beyond.

To thrive in an ecosystem, businesses must assess platform's needs, pain points, and opportunities for network effects and convert the insights into actionable strategies. Addressing gaps aligns a company with the platform's goals, establishing it as an essential player and driving mutual growth.

Monetizing Digital Innovations

Monetization doesn't always start with direct revenue generation; it can also come from rapidly growing a loyal customer base. By offering free or low-cost services, businesses can attract users, create network effects, and establish themselves as indispensable players in the ecosystem. This **customer growth strategy** not only builds a strong market position but also makes the business a valuable acquisition target for larger companies looking to enhance their ecosystem. For instance, businesses that successfully scale their user base often command premium valuations, as their growth directly contributes to the platform's expansion and influence.

Anchor initially offered a **free** podcasting app, providing users with tools to create, distribute, and monetize podcasts without any cost. This approach significantly lowered the barriers to entry for aspiring podcasters, enabling them to produce and share content easily. By offering these services for free, Anchor rapidly expanded its user base, attracting a diverse range of creators. This growth and the value added to the podcasting ecosystem eventually led to its acquisition by Spotify in 2019.

8.4 AI and Automation as Core Drivers

Artificial intelligence (AI) and automation are redefining industries by unlocking efficiencies, enhancing decision-making, and enabling entirely new ways of creating value. These technologies empower organizations to automate repetitive tasks, make data-driven predictions, and adapt dynamically to changing market needs. By leveraging AI and automation, companies are not only optimizing existing processes but also creating disruptive innovations that were previously unimaginable.

When we say AI and Automation, we have hardware side and software side. AI hardware side belongs to AI chip technology. Software side includes using big data and algorithms to address process optimization. Likewise, hardware side of automation is rooted in robotics, sensors etc., while software side includes integrating robots and sensors for real applications [15, 16]. Distinguishing between the hardware and software components of AI and automation is essential for understanding how these technologies drive innovation.

Hardware side, we can identify the key areas for both AI and automation as follows.

AI hardware	Robotics hardware
AI chips	Robots
Edge devices	Sensors
Data centers	Actuators (e.g., gripping, moving objects)
Specialized AI devices	Autonomous mobility systems

Software side, we can identify the key areas for both AI and Automation as follows.

AI software	Automation software
Machine learning algorithms	Integration platforms (e.g., RPA)
Big data integration	Control systems
AI platforms (e.g., TensorFlow)	Industrial IoT platforms
Natural language processing (NLP)	Task-oriented workflow software

Combining AI and automation hardware with respective software has driven groundbreaking digital innovations across industries. Some innovations had grown

from startups to become giants such as Tesla, cloud players, AI chip, and software leaders such as Nvidia and OpenAI. Below is a summary of such companies and brief summary of how they capitalized on AI and Automation as core driver of their companies.

Tesla: Tesla is a leader in combining AI hardware, sensors, and software to revolutionize the automotive industry. Its custom-built AI chips, paired with advanced autonomous driving algorithms, enable real-time decision-making and adaptive driving features. Tesla's Full Self-Driving (FSD) capabilities showcase the potential of AI to transform transportation by making vehicles smarter, safer, and more efficient.

Amazon Robotics (Formerly Kiva Systems): Amazon Robotics has transformed warehouse logistics by seamlessly integrating robotics hardware with intelligent workflow software. Mobile robots navigate warehouses, automate inventory movement, and streamline order fulfillment. This innovation has dramatically increased efficiency and scalability, setting a benchmark for automation in the logistics sector.

Amazon Web Services (**AWS**): Became one of the first companies to power the global AI ecosystem by providing scalable cloud infrastructure and tools like SageMaker, which simplify the development and deployment of AI models. Its robust ecosystem enables businesses of all sizes to access advanced AI capabilities, fostering innovation in industries ranging from healthcare to retail.

Azure (Microsoft): Combines cloud computing with cutting-edge AI services, offering platforms like Cognitive Services and machine learning tools that enable businesses to build intelligent applications. By democratizing access to AI technologies, Azure empowers organizations to create scalable and innovative solutions tailored to their needs.

Nvidia: Capitalized on the need for running complex neural network algorithms used in deep learning. Nvidia AI chips and GPUs are the backbone of many AI and automation innovations, powering applications from deep learning to autonomous driving. Its omniverse platform pushes boundaries by enabling AI-driven simulations, essential for robotics development and real-time environmental modeling. Nvidia stands as a cornerstone of the AI revolution.

OpenAI: A path-breaker on how advanced AI software can transform industries, with tools like ChatGPT leading the way in natural language processing. These applications improve customer interactions, streamline content creation, and enhance education. OpenAI demonstrates the real-world potential of AI to create intuitive, impactful user experiences.

Keyence: A Japanese company known for its innovative approach to factory automation, offering products that integrate advanced AI algorithms to enhance performance and adaptability. Their VS Series vision sensor system combines AI with optical zoom functionality, enabling rapid machine vision solutions across various applications.

In mobile platforms like Apple App Store, one can find many apps which uses AI to automate various tasks. A notable app, which has a leading position is **Lensa**, which is said to have been downloaded by over 20 million times. Lensa helps editing photos using AI to create vivid avatars and enhance selfies. It offers features like background blurring, filter application, and auto-adjustments, making photo editing accessible and efficient.

Innovation in the digital age is driven by a unique blend of creativity, strategy, and technology. AI and automation offer unparalleled opportunities to address complex challenges, streamline processes, and create transformative business models. Considering real innovations based on AI and automation and looking at past research (Astrom et al. 2022; Burstrom 2021), the **five-step framework** listed below provides the most structured approach to harnessing these technologies for innovation and sustainable growth.

1. Identify a problem or opportunity.
2. Leverage core strengths and AI/automation synergy.
3. Create a scalable business model.
4. Do a market study.
5. Iterate or pivot if necessary and expand.

Successful innovation using AI and automation follows a structured process, identified in the five-step approach.

It all begins with identifying a real-world problem or opportunity that may be addressed by applying AI and automation, ensuring that the solution addresses inefficiencies or unmet needs such as ease of use. By leveraging core strengths and aligning them with AI and automation capabilities, innovative leader can create effective and sustainable solutions. Scalability is vital, as a robust business model must allow for growth while maintaining efficiency. A comprehensive market study ensures alignment with customer needs, competitive dynamics, and regulatory landscapes. Finally, agility in iterating or pivoting based on feedback is crucial for refining solutions and unlocking new opportunities for innovation and expansion.

Tesla, that was mentioned earlier in this section as well, is one well-established innovative company that exemplifies the validity of five-stem approach to create new businesses based on AI and automation. How Tesla (CEO Elan Musk) did it:

1. Recognized the limitations of traditional automotive design and the environmental impact of fossil fuels, leading to the development of electric vehicles (EVs) with autonomous driving capabilities.
2. Utilized its expertise in software and hardware integration to develop AI-driven Autopilot systems, enhancing vehicle safety and driving experience.
3. Established a direct-to-consumer sales model and expanded its product line to include various EV models, energy storage solutions, and solar products, ensuring scalability.
4. Analyzed consumer demand for sustainable transportation and identified a growing market for EVs, aligning product development with market needs.

5. Continuously updates its vehicles through over-the-air software updates, iterating on features based on user feedback and technological advancements.

By addressing pressing challenges, leveraging technological strengths, and continuously adapting to market needs, Tesla exemplifies the transformative potential of the five-step framework. This approach not only enables innovation but also establishes a foundation for long-term success in an ever-evolving digital economy—a priority increasingly emphasized by businesses and governments worldwide. In addition to the lessons from Tesla, one can find the five-step framework applies to all the other companies mentioned earlies in this section, from Amazon Robotics, to Kyence, as well as Lensa App in Apple App Store. They serve as guides for businesses aspiring to lead through innovation and create value that resonates with both customers and society.

8.5 Sustainability and Social Responsibility

To effectively find a digital solution for any of these opportunities, it's helpful to focus on common features that align with the principles of Sustainability and Social Responsibility while leveraging the power of digital innovation. Examining recent research and real cases from around the world [17, 18] and scan of SDG-related websites) shows two groups of Sustainability and Social Responsibility-related models which had developed from two areas of digital innovations:

- Data and AI driven.
- Internet and App based.

Figure 8.4 highlights how Sustainability and Social Responsibility (**SSR**) models had developed out of data and AI-driven and Internet and app-based digital innovations.

The intersection of digital innovation and global challenges has given rise to transformative solutions in Sustainability and Social Responsibility. As organizations strive to address urgent environmental and social issues, digital technologies have emerged as critical enablers of change, combining purpose with innovation.

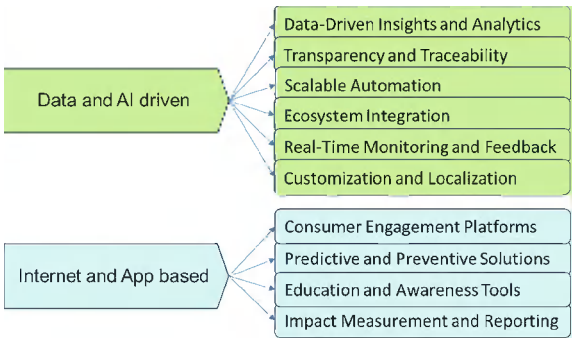


Fig. 8.4 How SSR models had developed out of digital innovations

At the heart of this shift are two dominant categories of technological advancement: **data and AI-driven solutions**, which leverage cutting-edge analytics, machine learning, and predictive modeling to optimize resource use and enable precision interventions, and **Internet and app-based solutions**, which empower individuals and communities through seamless connectivity and scalable digital platforms.

Recent examples show how those digital tools are reshaping industries and mindsets, offering actionable solutions to challenges such as climate change, resource scarcity, and social inequities. From harnessing AI to streamline energy efficiency to deploying app-based systems that promote inclusive participation in sustainability initiatives, these innovations underscore the immense potential of technology to align sustainability with social responsibility.

In this discussion, we noted six pioneering examples in the data and AI-driven category and four groundbreaking innovations in the Internet and app-based category, illustrating how each has set new benchmarks for advancing sustainability and social good. But, by all means, there are more, depending on the local environments that are summarized toward the end of this section.

Data and AI-Driven Models

1. **Data-Driven Insights and Analytics**

By leveraging the growing availability of big data from IoT devices, sensors, and operational systems, companies have developed models that analyze and optimize sustainable practices. For example, **predictive analytics models** have been used to assess energy consumption patterns and suggest adjustments, reducing carbon footprints in manufacturing processes. These insights enable informed decision-making that aligns operational efficiency with sustainability goals.

2. **Transparency and Traceability**

The need for ethical and sustainable sourcing drove the development of blockchain solutions that ensure transparency throughout supply chains. For instance, blockchain-based systems, which rely on data, were invented to t**rack the origin of materials**, such as conflict-free minerals or sustainably harvested wood. These systems provide immutable records, reassuring consumers and regulators about the ethical standards of products.

3. **Scalable Automation**

Automation technologies, powered by AI and robotics, were developed to handle resource-intensive tasks like waste sorting and recycling. For example, AI-driven robots have been invented to **separate recyclable materials from mixed waste streams**, significantly improving efficiency and reducing landfill contributions. These innovations are critical in advancing circular economy initiatives.

4. **Ecosystem Integration**

Platforms enabling multi-stakeholder collaboration were created to integrate data from various sources and drive collective sustainability efforts. For example, **shared**

energy management platforms aggregate data from multiple organizations to optimize renewable energy usage. Such systems encourage collaboration between industries, governments, and NGOs in achieving common goals.

5. **Real-Time Monitoring and Feedback**

The rise of IoT-enabled devices allowed for the invention of systems that monitor key environmental metrics like energy or water usage in real-time. These systems, paired with AI, provide immediate feedback and actionable suggestions to **minimize waste**. For example, **smart irrigation systems** dynamically adjust water usage based on weather forecasts and soil conditions, reducing resource waste.

6. **Predictive and Preventive Solutions**

Predictive maintenance models, powered by machine learning, were developed to anticipate equipment failures and optimize performance. For example, sensors in industrial machinery analyze patterns to **predict maintenance needs**, avoiding breakdowns and reducing waste. Such preventive approaches enhance resource efficiency and **reduce environmental impact**.

Internet and App-Based Models

1. **Consumer Engagement Platforms**

Interactive apps and platforms were designed to engage users in sustainable practices by incentivizing eco-friendly behavior. For example, mobile apps like Too Good To Go connect users with surplus food from restaurants, **reducing food waste**. Gamification features in such apps encourage sustained participation, making sustainability efforts fun and rewarding.

2. **Education and Awareness Tools**

The need to raise awareness about sustainability led to the development of digital tools that educate users interactively. For instance, AR/VR simulations allow users to visualize the impact of their carbon footprint, **fostering greater environmental responsibility**. These tools are widely used in corporate training programs and public awareness campaigns.

3. **Impact Measurement and Reporting**

Apps and dashboards were developed to simplify the process of tracking and reporting ESG metrics. For example, companies use platforms like Salesforce's Net Zero Cloud to **measure carbon emissions, monitor sustainability goals**, and report progress to stakeholders. These tools help organizations stay **accountable and transparent in their sustainability efforts**.

4. **Customization and Localization**

Recognizing the diverse needs of global markets, app developers created solutions tailored to specific regions. For example, **renewable energy recommendation apps** were developed to guide users based on local resources and regulatory contexts.

These localized solutions ensure higher adoption rates and **maximize the relevance of sustainability initiatives**.

The creation of these SSR models was driven by the capabilities of digital innovation. Data and AI-driven models focus on foundational, systemic optimization, while Internet and app-based models prioritize user engagement and interaction. Together, they form a comprehensive toolkit for addressing environmental and social challenges in diverse contexts.

But it must be kept in mind that Sustainability and Social Responsibility and digital innovations are deeply influenced by changes in **PEST** factors—political, economic, socio-cultural, and technological. These external forces shape the opportunities, challenges, and trajectories for both Sustainability and Social Responsibility initiatives and digital transformation efforts.

Political mandates on renewable energy drove the adoption of AI-powered energy management systems, while **economic incentives for green initiatives** encouraged the use of blockchain for transparency. Socio-cultural demands for inclusivity inspired apps that connected underserved communities to sustainable solutions, and **technological advances like IoT-enabled** smarter, more sustainable supply chains. Together, these PEST-driven dynamics fueled innovative approaches to Sustainability and Social Responsibility.

8.6 Technological Convergence

Technological convergence has emerged as a transformative force in digital innovation, where disparate technologies merge to create entirely new capabilities. At its core, this trigger is about leveraging the strengths of one innovation to amplify or redefine the potential of another. By combining existing systems with emerging technologies, leaders unlock synergies that drive groundbreaking solutions, enhancing functionality and expanding market possibilities. This convergence is not merely an evolution of existing tools; it is a reimagining of their combined purpose, enabling industries to achieve outcomes that were previously unattainable.

A case that set the tone of technological convergence that we talk about today is that of Steve Jobs' creator of iPod, iPhone and numerous "must haves" that we use today. Jobs were a master of technological convergence, blending diverse technologies, ideas, and talents from around the globe to create revolutionary products. The iPod is a perfect example—its success lay not just in individual components but in how they were thoughtfully integrated into a seamless, user-friendly ecosystem.

Jobs' genius was in identifying synergies: combining cutting-edge technology (like touchscreens) with intuitive design (minimalism by Jony Ive, Apple's CDO, Chief Design Officer) and a new business model (iTunes Store). This approach didn't just create a product; it transformed industries across the world [19].

Another example of technological convergence with wide applications is the shift from hardware-driven robotics, powered by application-specific integrated

circuits (ASICs) and field-programmable gate arrays (FPGAs), to **data-driven robots guided by software advancements and AI algorithms**. This transition transformed robots from rigid, task-specific machines into "smart robots" with adaptable systems capable of learning and responding in real-time. Similar example with wide range of applications is the **digitization of images coupled with advancements in deep learning** which has revolutionized industries like healthcare, enabling AI-powered diagnostics, and transportation, where autonomous vehicles rely on image recognition and decision-making capabilities derived from this convergence.

The power of technological convergence lies in its capacity to accelerate innovation by blending the familiar with the cutting-edge. Leaders who recognize this potential can forge solutions that not only address current needs but also anticipate future challenges. By viewing convergence as an opportunity to synthesize capabilities across domains, organizations position themselves at the forefront of innovation, creating products and services that redefine markets and improve lives.

In fact, technological convergence is at the heart of digital business whose thinking strategy can be formalized as follows:

1. **Identify the Core Problem or Opportunity**

Innovation often starts with recognizing a gap in the market or an inefficiency that needs solving. Ask: What challenge can be addressed by blending technologies?

Elon Musk identified the transformative potential of rechargeable battery technology, which had primarily been used in smaller electronics, and envisioned its application in the automotive industry. By experimenting with high-capacity lithium-ion batteries, Tesla successfully integrated this emerging technology into electric vehicles, addressing the growing demand for sustainable transport. Musk's vision didn't stop there—**Tesla combined this battery innovation with advancements in AI and software** to pioneer autonomous driving capabilities, over-the-air updates, and energy optimization systems. This convergence of hardware, software, and sustainable energy sources has redefined the automobile industry and cemented Tesla's position as a global leader in technological innovation.

2. **Explore the Intersection of Technologies**

Look for synergies between different digital domains. For instance, Sergey Brin and Larry Page, co-founders of Google, foresaw the explosive growth of the internet and the inevitable challenge of efficiently locating relevant information within a rapidly expanding web. They began working on a revolutionary search algorithm to address the impending need for users to navigate this complex digital space. By **converging the principles of link analysis (PageRank) with web crawling technologies**, they invented **Google**—a search engine that transformed the way information was indexed and retrieved. This convergence created a tool that not only defined Google's success but also reshaped how the world accesses knowledge.

3. **Leverage Existing Strengths**

Combine an established technology or platform with emerging trends. Jeff Bezos started Amazon by addressing a specific problem—how to make it easier for customers to search, find, and purchase books from a virtually infinite collection.

Recognizing this challenge, **Amazon** converged **emerging internet technologies with logistics and data-driven insights** to create a platform that redefined the shopping experience. The company utilized advanced search algorithms to simplify book discovery, built a reliable and scalable e-commerce infrastructure for secure transactions, and integrated a logistics system to ensure fast, efficient delivery. Over time, **the addition of an AI-driven recommendation engine further enhanced** the customer experience, transforming Amazon from an online bookstore to a global e-commerce powerhouse.

4. **Think Scalability and Ecosystem**

Evaluate how the converged solution can evolve into a broader platform. Microsoft foresaw the transformative potential of cloud computing and seized the opportunity to **integrate this emerging cloud technology into its existing software ecosystem**.

By creating **Azure**, a scalable cloud platform, **Microsoft** not only provided robust infrastructure services but also enabled seamless integration with its Windows software. This convergence allowed Microsoft to transition from traditional, standalone software to a cross-platform, cloud-enabled model, empowering businesses and developers to innovate at scale. The result was a reimagined approach to productivity, collaboration, and development, positioning Microsoft as a leader in the era of cloud-driven digital transformation.

5. **Prototype and Iterate Rapidly**

Start with small-scale implementations and refine based on feedback. **OpenAI**'s journey to develop GPT models exemplifies the power of rapid prototyping and iterative refinement.

Recognizing the growing potential of natural language processing, OpenAI **blended advancements in computational power with innovative neural architectures.** By building upon each iteration—starting from GPT-1 and evolving through GPT-4—the organization consistently incorporated feedback, enhanced training datasets, and leveraged cutting-edge GPUs to scale its models. This iterative approach not only advanced the state of AI but also ensured practical applications across industries, from content creation to customer service, making OpenAI a leader in transformative AI technologies.

6. **Stay Agile and Anticipate Future Trends**

Keep an eye on emerging technologies and regulatory shifts. **Tempus** recognized the untapped potential in harnessing vast amounts of clinical and molecular data to revolutionize cancer treatment.

By proactively **aggregating and analyzing patient-specific information**, Tempus developed a platform that enables physicians to make data-driven, personalized treatment decisions. This approach not only addresses the variability in individual patient responses but also anticipates the growing trend towards precision medicine. Through strategic collaborations and continuous innovation, Tempus exemplifies agility in integrating emerging technologies to advance patient care.

Startups often excel at leveraging one of these six strategies—or inventing entirely new methods—to create disruptive innovations. Their agility, **focus on niche problems**, and ability to **adapt quickly** allow them to thrive in rapidly evolving markets. Many startups specialize in identifying opportunities at the intersection of emerging technologies, such as combining AI with blockchain, or IoT with sustainability. Example cases can be found from around the world.

8.7 Summary

The five digital triggers—data-driven insights, ecosystem and platform dynamics, AI and automation as core drivers, Sustainability and Social Responsibility, and technological convergence—serve as **guiding pillars** for organizations embarking on their **Digital Transformation (DX) journey**. Each trigger represents a unique lens through which businesses can identify opportunities, address challenges, and innovate with purpose. Together, they illustrate how leveraging digital tools and strategies can drive not only operational efficiency but also sustainable growth and societal impact. As industries continue to evolve, a comprehensive understanding of these triggers will empower leaders to anticipate change, seize opportunities, and remain resilient in the face of disruption. By embracing these principles, organizations can position themselves at the forefront of innovation, building a future defined by agility, adaptability, and digital excellence. Indeed, startups too can learn from the analysis and examples that exemplified how the "Five Digital Triggers" can be used in practice.

The journey from innovation to actionable business transformation is where true success lies. Implementing ideas sparked by the "digital triggers" into sustainable, scalable business solutions defines digital transformation (DX) at its core. In Chap. 10, the focus will be this!

References

1. Applegate LM, Austin RD, McFarlan FW (2006) Corporate information strategy and management. McGraw-Hill/Irwin Custom Publishing
2. Turban E, Whiteside J, King D, Outland J (2017) Introduction to electronic commerce and social commerce. Springer
3. Chawla RN, Goyal P (2021) Emerging trends in digital transformation: a bibliometric analysis. Benchmarking: Int J 29(4):1069–1112
4. Endres H, Huesig S, Pesch R (2022) Digital innovation management for entrepreneurial ecosystems: services and functionalities as drivers of innovation management software adoption. RMS 16(1):135–156
5. Bhimani A (2015) Exploring big data's strategic consequences. J Inf Technol 30(1):66–69
6. Grover V, Chiang RH, Liang TP, Zhang D (2018) Creating strategic business value from big data analytics: A research framework. J Manag Inf Syst 35(2):388–423

7. Wu Z, Shu Y, Low BKH (2022) Davinz: Data valuation using deep neural networks at initialization. In: International conference on machine learning. PMLR, pp 24150–24176
8. Anderson C (2012) The long tail. Effective business model on the internet—Moscow: Mann, Ivanov & Ferber
9. Gojek (2024) We build products that nations run on. Gojek corporate website: https://www.gojek.com/en-id. Accessed on 23 Oct 2024
10. Gojek (2023) LPEM FEB UI: GoTo contributed up to IDR 428 trillion to Indonesia's economy in 2022, equivalent to 2.2% of GDP. Gojek corporate website: https://www.gotocompany.com/en/news/press/lpem-feb-ui-goto-contributed-up-to-idr-428-trillion-to-indonesias-economy-in-2022-equivalent-to-22-of-gdp. Accessed on 23 Oct 2024
11. Jakarta Post (2019) Gojek once again in Fortune's top-20 list of companies changing the world. https://www.thejakartapost.com/adv/2019/08/27/gojek-once-again-in-fortunes-top-20-list-of-companies-changing-the-world.html. Accessed on 23 Oct 2024
12. Kurniawati I, Kustulasari A (2020) Public value creation by private sector through cross-sector collaboration: A case study of the Gojek Wirausaha program. Bisnis & Birokrasi 27(3):153–166
13. Cho N, Anindya FJ (2021) Analysis of Indonesia's digital industry and the case of Gojek. J Inf Technol Appl & Manag 28(5):17–39
14. Sullivan JL (2019) The platforms of podcasting: Past and present. Soc Media+ Soc 5(4):2056305119880002
15. Brem A, Giones F, Werle M (2021) The AI digital revolution in innovation: A conceptual framework of artificial intelligence technologies for the management of innovation. IEEE Trans Eng Manage 70(2):770–776
16. Verganti R, Vendraminelli L, Iansiti M (2020) Innovation and design in the age of artificial intelligence. J Prod Innov Manag 37(3):212–227
17. Dionisio M, de Souza Junior SJ, Paula F, Pellanda PC (2024) The role of digital social innovations to address SDGs: A systematic review. Environ Dev Sustain 26(3):5709–5734
18. Atanasov A, Chipriyanova G, Krasteva-Hristova R (2023) Integration of digital technologies in corporate social responsibility (CSR) activities: a systematic literature review and bibliometric analysis. J Risk Financ Manag 16(8):373
19. Isaacson W (2012) The real leadership lessons of Steve Jobs. Harv Bus Rev 90(4):92–102

Chapter 9
Implementation Converting Digital Innovation to Sustainable Business

Innovation alone is not enough to build a successful business; innovation must be effectively integrated and implemented to create measurable value. This chapter explores how businesses can transform digital innovation into sustainable growth by focusing on strategy and execution. Anchored on two key strategic goals—process optimization and customer growth—it highlights the importance of evaluating business operations such as R&D, product design, procurement, manufacturing, marketing, and sales. Each operation comprises processes that drive its output, and by applying digital transformation (DX) to high-impact processes, businesses can achieve transformative results. Central to this approach is the use of design thinking as a framework for identifying challenges, reimagining processes, and implementing solutions that align with strategic objectives. This chapter provides a structured methodology to bridge the gap between innovation and implementation, ensuring long-term success.

9.1 Business Transformation and Innovation in Processes

Streamlining processes has long been championed by business strategists as a pathway to enhanced productivity. Nobel laureate Paul Krugman once remarked, "Productivity isn't everything, but in the long run, it's almost everything," underscoring productivity's central role in economic and business growth.

The concept of productivity traces back to the dawn of the Industrial Revolution, when businesses sought to maximize the output of machines. In its simplest form, productivity was seen as increasing the output of a machine while maintaining the same level of input. This definition worked well in an era dominated by mechanical systems, where technological advancements were focused on scaling production capabilities. However, as manufacturing operations expanded, it became evident that

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_9

increasing capacity alone did not equate to higher productivity—output increased, but so did the inputs of raw materials and labor, leading to inefficiencies.

This realization led to the pioneering work of Frederick Winslow Taylor, an American mechanical engineer often referred to as the father of scientific management [1]. While working in a factory, Taylor conducted the first systematic studies of workplace productivity, arguing that the key to improving labor output was not in workers working harder but in managing work processes more scientifically. His insights laid the foundation for modern productivity analysis, shifting focus from mere output scaling to optimizing how work is done.

By the mid-twentieth century, the emergence of quality management principles and methodologies such as Total Quality Management (TQM) and Six Sigma brought the concept of process productivity into sharper focus. Organizations began to prioritize operational efficiency and quality improvement, recognizing that refining processes could achieve more consistent and scalable results. This marked a shift toward viewing productivity not just as a measure of machine or labor output but as an integrated outcome of well-designed processes.

As the marketplace evolved, productivity alone was no longer sufficient to sustain business growth. The rise of customer-centric strategies highlighted the need for customer growth as a complementary pillar. Companies realized that optimizing processes to improve customer satisfaction, loyalty, and acquisition was equally critical for long-term success. Productivity now had to serve not just internal efficiency but also external impact, aligning operational improvements with the broader goal of enhancing customer experiences and driving market growth.

Similar to the productivity of a machine, efficiency can be understood as producing the same output with fewer inputs than before. This close relationship between input and output connects productivity and efficiency, a connection Frederick Winslow Taylor emphasized in his work. Taylor argued that improving efficiency inherently improves productivity, an idea that paved the way for a broader understanding of these concepts. This perspective can be generalized by replacing the focus on the "machine" with a focus on the "process." Quality management pioneers Deming [2] and Juran [3] advanced this view, introducing the concept of process-based productivity, often referred to as process productivity.

A pivotal moment in the evolution of process productivity was the introduction of Total Quality Management (TQM) principles by Deming and Juran. These quality management frameworks highlighted the importance of understanding, measuring, and optimizing processes to achieve higher levels of quality, efficiency, and productivity. Their work shifted the focus from individual tasks or machines to the broader processes driving organizational outcomes.

Building on these principles, the Toyota Production System (TPS), developed by Ohno and Shingo [4, 5] revolutionized manufacturing by examining the entire automobile production system. TPS emphasized waste reduction, continuous improvement, and a relentless focus on process efficiency. This system became the foundation for lean manufacturing and lean management, which prioritize not only optimizing processes for productivity but also delivering value to customers. By integrating

process efficiency with customer value, lean practices laid the groundwork for a new era of productivity thinking.

The rise of Business Process Reengineering (BPR) in the 1990s further emphasized the importance of process productivity. BPR focused on the radical redesign of processes to achieve significant improvements in productivity, efficiency, and customer value [6]. This approach underscored the need to rethink traditional workflows and align them with strategic goals, paving the way for transformative operational changes across industries.

Simultaneously, the concept of service productivity gained increasing recognition as the service sector expanded throughout the twentieth century. As organizations sought to enhance operational efficiency, customer satisfaction, and financial performance, the role of productivity in services became central to achieving these goals. Service productivity not only addressed internal efficiencies but also emerged as a strategic driver for customer growth, linking operational improvements directly to enhanced customer experiences and loyalty.

By the late-twentieth century and into the early-twenty-first century, discussions around service productivity took on greater prominence. The growing importance of customer-centric strategies and advancements in technology further highlighted the need to optimize service processes for both productivity and value creation, solidifying their place in modern business practices.

With advancements in the internet and digital technologies, discussions around process productivity expanded significantly. Concepts like Business Process Management (BPM) and process automation gained prominence as organizations leveraged technology-enabled solutions to streamline workflows and achieve greater efficiency [7].

The arrival of mobile phones, iPhones, and social media platforms ushered in a new era of connectivity and data generation. With the explosive growth in the volume of data traveling through the internet and stored in social media platforms and cloud centers, the age of big data emerged. Simultaneously, machine learning algorithms advanced, enabling organizations to analyze massive datasets and uncover insights that revolutionized customer growth strategies. Big data analytics offered unprecedented visibility into customer profiles, preferences, and behaviors, empowering businesses to craft targeted strategies for attracting new customers, retain existing ones, and elevate their experiences.

Process enhancements play a pivotal role in achieving these outcomes by enabling faster service, personalized interactions, and improved product quality. For instance, advancements in data analytics and customer relationship management (CRM) systems empower businesses to analyze customer behaviors, predict needs, and deliver tailored solutions. By integrating these tools into their operations, organizations can bridge the gap between internal efficiencies and external value creation, linking process optimization directly to competitive advantages.

Furthermore, customer-centric approaches demand agility and responsiveness, requiring businesses to adapt quickly to evolving market trends and customer expectations. Process enhancements in areas such as supply chain management, service delivery, and product development, and use of “Design Thinking” that will be

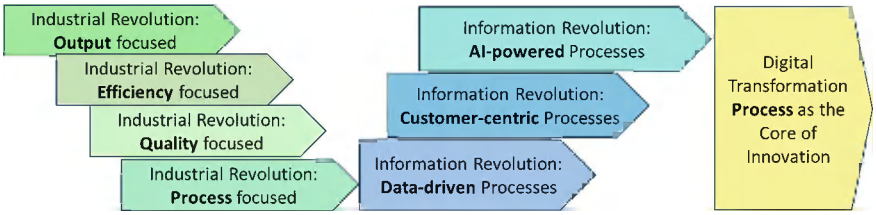


Fig. 9.1 Industrial revolution to information revolution and focus on processes

discussed in detail in this chapter, ensure that organizations not only meet but exceed customer demands. This synergy between **process-focused improvements** and **customer growth strategies** forms the backbone of sustainable business success, enabling organizations to thrive in an ever-changing marketplace.

As these technologies matured, the convergence of big data, machine learning, and advancements in computing power—driven by GPUs—heralded the dawn of the Age of AI. This transformative era introduced powerful tools capable of automating complex processes, making data-driven decisions, and unlocking new opportunities for innovation. The digital toolbox required for digital transformation (DX) continues to expand at an unprecedented pace, offering organizations more tools than ever before. The transformation of business from industrial revolution to information revolution based on process oriented digital innovations is illustrated according to changing phases of time which is illustrated in Fig. 9.1.

However, this abundance of digital tools brings its own challenges. Determining which tools to adopt and prioritizing which processes to transform—first, second, and beyond—has become increasingly complex. Organizations must adopt fresh, thoughtful approaches to navigate these decisions, ensuring that their DX efforts align with both strategic objectives and practical feasibility.

9.2 Digital Transformation and "Digital Pillars"

The past chapters in this book presented various ways to create digital innovations and use those innovations to create more digital innovations. Taking a process view helps connecting the innovations to a comprehensive business.

Optimizing a process raises the question: "What process is to optimized?" Additionally, "optimization" too can be looked at from various aspects, such as reducing costs, saving time, enhancing quality, or improving overall efficiency. In any business, whether manufacturing or service-oriented, operations are carried out through a series of interconnected processes.

For example, a company that manufactures shoes requires raw materials such as leather, resins, rubber, elastic, and shoelaces. Acquiring these materials involves processes like sourcing suppliers, placing purchase orders, receiving shipments,

and storing inventory. These processes extend beyond procurement to include manufacturing, sales, and distribution.

Productivity, in this context, refers to the efficiency and output of these processes. Even the machines used in production are part of a broader system of processes.

Digital transformation (DX) focuses on innovating and transforming these processes to enhance productivity, efficiency, agility, and customer satisfaction.

It is important to note that the concept of DX has evolved over time due to constant advances in what can be called "Digital Pillars" of technology, consisting of hardware, software, data, and information, as drivers of DX. In response to these technological advances, businesses have strategically adopted these pillars—not merely to optimize processes but also to devise innovative means of enhancing competitiveness and creating transformative opportunities.

A historical perspective provides valuable insights into the relationship between DX and process optimization. Table 9.1 summarizes the evolution of digital pillars—hardware, software, data, and information—over time, highlighting their role in driving productivity and efficiency improvements.

The overview of the major stages in the historical progress of DX shown in Table 9.1 helps in understanding the evolution of digital technologies and their impacts on businesses. The first column identifies key periods in the digital landscape, based on significant technological advancements. The remaining columns highlight the digital pillars—hardware, software, data, and information—and the transformations these pillars have undergone.

The Early Stages: The Pre-1990s and the Foundational Era

The journey of digital transformation began with the development of the first computers in the mid-20th century, marking the dawn of the digital era. Early computers were large, expensive, and primarily focused on scientific and military uses. In business contexts, they played a crucial role in automating routine

Table 9.1 Timeline and transformation of digital pillars

Period	Hardware	Software	Data	Information
Pre-1990: foundational era	Mainframes to PCs; miniaturization (Moore's law)	Basic operating systems; structured programming	Physical storage; early relational databases	Basic computing outputs; early digitization
1990–2020: growth era	GPUs for graphics, FPGAs/ASICs; optimized efficiency	Object-oriented programming, SaaS, cloud computing	Big data rise, NoSQL, Hadoop for unstructured data	Internet, search engines, digital content platforms
Present: acceleration era	AI-specialized hardware (NVIDIA GPUs, TPUs); quantum computing	AI-driven software, no-code platforms, open-source ecosystems	Real-time processing, edge analytics, AI-assisted pipelines	AI-curated personalized information; NLP advancements

data processing tasks, which led to productivity improvements in various sectors. Hardware at this stage was centralized, and early computing was focused on basic automation and calculations.

During the 1960s and 1970s, mainframe computers gained prominence. They provided centralized computing resources for large enterprises and governments. This era saw the implementation of early business automation systems such as Enterprise Resource Planning (ERP) and Material Requirements Planning (MRP). These systems optimized operational processes like manufacturing, logistics, and service delivery, enabling businesses to run more efficiently and with fewer errors.

ERP systems, a core element of software at this stage, helped manage essential processes across different departments, such as finance, HR, and production. As these systems grew in sophistication, they began incorporating modules for quality control, tracking data such as defect rates, corrective actions, and non-conformance. These modules laid the groundwork for modern quality management systems (QMS) and helped businesses identify improvement areas.

The Growth Era: 1990–2020 and the Rise of Data and Software Innovation

As digital transformation progressed, the 1990s to 2020 saw explosive growth driven by technological advancements across all digital pillars. Hardware experienced significant evolution with the rise of Graphics Processing Units (GPUs) and Field-Programmable Gate Arrays (FPGAs), which boosted computing power and allowed for more complex processing tasks. The increased miniaturization of hardware, driven by Moore's Law, made it more accessible, paving the way for more widespread adoption of digital technologies in various industries.

Software also evolved with the advent of object-oriented programming, the rise of software-as-a-service (SaaS) platforms, and cloud computing. These advancements allowed businesses to move from on-premises solutions to scalable cloud-based software, offering greater flexibility and efficiency. ERP systems also evolved during this time, becoming more integrated and customizable to meet the growing needs of businesses.

The 1990s also marked the rise of data-driven technologies. With the onset of big data and advancements in storage and processing, businesses began leveraging unstructured data using technologies like Hadoop and NoSQL databases. Data-driven insights became a central focus of many businesses, as they realized the potential of analyzing vast amounts of data to drive decisions. Companies began to collect and analyze massive datasets to understand customer behavior, market trends, and operational efficiencies, driving new levels of optimization.

The emergence of AI-powered software marked a significant milestone in transforming business processes. AI algorithms began analyzing data from production systems, customer relationship management (CRM) tools, and service interactions, uncovering patterns that led to more efficient and effective business practices. These developments drastically enhanced productivity, such as in marketing through AI-powered chatbots and virtual assistants, which could autonomously handle customer inquiries and provide instant responses. This change had profound

impacts on customer service and sales operations, enabling businesses to operate more efficiently.

The Acceleration Era: Present Day, AI, and Real-Time Digital Transformation

The current period, often referred to as the "Acceleration Era," has witnessed an explosion of technological innovation, particularly in the areas of hardware and software. AI-specialized hardware, such as NVIDIA's GPUs and Google's Tensor Processing Units (TPUs), has made it possible to develop AI models capable of real-time decision-making, analysis, and prediction at an unprecedented scale. Quantum computing is also on the horizon, offering the potential for even more powerful processing capabilities that will further enhance the scope of digital transformation.

Software has shifted toward AI-driven platforms, no-code environments, and open-source ecosystems, which are enabling companies to build and deploy applications without needing extensive coding expertise. These advancements in software development are fueling the rapid adoption of AI and automation across industries, from manufacturing to healthcare, retail, and beyond. Businesses are using AI-driven tools to optimize their workflows, personalize customer experiences, and enhance operational efficiency in ways that were previously impossible.

Data, as a digital pillar, has evolved to enable real-time processing, edge analytics, and AI-assisted pipelines. With real-time data processing, companies can now instantly react to changes in market conditions, customer behavior, or operational performance. The application of edge computing, where data is processed closer to the source, allows businesses to make faster decisions without the need to send all data to centralized servers. This has significant implications for industries that require quick, data-driven insights, such as supply chain management and predictive maintenance.

Information itself has become more personalized and tailored to individual users through AI-driven systems. The integration of natural language processing (NLP) has led to significant improvements in the delivery of personalized content and services. Companies like Google and Amazon now offer highly personalized recommendations to their customers, while organizations in healthcare and education are leveraging AI to provide personalized care and learning experiences.

DX in Action: Examples of Digital Transformation in the Acceleration Era

As businesses continue to adopt these advanced digital pillars, we see a greater focus on the convergence of AI, data, and software. For instance, in the automotive industry, companies like Tesla have integrated AI-driven systems with hardware (e.g., self-driving cars powered by GPUs), creating new business models and revenue streams. Similarly, in retail, companies like Amazon use AI and data analytics to optimize their supply chains, predict customer demand, and personalize shopping experiences.

Digital transformation (DX) has consistently advanced by leveraging innovations across the digital pillars—hardware, software, data, and information—resulting in substantial process innovations and optimizations. The examples of AI-powered chatbots and ERP systems demonstrate how DX enhances productivity through improved efficiency and decision-making. In these cases, the transformations in

the digital pillars catalyzed the transformation of business processes. AI-driven conversational tools, for instance, have automated customer service functions that once relied on large-scale human-operated call centers, enabling organizations to deliver 24/7 support at reduced costs. ERP systems, enhanced with AI and advanced data analytics, now proactively identify operational bottlenecks, improving overall process quality and responsiveness.

The convergence of AI, data, and software in the Acceleration Era exemplifies how innovations in the digital pillars are deeply intertwined with process evolution. Tesla's autonomous vehicles are a prime example, where AI hardware and real-time data analytics have reshaped automotive production and customer experiences. Similarly, in manufacturing, AI-powered predictive analytics enable real-time machine monitoring, reducing downtime and ensuring seamless production. In the service industry, personalized AI-driven systems revolutionize customer interactions, aligning business operations more closely with customer expectations.

Another case is **Nvidia**, which initially focused on improving CPUs for graphical rendering to meet the needs of gamers, who required high-quality graphics and fast rendering speeds for immersive gaming experiences. By addressing the specific process of graphics rendering, Nvidia developed **Graphics Processing Units (GPUs)**—specialized hardware capable of handling parallel processing tasks more efficiently than traditional CPUs. This innovation not only enhanced gaming experiences but also set the stage for broader applications in AI.

These examples underscore that the progression of digital pillars drives not only technical innovation but also the reinvention of processes, creating competitive advantages and ensuring sustainable growth in an increasingly digital-first world.

9.3 Process-Centric Digital Innovation as the Pathway to DX

Businesses are fundamentally structured around organized entities called operations, which include procurement, manufacturing or service, marketing, sales, and more. In practice, an alternate name for process is department, such as sales department. Each operation or department consists of various interconnected processes that collectively enable the organization to function effectively.

As businesses grow, operations often become more intricate and diverse. To maintain effectiveness, organizations typically break down these large operations into smaller **sub-operations** or units. This decomposition allows for better management, more focused decision-making, and enhanced performance. For example, when a company expands, the sales department may be divided into two departments based on different criteria, such as **customer segments** (e.g., B2B versus B2C), **geographic regions**, or **product categories**. Each sub-operation can then focus on specific needs and goals, enabling more targeted strategies. The processes that were in original sales

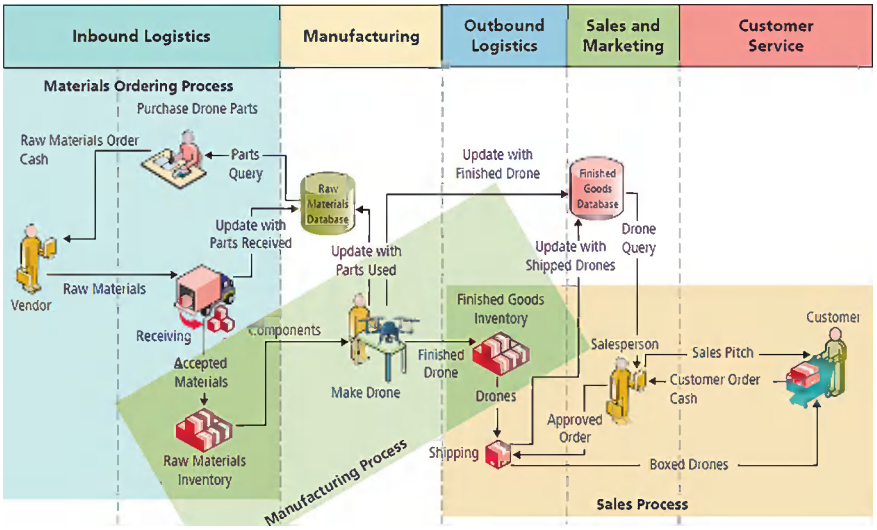


Fig. 9.2 Example of businesses operations and processes (Ref: Randall J. Boyle, David M. Kroenke Using MIS 2017, Publisher: Pearson Education, Year: 2017)

department may also be divided between the two new departments, or some of the process may be duplicated in the two new departments.

The following swim lane diagram from Kroenke and Boyle's popular text [8] explains a typical manufacturing company's major "operation" (listed in the top row), with the various processes listed below each operation (Fig. 9.2).

Operations encompass the broader functional units responsible for managing specific aspects of a business, while processes represent the detailed steps and activities that enable these operations to function effectively. Efficient management of processes within operations is critical for maintaining quality, optimizing efficiency, and ensuring alignment with organizational objectives and customer expectations.

By enhancing or transforming these processes through digital innovation, businesses can achieve a systematic implementation of Digital Transformation (DX).

JR East Railways (Japan) Ticket Gate Process Digital Innovation

A prime example of process optimization in digital transformation (DX) is **JR East**'s innovative approach to revolutionizing ticket gate operations, which not only enhanced commuter convenience but also laid the foundation for a thriving digital ecosystem.

As one of Japan's largest railway operators, JR East manages an extensive network of 12,000 trains daily, transporting approximately 16 million passengers. Ensuring the smooth and efficient operation of such a vast system is a core priority for the company.

For passengers, the ideal experience involves effortlessly purchasing tickets, boarding trains, traveling safely to their destinations, and disembarking without

unnecessary delays. However, bottlenecks in this journey—particularly at ticket gates—can create significant "pain points," reducing satisfaction and efficiency.

Recognizing this, JR East transformed its ticketing process, evolving from entirely manual systems to cutting-edge automated solutions that cater to modern needs and expectations.

JR East's Ticketing Challenge and the Sony Collaboration

JR East faced a challenge with its ticketing system, which relied on a magnetic ticket process. This system, while functional, had notable inefficiencies.

- Passenger Bottlenecks: Buying magnetic tickets at machines, feeding them into ticket gates, and validating payments caused delays and long lines, particularly during peak hours.
- Process Complexity: The need to calculate fares, purchase correct tickets, and validate them added friction to the passenger experience (Fig. 9.3).

When Sony developed contactless card technology, JR East recognized an opportunity to streamline its ticketing operation. But JR East had to create a strategic partnership with Sony because JR East by itself did not have the needed expertise. By collaborating with Sony JR East revolutionized several processes (Fig. 9.4).

- Elimination of Magnetic Tickets: The Suica card replaced traditional magnetic tickets, enabling passengers to load funds onto a single card and tap it at gates for seamless entry and exit.
- Streamlined Ticketing Process: Passengers no longer needed to calculate fares or purchase physical tickets for each journey. Instead, the system automatically deducted the correct fare based on the starting and ending stations.

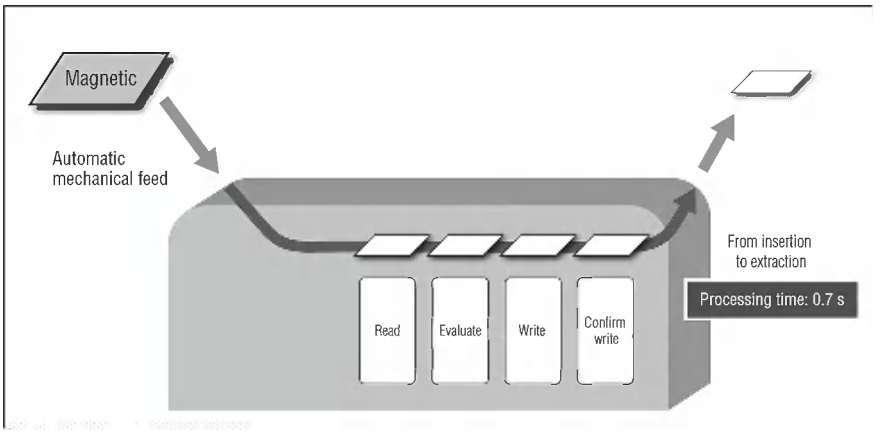


Fig. 9.3 JR East ticket gate process with magnetic ticket; **process time 0.7 s**. *Source* JR East website [9]

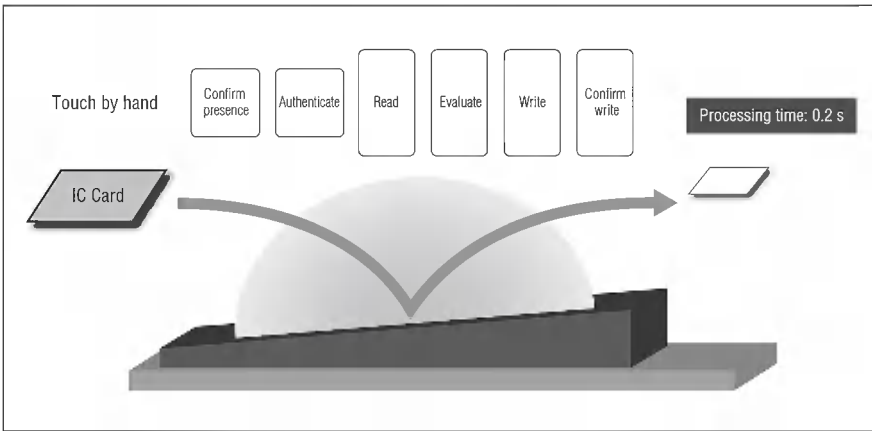


Fig. 9.4 DX of the JR East ticket gate process with Suica IC card; **process time 0.2 s**. *Source* JR East website [9]

- Improved Gate Operations: Contactless validation at gates significantly reduced the time required for passengers to enter and exit, alleviating congestion during peak hours (the processing time to pass through the gate reduced from 0.7 s to 0.2 s—over **300% improvement**). It a straightforward application of well-known Little's Law that to improve the customer gate pass rate, also known as gate throughput, the time a passenger spends to clear the gate must be shortened.

Results and Transformation

The implementation of the Suica card brought significant benefits.

- Enhanced Efficiency: By simplifying and automating ticketing processes, JR East improved passenger flow and reduced bottlenecks.
- Improved Customer Experience: The frictionless system offered greater convenience, encouraging more people to use trains.
- New Business Opportunities: The Suica card became a multi-purpose platform, expanding into retail payments and other services, creating a sizable business ecosystem around it.

In addition to these DX processes, the information and knowledge pillars have also been transformed. New data analytics tools now extract valuable insights, enabling JR East to devise strategies for customer growth and planning. The adoption of the Suica Card has extended well beyond the JR East train system, finding acceptance in:

- Supermarkets and shopping centers.
- Fast-food chains and cafes.
- Electronics retailers and drugstores.
- Taxis and rental cars.

- Hotels.
- Entertainment venues.

The acceleration of financial transaction times and gate clearance processes has had a direct impact on increasing operational productivity. This heightened efficiency contributes not only to JR East's operations but also to the productivity of users and resources, such as ticket gates. A key factor in the Suica card's widespread acceptance is its "ease of use," which has driven its popularity. By 2022, the number of Suica cards in use had reached 90 million physical cards and 16 million mobile cards [8].

9.4 Optimizing a Process with Design Thinking

As organizations embark on the journey of digital transformation (DX), process-centric digital innovation becomes a crucial driver for success. By focusing on optimizing workflows and delivering tangible benefits to customers, businesses can create systems that are not only efficient but also impactful. However, achieving this requires more than just technological integration; it demands a deep understanding of how these innovations interact with the end-users of the processes they aim to improve. This is where Design Thinking becomes indispensable. Rooted in empathy and iterative problem-solving, Design Thinking provides a structured approach to reimagine processes with the user at the center—ensuring that digital innovations are not only functional but also intuitive, engaging, and aligned with the needs of those they serve.

In the case of JR East's transformation of ticket gates to accommodate Suica cards, the initiative was driven by two core objectives: enhancing operational efficiency and improving customer convenience. This dual focus reflects the strategic imperative of aligning digital transformation (DX) efforts with tangible, measurable outcomes. Central to this approach is the application of Design Thinking, a problem-solving methodology that prioritizes the needs and experiences of end-users. Steve Jobs, the visionary founder of Apple, encapsulated this philosophy with his assertion that "Design… is really how it works," emphasizing the functional essence of design beyond aesthetics.

Since its inception, Design Thinking has evolved into a widely adopted framework in academia and industry, recognized for its ability to address complex challenges by fostering innovation that is not only user-centered but also practical and impactful. Design Thinking can be applied to improve processes in both the manufacturing and service sectors. By adopting this approach, manufacturers and service providers can better understand the needs of customers and stakeholders—ranging from internal employees engaged in the functioning of these processes to external end-customers purchasing products or services. This methodology enables the identification of pain points and the development of innovative solutions that enhance efficiency, productivity, and overall performance. The five key steps in Design Thinking, as illustrated in Fig. 9.5 (Dam and Teo), provide a structured approach to problem-solving. The framework gained mainstream recognition, alongside this five-step model, when

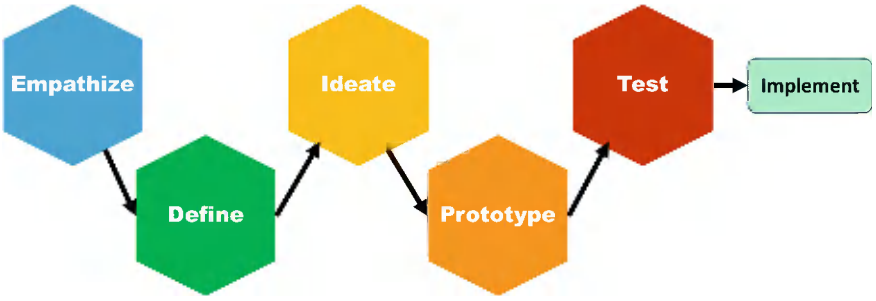


Fig. 9.5 Five key steps in design thinking (Ref [10])

prestigious business schools such as Harvard and Stanford began teaching it, often citing Steve Jobs' groundbreaking innovations as prime examples.

The Five Steps of Design Thinking

1. **Empathize: Understand the User**

The first step in Design Thinking is to develop a deep understanding of the people for whom the solution is being designed. This involves conducting interviews, observations, and research to gain insights into their needs, challenges, and aspirations. Empathy is crucial here, as it allows designers to step into the shoes of end-users and uncover not only explicit requirements but also latent desires and pain points. For example, in the case of JR East's Suica Cards, empathizing with commuters' frustration over long wait times and inefficiencies was the foundation for reimagining the ticketing experience. In order to understand and empathize wholly, it is a good practice to have cross-functional participation in this step.

2. **Define: Articulate the Problem**

Once sufficient insights have been gathered, the next step is to synthesize the findings into a clear and actionable problem statement. This phase focuses on framing the challenge in a way that aligns with users' core needs. A well-defined problem statement serves as a guiding light for the design process, ensuring that efforts remain user-centered. For instance, JR East's challenge could be summarized as, *"How might we streamline ticketing processes to reduce commuter delays while enhancing convenience?"*

3. **Ideate: Generate Creative Solutions**

With a well-defined problem in hand, the next step is to brainstorm and explore a wide range of potential solutions. This is a highly creative and strategic phase where no idea is too big or too small. Techniques such as brainstorming sessions, mind mapping, and collaborative workshops are often employed to encourage out-of-the-box thinking.

For JR East, while the company did not possess advanced IT expertise in-house, their strategic ideation process involved collaborating with strategic partner Sony, who brought their expertise in contactless IC card technology. By leveraging Sony's

technological innovation, JR East was able to develop an innovative solution that optimized the ticketing process, reducing processing time and introducing a rechargeable, cashless card system. This collaboration illustrates how companies can bridge the gap between strategic thinking and technological capability by forming partnerships that combine industry insights with advanced technological resources, leading to impactful innovations.

4. **Prototype: Build to Learn**

Prototyping involves turning abstract ideas into tangible representations. These can be anything from simple sketches and mockups to interactive models or early-stage working solutions. Prototypes allow designers to test their concepts in real-world scenarios, gathering feedback from users to identify what works, what doesn't, and where improvements are needed. In the Suica Card case, early prototypes of card readers and user interfaces likely underwent several iterations to ensure they met both technical and user expectations.

5. **Test: Refine and Validate**

The final step is to test the prototypes with real users, gathering actionable feedback to refine and improve the solution. This iterative process ensures that the end product not only meets user needs but also delights them by exceeding expectations. Testing is a critical validation phase that often loops back to earlier steps as new insights emerge. For instance, JR East's eventual implementation of Suica Cards likely went through rigorous testing to ensure seamless integration across various touchpoints, from ticket gates to vending machines.

When it comes to digital transformation (DX) in a typical business, a cautious and structured approach is key to ensuring that operations are not disrupted during the transition. This step-by-step method allows companies to implement changes incrementally, ensuring that they have sufficient resources—especially technical expertise—at each stage. A serious review of existing IT infrastructure, capabilities, and technical know-how is essential to determine whether the organization has the internal capacity to drive transformation or if external resources (e.g., specialized IT consultants or partners) are needed.

The urgency of the digital transformation, as well as the available resources, will often dictate the pace and scale of the implementation. A rational approach involves prioritizing high-impact areas, evaluating risks, and aligning digital initiatives with the company's strategic goals. In some cases, businesses may need to start with pilot projects to test the waters before scaling up, while others may be able to pursue more ambitious initiatives depending on their existing infrastructure and expertise.

9.5 Comprehensive Implementation of Digital Innovation via DXPO

Implementing digital innovation within a business should not be limited to applying an idea to a single process, even if it serves as the initial entry point. While a single optimized process can act as a catalyst for transformation, the true value of digital innovation lies in its ability to scale and integrate into broader operational and strategic ecosystems. To achieve this, organizations must nurture the initial innovation by creating a comprehensive ecosystem that supports and sustains its growth. In this context, the emerging framework of **DX-driven Process Optimization** (**DXPO**) offers a structured approach. DXPO emphasizes the systematic alignment of digital transformation efforts with process optimization to drive efficiency, enhance customer value, and foster business resilience.

Strategic Focus

A critical element in implementing DX-driven Process Optimization (DXPO) is the strategic assessment of processes to identify those that can deliver measurable business success through digital innovation. To accomplish this, dedicated DX teams should be established to conduct a comprehensive review of organizational processes, with particular attention to those that enhance customer value. This includes considering the perspectives of both internal stakeholders—employees engaged in operational workflows—and external stakeholders, such as end-customers who interact with the final products or services. As mentioned during Design Thinking stage, cross-functional team, including marketing side, IT side, operations' side, should be considered.

For instance, an issue such as a machine producing defective parts represents not only a productivity challenge for internal employees but also a quality concern with broader implications for the organization. Addressing such pain points strategically involves assessing whether digital technologies can mitigate or eliminate these inefficiencies, thereby enhancing overall organizational performance.

In the case of JR East, the ticketing process posed significant challenges. It affected external customers by increasing waiting times and caused operational inefficiencies for the company due to congestion at station ticket areas, particularly during peak hours. By focusing on this critical pain point, the DX team likely recognized an opportunity to transform the ticketing process through digital innovation. The introduction of the Suica card addressed customer frustrations and simultaneously alleviated operational bottlenecks, demonstrating how a strategic focus on high-impact processes can drive meaningful transformation.

Implementation Potential

A key consideration in deploying a DX-driven Process Optimization (DXPO) strategy is assessing the human and technological resources required for successful implementation. This involves examining the availability and alignment of resources across three fundamental categories of digital solutions: hardware-based solutions,

software-driven systems, and data- or information-centric innovations. Depending on the specific objectives of the digital transformation initiative and the organization's existing expertise, solutions may also emerge as a combination of these categories, leveraging the synergies between them to create comprehensive and impactful innovations.

Organizations with strong technical capabilities may possess the ability to independently develop bespoke digital solutions. Many notable digital startups, such as video conferencing giant Zoom Technologies and generative AI innovator OpenAI with ChatGPT, exemplify how in-house expertise and innovation can lead to globally recognized platforms. However, for companies lacking such technical depth, particularly smaller organizations and those operating outside IT-centric industries, acquiring the requisite expertise can pose significant challenges. The accelerated adoption of DX has highlighted a critical shortage of IT professionals with advanced digital skills, disproportionately impacting resource-constrained businesses.

To navigate these challenges, companies can explore several strategic pathways, which align closely with the workforce automation strategies discussed in **Chap. 6: Workforce Automation**.

1. **Leverage Internal Skills and Resources**: If an organization possesses the necessary technical expertise, the most efficient path is to develop and implement digital solutions internally. This approach allows for greater customization and control, enabling the creation of solutions that closely align with specific business needs and strategic goals.
2. **Form Strategic Alliances**: As highlighted in **Chap. 6**, when the digital transformation initiative is strategic and transformative but requires capabilities beyond the organization's current skill set, forming alliances with technology providers or digital innovation partners is essential. Successful examples include partnerships like **BMW with Nvidia** for factory automation and **Uniqlo with ToshibaTec** for autonomous checkout systems. Such alliances help protect competitive advantages by ensuring access to cutting-edge expertise and co-developed innovations. The JR East strategic partnership is another example.
3. **Outsource or Leverage Cloud-Based Platforms**: If the necessary skills are not available internally and developing them is not feasible, companies can rely on external expertise through outsourcing or adopting cloud-based platforms. Cloud solutions offer scalable, flexible, and cost-effective digital capabilities, enabling businesses to overcome resource constraints while implementing DX initiatives effectively.

By carefully evaluating their specific needs, resource limitations, and the potential for collaboration, organizations can select the most suitable pathway to secure the digital resources required for DX. This strategic assessment ensures that DX initiatives are both practical and sustainable, effectively bridging the gap between ambition and execution.

DXPO Impact Evaluation Model

With a skilled DX team, an organization can embark on its digital transformation (DX) journey by identifying key processes and selecting the best solutions using design thinking principles. However, alongside the right technological solutions, human resources are often pivotal to the successful implementation of a digital innovation. A common initial question for many companies is: *"Where should we start?"* This question can be effectively answered through the DXPO framework, which evaluates customer value and implementation potential in tandem.

The DXPO framework enables organizations to prioritize processes by assessing "**Digitization Urgency**"**—**the immediate need for digitization—and "**Implementation Potential**"—the feasibility of executing the transformation based on available resources. First, the company evaluates processes based on their strategic alignment with business goals, assigning a **Digitization Urgency** score on a 1–10 scale. A high score indicates that the process urgently requires digital innovation, such as the case with JR East, where the ticketing process was vital to both customer satisfaction and operational efficiency.

Next, the **Implementation Potential** of each process is assessed by determining whether the necessary resources—such as technology, expertise, and human capital—are available for the proposed transformation. If a company lacks the required resources, the **Implementation Potential** is rated low, signaling that the process may not be ready for immediate digitization without external support or internal resource development.

The final **Impact** score is calculated by multiplying the **Digitization Urgency** score by the **Implementation Potential** score.

$$\textbf{Impact} = (\textbf{Digitization Urgency}) \times (\textbf{Implementation Potential})$$

This provides a comprehensive view of which processes hold the most promise in terms of driving business value through digital innovation. The higher the impact score, the more critical it is to implement that process first in the digital transformation journey.

In summary, the **DXPO framework** provides a structured approach to assessing the potential success of digital innovations by focusing on the urgency of digitizing processes and the company's ability to implement such innovations. By using this model, organizations can prioritize their efforts, ensuring that their DX initiatives are both impactful and resource-efficient.

In Fig. 9.6, the process to apply DX is listed on the left column as P1, P2, etc. Then using Design Thinking, what needs to be implemented are decided and evaluated based on customer value and implementation potential, as explained above. Based on the ranking of impact, the implementation can be progressed.

It is important to recognize that not all operational challenges within business processes can be effectively addressed through digital transformation (DX) alone. The role of the DX team is to critically evaluate which processes are best suited for digital interventions. In some cases, non-digital solutions may offer more practical

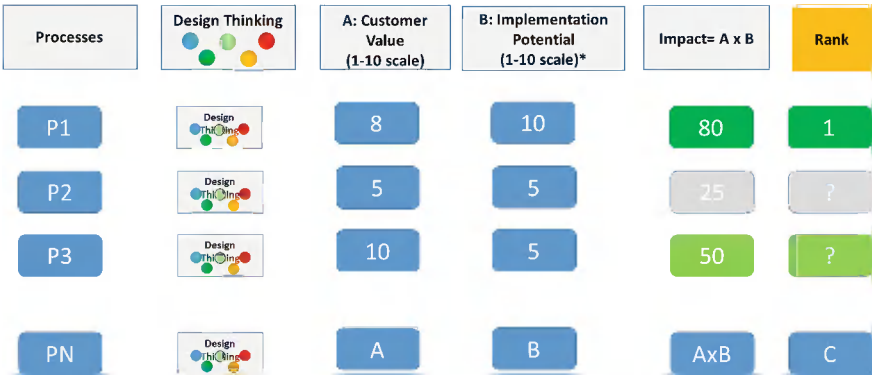


Fig. 9.6 DXPO framework explains how to rank processes to focus based on business value (Ref [12])

and efficient methods for addressing inefficiencies and enhancing productivity. A notable example of this is the *lean thinking* approach that originated with the Toyota Production System (TPS). Through meticulous process analysis, teams can identify redundancies, bottlenecks, and opportunities for improvement, thereby increasing efficiency without relying on digital technologies.

The *kanban system* within TPS illustrates this concept well. By using physical cards to signal inventory replenishment needs, the kanban system prevents overproduction and reduces waste, ensuring that materials are supplied only when necessary. This straightforward yet effective method improves workflow and overall productivity. However, with advancements in digital technology, the kanban system too has evolved into *digital kanban*, incorporating real-time data and automation to enhance efficiency even further [11]. This digital transformation demonstrates how traditional processes can be augmented by technology to reduce costs and optimize production line operations.

The DX-driven Process Optimization (DXPO) framework also allows potential to extend DX initiatives beyond efficiency improvements to broader strategic goals. For example, if an organization aims to drive customer growth, DX initiatives can focus on optimizing key performance metrics such as aftersales service quality, on-time delivery rates, and brand loyalty. By leveraging DXPO, companies can strategically align process improvements with overarching business objectives, showcasing the framework's versatility in supporting various aspects of business optimization. This adaptability highlights the importance of integrating both digital and non-digital solutions, enabling organizations to achieve sustained growth, efficiency, and competitive advantage.

To ensure the success of DXPO initiatives, organizations must also keep pace with technological advancements to remain competitive. This involves fostering a culture of **kaizen** (continuous improvement), staying engaged with new technologies, and committing to ongoing learning. One example of such an emerging technology is the application of **AI models** like **ChatGPT**, which have shown to drastically increase

productivity across a range of industries. Professionals such as doctors, consultants, insurance companies, and government agencies have leveraged AI-powered tools to enhance their operational efficiency significantly. Engaging with technology providers and adopting new, faster technologies is essential for organizations to continue benefiting from the ongoing advancements in digital tools and platforms.

In conclusion, while DXPO offers a robust framework for optimizing business processes, it is essential to remember that successful implementation requires careful assessment of the most suitable digital and non-digital solutions. As technology evolves, continuous adaptation and learning are key to maintaining a competitive edge.

9.6 Conclusion

This chapter explored the multifaceted journey of implementing digital innovation to achieve effective business transformation. Beginning with *Business Transformation and Innovation in Processes*, we underscored the importance of identifying and optimizing processes that drive organizational growth and efficiency. Digital innovation isn't just a one-time event; it's an ongoing evolution of processes aimed at enhancing customer value and productivity. We then examined the foundational *Digital Pillars*—hardware, software, data-driven, and information-driven solutions—that form the backbone of digital transformation (DX) initiatives. These pillars provide a strategic framework for integrating technology to create meaningful business outcomes.

The discussion progressed into process-centric digital innovation as the pathway to DX, emphasizing that focusing on specific processes helps businesses align their DX efforts with strategic goals. We highlighted the significance of methodologies like *Design Thinking* to optimize these processes, illustrating how user-centric innovation leads to practical and creative solutions. Finally, we introduced the DX-driven Process Optimization (DXPO*)* framework, a comprehensive approach to evaluating digitization urgency and implementation potential, ensuring that DX initiatives are prioritized effectively. Through strategic assessments, resource evaluations, and continuous improvement, DXPO helps organizations implement digital innovations in a way that maximizes impact while maintaining business continuity.

Together, these insights form a cohesive guide for businesses aiming to thrive in the digital age. By integrating innovation, strategic planning, and process optimization, organizations—whether established enterprises or startups—can achieve sustained growth, enhanced customer satisfaction, and operational excellence.

References

1. Taylor FW (1911) The principles of scientific management. Harper & Brothers, New York and London
2. Deming WE (2018) Out of the crisis. MIT Press, Boston, MA (reissue)
3. Juran JM (1986) The quality trilogy: A universal approach to managing for quality. Qual Prog 19(8):19–24
4. Ohno T (1982) The origin of Toyota production system and kanban system. In: Proceedings of the international conference on productivity and quality improvement. Industrial Engineering and Management Press, Atlanta, GA, pp 3–8
5. Shingo S (1987) The sayings of Shigeo Shingo: Key strategies for plant improvement. Productivity Press, New York
6. Hammer M, Champy J (2009) Reengineering the corporation: Manifesto for business revolution. Harper Business
7. Kirchmer M (2017) High performance through business process management. Springer, West Chester, PA
8. JR East (2023) Suica e-Money. https://www.jreast.co.jp/e/suicamoney/shop.html. (Accessed 14 July 2023)
9. JR East (2022) JR East group report integrated report 2022. JR East, Tokyo. https://www.jreast.co.jp/e/environment/pdf_2022/all.pdf. (Accessed 2 Aug 2023)
10. Dam RF, Teo YS (2024) What is design thinking and why is it so popular? Interaction Design Foundation—IxDF. https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why-is-it-so-popular. (Accessed 31 July 2023)
11. Takeguchi K, Watanabe N (2023) ChatGPT tech to be adopted by Japan government for administrative tasks. Nikkei Asia. https://asia.nikkei.com/Business/Technology/ChatGPT-tech-to-be-adopted-by-Japan-government-for-administrative-tasks. (Accessed 31 July 2023)
12. Rajasekera J (2023) Enhancing productivity through DXPO

Chapter 10
Digital Innovation… Looking Ahead

The technologies started unfolding business stories. The routes became vehicles and further transformed to strategic drivers. The stories began with automation and created new pathways for intelligent innovation and transformation. The boundaries of technology landscapes keep expanding and new action spaces emerge to question the old hypotheses. This created brand new directions in research realm to conquer the new horizons. Technologies question the existence and move further ahead to ask questions—can human-beings will be able to compete with their own creations? Will there be clash of values and principles in the fight for supremacy once again? Is there need to define new standards for ethicality? And above all, the questions are answered by experts in both ways rather in very ambiguous way to protect their so-called business interests. The information flood endangers the knowledge principles. With all this happening in the most dynamic information era of digital transformation, it becomes exceedingly important to be ready for the future on a strong foundation. It is necessary to ask right questions and use the tools and technologies in the right way. Reverence and fondness along with business orientation needs to meet digital technologies on more graceful way for a bright future. It is fine to redefine technologies and businesses and it is even fine to transform business landscape—the destination and means along with cultural dilemma demands for a fresh look. The questions raised by answers could be more threatening. These demands change not only in thinking but also in the level of thinking. In this chapter, let us take a look at some futuristic aspects of DBI and what can we expect out of it?

We definitely expect DBI to change the face of business. It will change the way business is being done even today. What could change further? What could be the next level of intelligence and innovation? DBI will find relationships among businesses which were never seen before. In turn, it would start a new chapter of business innovation. Where non-businesses will be converted into businesses, non-customers will become customers and market space would be expanded as never before. Data will find new ways to strategize business processes, market penetration, and spawning of new businesses. AI could become inherent participant to creative spaces, literary

P. Kulkarni et al., *AI Empowered Digital Business Innovation*, Smart Innovation, Systems and Technologies 118, https://doi.org/10.1007/978-981-96-5593-9_10

spaces, and even every space which we have not yet imagined. It will definitely demand digital maturity to cope up with new challenges and voracious appetites of AI and intelligent technologies. It would demand cultural transformation as well—the transformation in the thinking of not only developers, scientists, and administrators but also of the users. AI needs to safeguard user interests and it is "the AI" that will be the tool and also the mechanism for safeguarding from AI.

10.1 Future of Digital Business Innovation

The decentralization and digital ownership challenges further question regarding managing expectations. The digital business innovation is working more on the integration of businesses. The strategic collaboration and AI partnership create avenues for business expansion and new opportunities. We could experience the merger between human creativity and machine creativity, human thinking, and machine thinking with unprecedented co-working. This will create the expansion for business space and new roles and opportunities will emerge. These opportunities will not be limited to GenAI space but every other business will graduate to talk with every other business and will take us to new possibilities every day. The next level of technologies will also introduce new roles for executives. CEOs will become facilitators and the scope of chief knowledge officers will go beyond the organization welfare and knowledge management. The intelligent business innovation creates new connections to make it possible for businesses to work together. What could be follow innovation like LLMs and what could follow innovations like GenAI? Will it be InclusiveAI or will it be CreativeAI? Inclusive AI will make competitors partners, non-customer customers and expand the business space. What today may not look like a valid business proposal the CreativeAI may make it a possible multi-billion-dollar idea. There are many more possibilities and surprises in store and intelligent business innovation will offer to cope up with these surprises. Being human and by understanding our true sapiens' roots, we could use our innovations not simply as a business enabler but also to make this world a better place to live in.