

# ECONOMICS OF INNOVATION

**MASTER OF BUSINESS ADMINISTRATION (MBA)**

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**(FOR LIMITED CIRCULATION ONLY)**



**DEPARTMENT OF DISTANCE AND CONTINUING EDUCATION  
UNIVERSITY OF DELHI**

ECONOMICS OF INNOVATION

[FOR LIMITED CIRCULATION ONLY]

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# UNIT - I





# Economics of Innovation

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## STRUCTURE

- 1.1 *Learning Objectives*
- 1.2 *Introduction*
- 1.3 *Historical Evolution of Innovation Economics*
- 1.4 *Industrial Revolution and the Economics of Innovation: Navigating Transformation Through the Ages*
- 1.5 *Impact of Innovation*
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- 1.12 *Self-Assessment Questions*
- 1.13 *Reference*
- 1.14 *Suggested Readings*

### 1.1 Learning Objectives

- ◆ Recognize key contributors and foundational concepts in the emergence of the economics of innovation.
- ◆ Understand the historical context that gave rise to the specialization field within economic theory.



- ◆ Grasp Joseph Schumpeter's role as a pivotal figure, distinguishing between invention and innovation
- ◆ Trace the historical waves of innovation from the Industrial Revolution to contemporary times.
- ◆ Investigate how technological advancements, particularly during the Industrial Revolution, led to social and economic transformations, including shifts in labor dynamics and societal structures.

## 1.2 Introduction

The economics of innovation stands as a dynamic and ever-evolving discipline within economic theory, weaving together insights from industrial organization, sociology, history of technology, firm theory, and the management of technology. Emerging around the mid-20th century, this specialized field has thrived on the intersection of diverse realms, including biology, physics, cognitive psychology, information theory, and mathematical statistics. Delving into the origins of the economics of innovation unveils a rich tapestry of economic thought, where contributions from scholars of the 19th century laid the groundwork for the systematic study of technological change.

This exploration begins with an examination of the “pre-Schumpeterian” era, a period characterized by scattered references to technology among Physiocratic and Mercantilist scholars. While the 17th-century “Statute of Monopolies” in England hinted at the potential economic incentives of temporary monopolies for technical inventions, it was Francis Bacon who envisioned the transformative power of science on economic conditions and standards of living. His work, particularly “New Atlantis” (1629), laid the early foundations for concepts that would later be recognized as central to the economics of innovation.

As the 19th century unfolded, economic luminaries such as Adam Smith and David Ricardo further contributed to the discourse. Smith's ideas on the specialization and division of labor influencing technological progress and Ricardo's discussion of technology lessening workload provided glimpses into the economic dynamics intertwined with technological advancements. However, it was not until the mid-19th century that Charles Babbage's “On the Economy of Machinery and Manufacturers” (1832) offered a more



explicit exploration of the economics of technology. Though Babbage's work has been overshadowed by time, some argue that it could be to industry and technology economists what Smith's seminal work was to economics in general.

The 20th century witnessed the emergence of scholars like Karl Marx and Thorstein Veblen, who scrutinized technological change from macroeconomic perspectives, emphasizing its social dimensions, class struggles, and evolutionary aspects. Yet, it was Joseph Schumpeter who, in 1939, systematically analyzed the pivotal role of innovation in modern economies, introducing the seminal distinction between invention and innovation. His insights into the effects of innovation on firms, sectors, and markets, as well as his perspectives on monopolies, continue to shape the discourse within the economics of innovation.

This book embarks on a journey through the annals of economic thought, tracing the historical roots of the economics of innovation, and delving into the transformative waves of industrial revolutions that have shaped and reshaped economies across time. As we navigate this rich tapestry of ideas, we seek to understand not only how innovation has propelled economic progress but also how economic theories have adapted to comprehend the intricacies of technological change through the ages.

### 1.3 Historical Evolution of Innovation Economics

The rich tapestry of innovation economics unfolds across centuries, shaped by the visionary insights of prominent scholars and thinkers. A pivotal chapter in this narrative begins with the emergence of the Industrial Revolution, a period of transformative change that laid the groundwork for subsequent waves of innovation. From the mechanization of agriculture to the advent of information technology, each epoch has been meticulously examined by scholars who sought to understand the intricate dance between technological progress and economic development. Notably, Joseph Schumpeter, the Austrian economist considered the "father of innovation economics," played a foundational role in formalizing this sub-discipline. His heterodox theories challenged the prevailing neoclassical thought, introducing dynamic perspectives that embraced systemic change, entrepreneurial dynamism, and the concept of "creative destruction." As we embark on a journey through the waves of innovation, we'll traverse the



intellectual landscapes shaped by Schumpeter and other influential figures, unravelling the history and theories that have laid the foundation for our contemporary understanding of the economics of innovation. Figure 1 shows how innovation cycles have impacted economies since 1785, and what's next for the future:

### **1. The First Wave: Industrial Revolution (Late 18th to Early 19th Century)**

The inaugural wave, marked by the Industrial Revolution, unfolded in the late 18th to the early 19th century. This period witnessed the mechanization of agriculture, the introduction of steam engines, and the innovation of textile machinery. The profound economic shifts from agrarian to industrial societies were propelled by urbanization and significant advancements in manufacturing.

### **2. The Second Wave: Electrification and Mass Production (Late 19th to Early 20th Century)**

In the late 19th to early 20th century, the second wave brought forth the harnessing of electricity, the internal combustion engine, and the refinement of mass production techniques. This era saw the electrification of cities, the rise of the automobile industry, and increased manufacturing efficiency, setting the stage for substantial growth in consumer markets.

### **3. The Third Wave: Information Technology and Digitalization (Mid-20th Century to Present)**

The mid-20th century ushered in the third wave characterized by the proliferation of information technology and digitalization. Computers, semiconductors, and the internet became pivotal innovations, reshaping communication, business processes, and the global economy. This wave solidified the emergence of the knowledge-based economy.

### **4. The Fourth Wave: Biotechnology and Genomics (Late 20th Century to Present)**

Advancements in biotechnology and genomics defined the fourth wave, spanning the late 20th century. Genetic engineering, gene sequencing, and bioinformatics revolutionized healthcare, agriculture, and pharmaceuticals. The promise of personalized medicine and innovative therapies became tangible outcomes of this wave.



The History of

# INNOVATION CYCLES

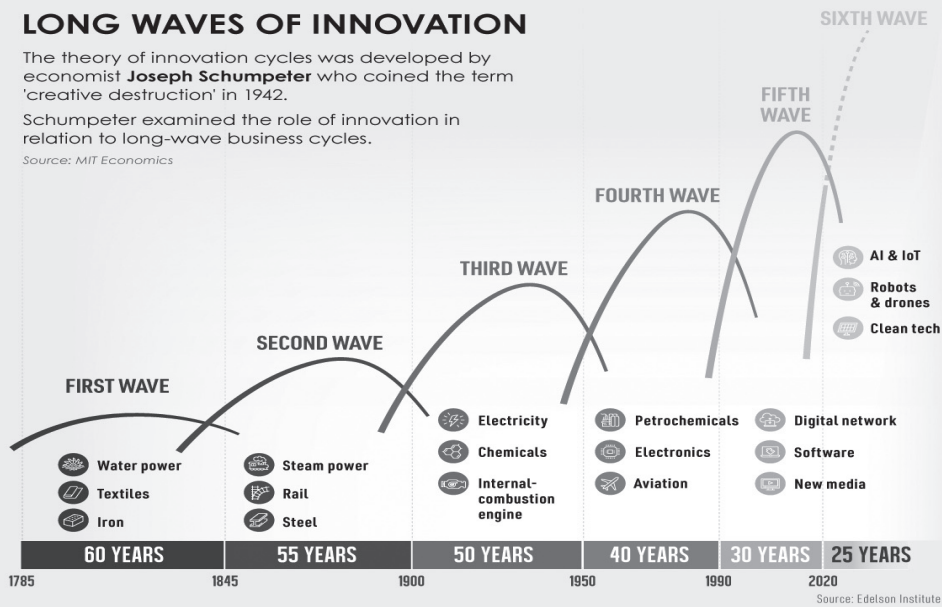
Below, we show waves of innovation across 250 years, from the Industrial Revolution to sustainable technology.

## LONG WAVES OF INNOVATION

The theory of innovation cycles was developed by economist **Joseph Schumpeter** who coined the term 'creative destruction' in 1942.

Schumpeter examined the role of innovation in relation to long-wave business cycles.

Source: MIT Economics



Source: Edelson Institute

## KEY BREAKTHROUGHS

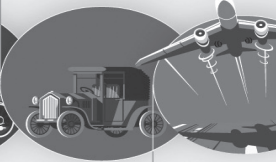
### FIRST WAVE

During the Industrial Revolution, the first factory emerged—a cotton mill in Britain.



### THIRD WAVE

Henry Ford's Model T introduced the assembly line, revolutionizing the automotive industry.



### FIFTH WAVE

In 1990, 2.3M used the internet—by 2016 this reached 3.4B.

Source: World Bank



### SECOND WAVE

As railways proliferated, their networks strongly influenced urban growth.

Source: Nacima Baron, HAL



### FOURTH WAVE

Aviation gains mass adoption on a global scale, providing a lever to economic integration.

Source: OECD



### SIXTH WAVE

As climate challenges intensify, clean tech may reshape business models and consumption patterns.



Facebook: /visualcapitalist | Twitter: @visualcap | Website: visualcapitalist.com

COLLABORATORS | RESEARCH + WRITING: Dorothy Neufeld | ART DIRECTION + DESIGN: Joyce Ma

Source: Edelson Institute



### 5. The Fifth Wave: Artificial Intelligence and Machine Learning (Late 20th Century to Present)

The late 20th century and continuing into the present, the fifth wave brought forth the era of artificial intelligence and machine learning. Computers gained the ability to learn and adapt, transforming various sectors such as finance, healthcare, and manufacturing. Automation technologies and sophisticated algorithms reshaped decision-making processes and further integrated technology into everyday life.

### 6. The Anticipated Sixth Wave: Renewable Energy and Sustainable Technologies (21st Century)

Anticipating the 21st century, the sixth wave centers around renewable energy and sustainable technologies. Innovations in solar, wind, and other clean energy sources respond to environmental concerns, reshaping the energy landscape, and guiding economies toward a more sustainable and resilient future.

Each wave represents a distinct chapter in the ongoing story of technological progress, with unique characteristics and economic implications. The subsequent exploration of these waves will unravel the intricacies and dynamics between innovation and economic growth across different epochs.

#### CASE STUDY 1

##### **Impossible Foods - Pioneering Sustainability Through Life Cycle Assessment**

**Introduction:** Impossible Foods, a trailblazer in plant-based alternatives to meat and dairy, aims to transform the global food system by reducing the environmental impact of animal product consumption. Their flagship product, a plant-based burger, is crafted from innovative ingredients such as coconut oil, textured vegetable protein, and potato protein. Faced with the environmental challenges associated with beef production, Impossible Foods embarked on a journey to comprehensively understand the life cycle impacts of its product and communicate these findings transparently to consumers.



**The Issue:** Beef, a resource-intensive component of global diets, prompted Impossible Foods to delve into the environmental repercussions of food ingredients and processes. Their goal was to develop a plant-based alternative with clear environmental benefits, fostering consumer motivation beyond taste to make environmentally conscious choices.

**The Solution:** Recognizing the integral role of environmentally-friendly choices in their mission, Impossible Foods committed to an ongoing and rigorous Life Cycle Assessment (LCA) of their products. They initiated a farm-to-factory LCA of the Impossible Burger, comparing its impacts to ground beef. The assessment, performed using professional LCA software, aimed to reveal hotspots and impacts throughout the supply chain. External reviews ensured the credibility of their findings, paving the way for transparent communication with customers.

**The Challenges:** The LCA process posed challenges in terms of staff time, costs, and collaboration across company divisions. Significant efforts were required to collect data from various operational domains, emphasizing the importance of engaging experts from manufacturing, R&D, and facilities. The unique fermentation method used in the production process added complexity, demanding close collaboration with engineers to model energy requirements accurately.

**The Advice:** Impossible Foods advises companies undertaking LCA to read industry reports and journal articles comprehensively. For those partnering with sustainability consultants, understanding the methodologies and theories behind various footprinting protocols is crucial. They emphasize the importance of starting small, giving staff ample time, and building a life cycle inventory early on to understand baseline performance.

**The Benefits:** While the economic benefits are yet to be fully realized, Impossible Foods has derived value from communicating the sustainability of their product to customers and investors. The in-depth



understanding gained through the LCA has influenced future growth strategies, optimal facility designs, and streamlined operations. The environmental benefits include reduced impact on production and suppliers, aiding consumers in choosing environmentally preferable products.

This case study showcases Impossible Foods' commitment to sustainability, leveraging LCA to not only meet their mission but also to educate consumers and drive positive environmental change.

### **1.4 Industrial Revolution and the Economics of Innovation: Navigating Transformation Through the Ages**

The economics of innovation, a burgeoning field within economic theory, finds its roots in the transformative epochs known as the Industrial Revolutions. Emerging around the mid-20th century, this specialized field synthesizes insights from various disciplines to unravel the complex dynamics of technological advancements and their profound impacts on societies. Our exploration begins with a historical voyage through the Industrial Revolutions, tracing the evolution from Industry 1.0 to the current frontier of Industry 4.0.

#### **1. The First Industrial Revolution (1760 - Late 18th Century)**

The inaugural chapter unfolded in Britain around 1760, focusing on mechanizing the textile industry and harnessing the power of steam. Key players like James Watt and Co. and Arkwright's Cotton Mills laid the groundwork for the mechanized transformation of production processes, setting the stage for a paradigm shift in working conditions and lifestyles.

#### **CASE STUDY 2**

##### **The Transformation of the Textile Industry in Industrial Revolution England**

At the onset of the Industrial Revolution in the late 18th century, the textile industry in England was largely characterized by manual labour



and traditional methods of production. With the advent of technological innovations, this industry underwent a profound transformation that would serve as a paradigm for industrial change.

**Technological Innovations:** The introduction of mechanized spinning and weaving technologies revolutionized the textile manufacturing process. Key inventions, such as the spinning jenny by James Hargreaves and the power loom by Edmund Cartwright, drastically increased production capacities. These machines replaced manual labour, enabling the mass production of textiles at a scale previously unimaginable.

**Impact on Production:** The adoption of machinery resulted in a significant increase in the speed and volume of textile production. Factories emerged as centres of production, bringing together various stages of the manufacturing process under one roof. This shift from cottage industries to factory-based production not only boosted efficiency but also altered the organization of labour.

**Labor and Social Changes:** As factories became the hub of textile production, the demand for labour in these industrial centres skyrocketed. This led to rural-to-urban migration as people sought employment opportunities in the burgeoning factories. The nature of work changed, with labourers now operating machines rather than engaging in manual craftsmanship. This shift in labour dynamics had profound social implications, contributing to the rise of an industrial working class.

**Economic Impact:** The increased efficiency and scale of textile production had a cascading effect on the economy. England became a global leader in textile exports, fuelling economic growth and laying the foundation for its industrial dominance. The industrialization of the textile industry exemplified the broader economic shifts brought about by the Industrial Revolution.



**Key Takeaways from the Industrial Revolution Textile Industry Case Study:**

- ◆ **Technological Revolution:** Introduction of mechanized spinning and weaving transformed the textile industry, replacing manual labor with efficient machines.
- ◆ **Factory System Evolution:** Transition from cottage industries to factories centralized production, optimizing processes and changing the nature of work.
- ◆ **Labor Dynamics and Urbanization:** Demand for factory labor led to significant rural-to-urban migration, creating an industrial working class.
- ◆ **Economic Dominance:** England's rise as a global leader in textile exports showcased how technological innovation can fuel economic growth and establish industrial dominance.
- ◆ **Social Challenges:** The Industrial Revolution brought social challenges, including labor exploitation and poor working conditions, prompting movements for workers' rights.
- ◆ **Legacy of Innovation:** The case study underscores how innovation in one industry can serve as a catalyst for broader industrial and economic transformations.
- ◆ **Balancing Progress and Challenges:** The dual nature of industrialization highlights the importance of addressing social, labor, and ethical considerations alongside economic progress.
- ◆ **Lessons for Future Development:** Studying this case provides insights into responsible technological implementation, equitable labor practices, and comprehensive societal responses to industrial change.

**2. The Second Industrial Revolution (1850s - Early 1900s)**

Spanning the late 19th century, the Second Industrial Revolution marked the ascendance of steel, oil, and electricity, accompanied



by groundbreaking innovations like the telegraph and telephone. Corporate giants such as Standard Oil and US Steel emerged, shaping industries and economies with a focus on mass production and communication.

### 3. The Third Industrial Revolution (1960s - 2000s)

The 'Digital Revolution' of the mid-20th century to the early 21st century was characterized by computing advances and the rise of the internet. Visionary companies like Apple and Google became standard-bearers, altering the economic landscape by revolutionizing communication, information sharing, and personal computing.

### 4. The Fourth Industrial Revolution (Early 2010s - Present)

Industry 4.0, the contemporary epoch, witnesses the convergence of cutting-edge technologies like Artificial Intelligence, Additive Manufacturing, Blockchain, Augmented Reality, Nanotechnology, and the Internet of Things. Though the timeline is still unfolding, the early 2010s mark the inception of this era. OpenAI, a contender in the field of artificial intelligence, exemplifies the transformative potential of these technologies, ushering in new business models and reshaping the very essence of industry.

## CASE STUDY 3

### The Electrical Industry

The expansion of the electrical industry can be traced to the late 19th century, marked by the contributions of inventors like Thomas Edison, Nikola Tesla, and George Westinghouse, who played pivotal roles in the development and commercialization of electricity.

As power stations, transformers, and light bulbs were introduced, the industry witnessed the emergence of innovative applications for electricity. Electric motors, for instance, were instrumental in automating manufacturing processes, while household appliances transformed the daily lives and work routines of people. This comprehensive electrification not only boosted productivity but also ushered in novel forms of communication and more efficient transportation systems.



### Key Lessons Learnt

**Strategic Vision:** Proactively anticipate the repercussions of emerging technologies on your industry, and develop a strategic vision to navigate and capitalize on these changes.

**Sustainable Innovation:** Recognize that your product or service may have broader applications than initially perceived. Embrace sustainability by exploring and leveraging diverse use cases for long-term viability.

**Holistic Perspective:** Adopt a holistic perspective on technological advancements, considering not only their immediate impact but also their potential long-term effects on your industry and beyond.

**Adaptability and Diversification:** Foster adaptability within your organization to swiftly respond to evolving market demands. Explore diversified applications for your product or service, uncovering untapped potentials and ensuring resilience in a dynamic business environment.

## 1.5 Impact of Innovation

Innovation serves as a driving force with far-reaching implications, profoundly impacting various facets of a company's operations and overall trajectory. Firstly, in terms of creativity and idea generation, fostering an innovative culture within a company cultivates an environment where employees feel empowered to generate and incubate novel ideas, fueling continuous creativity. Second, innovation significantly influences Research and Development (R&D) investment, driving technological advancements that form the foundation for cutting-edge products, thus ensuring a company stays at the forefront of industry evolution. Thirdly, innovation plays a crucial role in product portfolio diversification, enabling companies to expand into new markets and mitigate risks associated with overreliance on a single product or market segment. Lastly, the impact of innovation on market responsiveness is pivotal, allowing companies to adapt swiftly to changing consumer trends and maintain a competitive edge by meeting



evolving customer demands in a dynamic market landscape. Overall, the pervasive influence of innovation underscores its pivotal role in shaping a company's growth, competitiveness, and sustainability. Let's discuss the impact of innovation on four major areas:

- ◆ Innovation and Business Cycle
- ◆ Innovation and employment
- ◆ Innovation and company performance
- ◆ Product innovation and growth

## 1.6 Impact of Innovation and Business Cycle

The impact of innovation on the business cycle is a dynamic and multifaceted relationship that influences economic growth, productivity, and market dynamics. Here are several key aspects to consider:

### 1. Economic Growth and Productivity:

- ◆ **Positive Impact:** Innovation is a primary driver of economic growth. Technological advancements, new products, and improved processes contribute to increased productivity and efficiency, fostering overall economic expansion.
- ◆ **Negative Impact:** Rapid innovation can lead to creative destruction, where new technologies replace older ones. This can result in short-term disruptions, job displacement, and the decline of traditional industries.

### 2. Business Cycle Phases:

- ◆ **Expansion Phase:** During economic expansions, innovation often thrives. Increased consumer demand, business confidence, and access to capital create a conducive environment for companies to invest in research and development (R&D) and bring new products to market.
- ◆ **Contractions and Recessions:** Economic downturns can impact innovation as businesses may cut back on R&D spending and focus on cost-cutting measures. However, some innovations may emerge as a response to economic challenges, leading to efficiency improvements and new business models.



### 3. Investment and Capital Flows:

- ◆ **Positive Impact:** Innovation attracts investment, and during periods of economic growth, there is often increased venture capital and private equity funding for innovative startups. This influx of capital supports research, development, and the scaling of new technologies.
- ◆ **Negative Impact:** Economic downturns can lead to reduced investment in innovation as risk aversion rises. Access to funding may become constrained, particularly for early-stage ventures, impacting the pace of technological advancements.

#### *Labor Market Dynamics:*

**Positive Impact:** Innovation creates new job opportunities, especially in emerging industries. As businesses adopt new technologies, skilled workers are often in demand, contributing to job growth and wage increases.

**Negative Impact:** Some innovations may lead to job displacement, particularly in industries where automation and technology replace traditional labor. This can contribute to short-term unemployment challenges.

#### *Consumer Behavior and Market Disruption:*

**Positive Impact:** Innovative products and services often meet consumer needs more effectively, leading to increased consumer spending and market growth. Disruptive innovations can create entirely new markets and industries.

**Negative Impact:** Market disruptions caused by innovation can lead to the decline or obsolescence of existing products or industries, affecting businesses that fail to adapt.

#### *Government Policies and Regulations:*

**Positive Impact:** Supportive government policies, such as tax incentives for R&D and innovation-friendly regulations, can foster an environment conducive to technological advancement.

**Negative Impact:** Regulatory hurdles or uncertain policy environments may impede innovation. Stringent regulations can also affect the speed at which new technologies are adopted.



## 1.7 Impact of Innovation on Employment

The relationship between innovation and employment is intricate, involving both positive and negative dynamics that vary across industries, skill levels, and economic conditions. Here are key insights into how innovation impacts employment:

### *Job Creation through Innovation:*

**Emerging Industries:** Innovation often gives rise to entirely new industries and sectors, creating job opportunities in areas such as technology, renewable energy, and biotechnology.

**Entrepreneurship:** Startups and innovative ventures contribute significantly to job creation, as entrepreneurs develop novel products, services, and business models.

### *Job Displacement and Automation:*

**Technological Unemployment:** Automation and advanced technologies can replace certain repetitive or manual tasks, leading to concerns about technological unemployment. Jobs in manufacturing, routine data entry, and certain service industries may be susceptible to automation.

**Skill Shift:** While some jobs may be displaced, innovation often results in the creation of new, higher-skilled roles. The workforce needs to adapt by acquiring new skills to remain relevant in the evolving job market.

### *Productivity and Efficiency Gains:*

**Streamlined Processes:** Innovations in technology and management practices enhance efficiency and productivity, allowing companies to do more with less. This can lead to business growth and job creation in other areas of the organization.

**Global Competition:** Innovations that improve efficiency make businesses more competitive globally, sustaining or expanding market share, and potentially leading to increased hiring.

***Job Quality and Wage Disparities:***

**High-Skilled Jobs:** Innovations often create demand for high-skilled and specialized workers, leading to the growth of high-paying jobs in fields such as technology, research, and design.

**Income Inequality:** The impact of innovation on job quality is a double-edged sword. While high-skilled jobs may see wage growth, low-skilled jobs may face stagnation or decline, contributing to income inequality.

***Entrepreneurial Ecosystems and Startups:***

**Innovation Hubs:** Regions fostering innovation often have vibrant entrepreneurial ecosystems, supporting startups and small businesses that can be significant contributors to local employment.

**Risk of Failure:** The startup environment is characterized by risk, and not all ventures succeed. Failures can result in job losses, but successful startups can become major employers.

***Government Policies and Training Initiatives:***

**Support for Reskilling:** Governments and businesses may implement policies to support reskilling and upskilling initiatives, helping workers adapt to changing job requirements due to technological advancements.

**Labor Market Flexibility:** Policies that promote labor market flexibility can facilitate smoother transitions for workers affected by job displacement, allowing them to move into new roles more effectively.

***Social Impact and Inclusive Growth:***

**Social Innovation:** Innovations addressing social challenges can create jobs in sectors like healthcare, education, and community development, contributing to inclusive economic growth.

**Ensuring Inclusivity:** Policymakers and businesses need to ensure that the benefits of innovation are inclusive, addressing potential disparities and providing opportunities for a diverse range of workers.

**1.8 Impact of Innovation on Company Performance**

The impact of innovation on company performance is substantial, influencing various aspects of a firm's operations, market position, and long-term



sustainability. Here are key ways in which innovation positively affects company performance:

***Market Differentiation and Competitiveness:***

**Product Innovation:** Introducing innovative products or services allows a company to differentiate itself in the market. Unique and cutting-edge offerings can attract customers and give the company a competitive edge over rivals.

**Brand Positioning:** Innovation contributes to a positive brand image, positioning the company as forward-thinking and dynamic. This perception can enhance customer loyalty and attract new audiences.

***Revenue Growth and Market Expansion:***

**New Revenue Streams:** Innovations often open avenues for new revenue streams. Companies that continuously invest in R&D and bring novel solutions to market can experience sustained revenue growth.

**Global Reach:** Breakthrough innovations can enable companies to expand into new markets, both domestically and internationally, further contributing to revenue expansion.

***Operational Efficiency and Cost Reduction:***

**Process Innovation:** Innovations in operational processes, logistics, and supply chain management can enhance efficiency, reduce costs, and optimize resource utilization.

**Technological Advancements:** Adopting advanced technologies internally can streamline operations, leading to cost savings and improved overall performance.

***Customer Satisfaction and Loyalty:***

**Enhanced Customer Experience:** Innovations that improve the customer experience, such as user-friendly interfaces, personalized services, and responsive support systems, contribute to higher customer satisfaction.

**Brand Loyalty:** Satisfied customers are more likely to become loyal advocates for a brand, leading to repeat business and positive word-of-mouth marketing.

***Adaptation to Market Changes:***

**Agility and Flexibility:** Innovative companies are often more adaptable to changes in the business environment. They can pivot quickly in response to market trends, technological shifts, or regulatory changes.

**Risk Mitigation:** Diversifying product or service offerings through innovation can mitigate risks associated with dependence on a single market or product line.

***Employee Morale and Talent Attraction:***

**Innovation Culture:** Fostering a culture of innovation within the company enhances employee morale and engagement. Employees are more likely to be motivated when they see their ideas and contributions valued.

**Attraction of Talent:** Innovative companies are attractive to top talent seeking dynamic and challenging work environments. This aids in recruiting and retaining skilled professionals.

***Sustainability and Corporate Social Responsibility:***

**Green Innovations:** Companies that invest in eco-friendly or sustainable innovations align with growing consumer preferences for environmentally conscious products and practices.

**CSR Impact:** Innovation in social responsibility initiatives, such as community engagement and ethical business practices, can positively impact the company's reputation and performance.

***Long-Term Resilience and Future Readiness:***

**Future-Proofing:** Companies that consistently innovate are better positioned to navigate uncertainties and disruptions, making them more resilient in the face of evolving market conditions.

**Preparedness for Technological Shifts:** Staying at the forefront of technological advancements ensures that a company is prepared for industry changes and can leverage emerging opportunities.



## 1.9 Impact of Innovation on Product Innovation and Growth

Innovation has a profound impact on product innovation and growth, playing a central role in shaping a company's ability to create novel offerings, capture market share, and drive sustained expansion. Here are key ways in which innovation influences product innovation and growth:

### *Creativity and Idea Generation:*

**Idea Incubation:** Innovation fosters a culture of creativity within a company, encouraging employees to generate and incubate new ideas. This creative environment is a catalyst for product innovation.

### *Research and Development (R&D) Investment:*

**Technological Advancements:** Companies that allocate resources to R&D activities are better equipped to leverage technological advancements. These investments lead to the development of cutting-edge products that meet evolving customer needs.

### *Product Portfolio Diversification:*

**Expansion into New Markets:** Innovation allows companies to diversify their product portfolios, entering new markets and reaching different customer segments. Diversification minimizes dependence on a single product or market.

### *Market Responsiveness:*

**Adapting to Consumer Trends:** Innovations enable companies to respond swiftly to changing consumer preferences and market trends. This agility is crucial for staying ahead of competitors and meeting evolving customer demands.

### *Competitive Advantage:*

**Differentiation:** Innovative products set companies apart from competitors, providing a unique selling proposition. A distinctive product offering creates a competitive advantage and enhances the company's market position.



## Notes

**First-Mover Advantage:** Companies that pioneer innovations in their industry often gain a first-mover advantage, establishing themselves as industry leaders and influencers.

***Customer Value Proposition:***

**Enhanced Customer Experience:** Innovations contribute to the improvement of product features, quality, and functionality, enhancing the overall customer experience. Products that provide significant value are more likely to foster customer loyalty.

***Speed to Market:***

**Efficient Product Development:** Innovations in product development processes, such as rapid prototyping and agile methodologies, enable companies to bring products to market more quickly. This speed is crucial in capturing early market share.

***Revenue Growth and Market Share:***

**Expanding Revenue Streams:** Launching innovative products can lead to increased sales and revenue. Successful products contribute directly to a company's growth trajectory.

**Market Dominance:** Consistent product innovation allows companies to establish and maintain a strong market presence, capturing a larger share of the market.

***Long-Term Sustainability:***

**Future-Proofing:** Companies that continuously innovate are better positioned for long-term sustainability. They are more adaptable to changes in market conditions, technological shifts, and emerging industry trends.

***Ecosystem Collaboration:***

**Partnerships and Alliances:** Innovation often involves collaboration with external partners, suppliers, or startups. These collaborations can bring complementary expertise, resources, and capabilities, fostering a robust innovation ecosystem.



**Brand Image and Reputation:**

**Innovation Leadership:** A reputation for innovation enhances a company's brand image, instilling confidence in customers and investors. Customers are more likely to choose products from a company perceived as an industry innovator.

**IN-TEXT QUESTIONS**

1. What is innovation?
  - (a) Maintaining the status quo
  - (b) Creating and implementing new ideas for positive change
  - (c) Copying existing products
  - (d) Avoiding technological advancements
2. Who introduced the concept of creative destruction?
  - (a) Adam Smith                      (b) Karl Marx
  - (c) Joseph Schumpeter              (d) John Maynard Keynes
3. How is economic development defined?
  - (a) Short-term financial gains
  - (b) Sustained, qualitative improvement in standard of living
  - (c) Rapid industrialization
  - (d) Decrease in education levels
4. What does a creative environment in the workplace encourage?
  - (a) Strict adherence to rules
  - (b) Conformity and routine
  - (c) Creative thinking and experimentation
  - (d) Hierarchical decision-making
5. Market differentiation involves:
  - (a) Maintaining a similar product to competitors
  - (b) Offering unique features, quality, or branding
  - (c) Lowering prices to attract customers
  - (d) Avoiding changes in product offerings



**IN-TEXT QUESTIONS**

6. What does technological advancement contribute to?
  - (a) Stagnation in industries
  - (b) Decreased efficiency and capability
  - (c) Development of new tools, equipment, or processes
  - (d) Preservation of traditional methods
7. What does agility and flexibility in business refer to?
  - (a) Resistance to change
  - (b) Slow response to market trends
  - (c) Quick and effective adaptation to changes
  - (d) Rigid organizational structure
8. What is the goal of market differentiation?
  - (a) Conforming to industry norms
  - (b) Lowering product quality
  - (c) Standing out from competitors
  - (d) Reducing innovation
9. Why is sustainability important for a company or economic system?
  - (a) To encourage wasteful practices
  - (b) To thrive only in the short term
  - (c) To endure and thrive over the long term
  - (d) To ignore economic factors
10. Who is associated with the theory of creative destruction?
  - (a) Adam Smith
  - (b) Karl Marx
  - (c) Joseph Schumpeter
  - (d) John Maynard Keynes



## 1.10 Summary

The chapter on the economics of innovation delves into the historical evolution of this specialized field within economic theory. Emerging around the mid-20th century, it amalgamated insights from various disciplines such as industrial organization, sociology, technology history, and management. The 19th-century economists laid the groundwork, with figures like Babbage, Marx, and Veblen contributing to early discussions on the relationship between technology, innovation, and economic development. However, it was Schumpeter in the early 1900s who systematically analyzed the role of innovation in modern economies, introducing concepts like “creative destruction” and distinguishing between invention and innovation. The discussion extends to the present day, emphasizing the continuous interplay of innovation with economic, social, and technological dimensions. The impact of innovation on employment, business cycles, and company performance underscores its multifaceted role in shaping the dynamics of economic systems. From fostering creativity and differentiation to influencing market responsiveness and sustainability, innovation emerges as a transformative force driving growth, competitiveness, and long-term resilience in the ever-evolving economic landscape.

## 1.11 Answers to In-Text Questions

1. (b) Creating and implementing new ideas for positive change
2. (c) Joseph Schumpeter
3. (b) Sustained, qualitative improvement in standard of living
4. (c) Creative thinking and experimentation
5. (b) Offering unique features, quality, or branding
6. (c) Development of new tools, equipment, or processes
7. (c) Quick and effective adaptation to changes
8. (c) Standing out from competitors
9. (c) To endure and thrive over the long term
10. (c) Joseph Schumpeter



### 1.12 Self-Assessment Questions

1. Provide an in-depth analysis of how the concept of innovation has evolved over time, tracing its historical roots and highlighting key milestones. Discuss its transformative role in shaping economic structures and development.
2. Assess the various ways in which innovation influences employment patterns. Discuss both the positive and potentially disruptive aspects, considering changes in job markets and the emergence of new industries.
3. Explore the relationship between entrepreneurship and creative destruction, drawing insights from Schumpeter's theories. Discuss how entrepreneurs contribute to economic growth through innovation and the challenges they may face in the process.

### 1.13 Reference

- ◆ Hall, B., & Rosenberg, N. (eds.). (2010). *Handbook of the Economics of Innovation*. North Holland.

### 1.14 Suggested Readings

- ◆ Afuah, A. (2009). *Innovation Management: Strategies, Implementation, and Profit*. Oxford University Press.
- ◆ Burgelman, R., & Christensen, C. (2017). *Strategic Management of Technology & Innovation*. McGraw Hill Education.
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# UNIT - II





# Scope and Theories of Innovation

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## STRUCTURE

- 2.1 *Learning Objectives*
- 2.2 *Introduction*
- 2.3 *Types of Innovation*
- 2.4 *Sources of Innovation*
- 2.5 *Path Dependency*
- 2.6 *Theories of Innovation*
- 2.7 *Summary*
- 2.8 *Answers to In-Text Questions*
- 2.9 *Self-Assessment Questions*
- 2.10 *References*
- 2.11 *Suggested Readings*

## 2.1 Learning Objectives

- ◆ To understand the various types of innovation.
- ◆ To explain the different sources of innovation.
- ◆ To understand the path dependency theory of innovation.
- ◆ To understand the various theories of innovation.



## 2.2 Introduction

Simply, innovation is the generation of new ideas as well as creativity. When people implement new ideas, it becomes innovation. Innovation, in business terms, becomes '*the commercial exploitation of ideas*'. It is true that the rapid pace of change in business is unbelievable. What is profitable and successful today may be outdated or copied by competitors tomorrow. Innovation is the key to differentiation and differentiation is the key to staying ahead in the ever-changing business world. **Oslo Manual (2005)** defined innovation as, "it is the implementation of a new or significantly improved product (good or service), process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations".

## 2.3 Types of Innovation

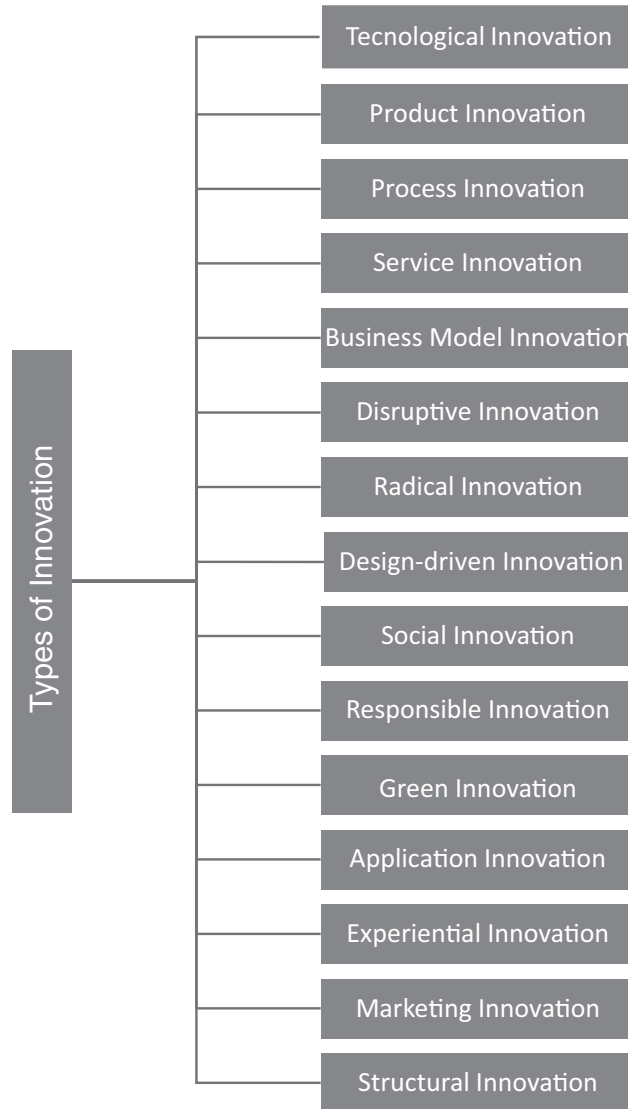
The question arises what types of innovation are there? Generally, there are product/service innovation (i.e. new or upgraded products or services); process innovation (i.e. new ways of producing, sourcing or manufacturing); market innovation (i.e. new markets or new ways of delivering goods and services) and business innovation (i.e. business transformation, business model innovation and diversification). These innovation types denote the various means by which business firms make changes to improve their performance and economic results and finally add to the growth of knowledge. Figure 2.1 exhibits various types of innovation.

### 1. Technological Innovation

It is related with the technological development of new products and new production techniques by firms. Currently, developing countries are least ready to harness frontier technologies which can increase productivity and improve livelihoods. For example, artificial intelligence combined with robotics can transform production systems, while 3D printing allows faster and cheaper low-volume manufacturing. Another example of technological innovation is the Tata Motors' key innovation of Common Rail Diesel Injection (CRDI) technology, which was first introduced in the Indica brand in the year 2001. The technology improves fuel efficiency and



reduces emissions, making it a popular choice among commercial vehicle operators.



**Exhibit 2.1: Various Types of Innovation**

**2. Product Innovation**

This innovation takes established market offerings in established markets to the next level focusing on (a) product performance increase (e.g. Intel releases its new micro-processor, Toyota releases its new hybrid Toyota Prius); (b) cost reduction (e.g. HP inkjet



printers; Dell's PCs or laptops); (c) usability improvement (e.g. Palm handhelds); or (d) any other product enhancement (e.g. various cell phones; iPod to iTunes). Innovation needs not result in a new product in all cases. For example, Emami's launch of Fair and Handsome for men is a fine example of an innovation of a new marketing opportunity and resulted in a new business for the company.

### 3. Process Innovation

It makes production processes of established products more efficient and effective (e.g. Wal-Mart's refinement of vendor-managed inventory process; Dell's personal computer supply chain and order fulfillment systems; FedEx's package tracking). Another example is of only Indian Air Express Company - the Blue Dart – that has always believed in growth powered by technology. As the Blue Dart's investment in technology infrastructure has created differentiated delivery capabilities, quality services and customized solutions for customers. The Blue Dart has indigenously developed Cosmat II, which includes an advanced state-of-the-art track and trace system for all consignments. Consignments are scanned from pick up to every transit point till delivery, using bar coding and laser scanner technology, transmitting updates automatically to the Oracle database.

### 4. Service Innovation

Service innovation refers to the development and implementation of new or significantly improved services that create value for both customers and the service providers. An example of service innovation in India is digital payment services of Unified Payments Interface (UPI). UPI is a system that powers multiple bank accounts into a single mobile application (of any participating bank), merging several banking features, seamless fund routing and merchant payments into one hood. It also caters to the "Peer to Peer" collect request which can be scheduled and paid as per requirement and convenience. Each Bank provides its own UPI App for Android, Windows and iOS mobile platform(s).

### 5. Business Model Innovation

This innovation reframes an established value proposition to the customer or a company's established role in the value chain or both (Gillette's move from razors to razor blades; IBM's shift to on-demand



computing and Apple's expansion into consumer retailing). It involves generating, altering, or adapting the method a company delivers value to its customers, captures value for itself, or both. In India, for example, Swiggy, originally known for its food delivery services, expanded its business model with the introduction of Swiggy Instamart, a hyperlocal grocery delivery service. This move permitted Swiggy to diversify its offerings and tap into the increasing demand for online grocery shopping. The hyperlocal model involves setting up small warehouses or dark stores strategically situated in different neighborhoods.

### 6. Disruptive Innovation

Harvard Business School Professor *Clayton Christensen* in his book "*The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*" popularized the concept of a "disruptive" innovation. This innovation appears from nowhere, creating a massive new source of wealth from certain technological discontinuities (e.g. Motorola's first-generation cell phones; Sony's PlayStation One, Two and Plus; Apple's iPod and iTunes; and like). It introduces a new value proposition either by creating new markets or reshaping existing markets.

### 7. Radical Innovation

It involves the development and application of totally new products, services, or processes that significantly disrupt present markets or industries. In India, there are examples of companies that have involved in radical innovation to bring about substantial changes. One example is Reliance Jio's Disruptive Telecom Services (DTS) introduced a radical innovation in the Indian telecommunications industry with its launch in September 2016. Jio disrupted the market by offering high-speed 4G data services at very affordable prices, coupled with free voice calls and text messages.

### 8. Design-driven Innovation

This involves incorporating design principles and user-centered methods into the development of products, services, or processes to make meaningful and differentiated solutions. In India, Tata Motors has incorporated design-driven innovation to improve user experiences and deliver unique value by offering Tata Nano, an



affordable and compact car design launched in 2008 in the automobile sector. It aimed to create an affordable and compact car to meet the transportation needs of a large segment of the Indian market.

### **9. Social Innovation**

It involves creation and application of new ideas, concepts, and strategies to address social problems and improve the welfare of communities. In India, numerous organizations have confirmed social innovation across different sectors. One example is Aravind Eye Care System - Vision Care for All. Founded by Dr. G. Venkataswamy in 1976 in Madurai, Tamil Nadu, India, Aravind Eye Care System has developed to become one of the largest and most efficient eye care providers in the world. It is a social innovation that aims to offer high-quality, affordable eye care services to all, with a particular attention on those who are economically poor.

### **10. Responsible Innovation**

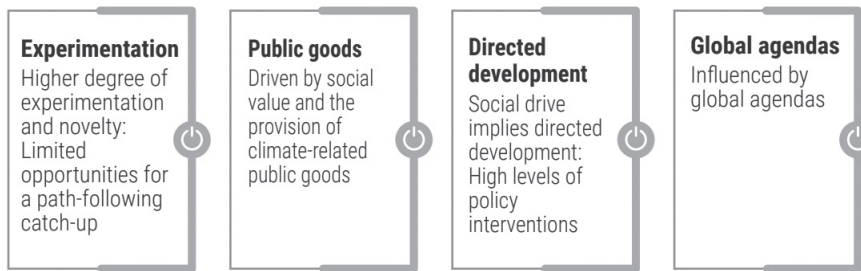
It involves ethical and sustainable development and deployment of new products, services, or processes, taking into consideration the possible social, environmental, and ethical impacts. It not only demands new business practices in terms of innovation activities such as Corporate Social Responsibility (CSR), corporate social innovation but also in business models of companies and their roles and responsibilities for the political and socio-economic system in which they operate considering to dimensions of social justice or inclusion and sustainability. In India, there is an example of an enterprise using responsible innovation. The Greenway Grameen Infra is a social enterprise based in India that focuses on providing clean and efficient cooking solutions for rural households. The company addresses the health and environmental issues associated with traditional biomass cooking methods, such as open fires and traditional stoves that generate harmful indoor air pollution.

### **11. Green Innovation**

The concept of green innovation – creating or introducing new or improved goods and services that leave lighter carbon footprints and open up green windows of opportunity. It refers to all forms of innovation that minimize environmental damage and ensure that natural resources are used in the most effective manner possible. Green



buildings, green vehicles, vertical greening, biodegradable plastic are examples of green innovation. Green innovation – goods and services with smaller carbon footprints – offer developing countries to spur economic growth and enhance technological capacities. Figure 2.2 below sets out the four main components of green innovation. The starting point is experimenting with new ideas and technologies and adapting these to local circumstances, values and priorities (Figure 2.2). To take advantage of these ideas, countries will need the appropriate infrastructure and in the form of public goods – through direct government intervention, supporting the establishment of new green sectors, for example, or introducing regulations such as on air or water pollution. Green innovation is also influenced by global agreements and agendas, rules, and mechanisms, especially those related to climate change, such as the Paris Agreement.



Source: UNCTAD.

**Figure 2.2**

At the leading edge of green innovation are new and rapidly developing technologies that take advantage of digitalization and connectivity. The 17 ‘frontier technologies’ e.g. Internet of Things (IoT), concentrated Solar power, block chain, nanotechnology, big data, 5G, biofuels, electric vehicles, gene editing, robotics, drone technology, 3D printing, wind energy, biogas and biomass, green hydrogen, artificial intelligence and solar PV highlighting their potential economic benefits and assessing country capabilities to use, adopt, and adapt these innovations. The green innovation has the following features:

- ◆ It decreases harmful environmental impact.
- ◆ The goal of innovation is a product, a procedure, a service, or a system.



- ◆ It meets customer expectations while remaining competitive in the market.
- ◆ It considers and innovates the entire product life cycle to develop a green offering.

## 12. Application Innovation

This innovation takes existing technology into new markets to serve new purposes (e.g. Tandem applied its fault-tolerant computers to the banking market to create ATMs; OnStar took Global Positioning System (GPS) into the automobile market for roadside assistance.) Another example is Suzuki Connect – Automotive Telematics that is redefining car ownership. It is an intelligent automotive telematics solution that keeps you connected with your car, irrespective of your location. It comes with a telematics device for cars that has an integrated Telematic Control Unit (TCU) and GPS receiver. Designed to provide real-time information, driving and performance updates, vehicle location, and so on; Suzuki Connect caters to all the essential needs of car ownership today.

## 13. Experiential Innovation

This innovation makes surface or cosmetic modifications to improve customer experience of established products or processes (e.g. Disneyland, Hard Rock Café and MGM Casino). It focuses on improving the overall experience of users, customers, or participants through the development of innovative products, services, or processes. In India, many companies have created experiential innovation to produce memorable and engaging experiences. One such example is Starbucks, the global coffeehouse chain, entered the Indian market in 2012 with a focus on delivering a unique and culturally relevant coffee house experience. While the core product is coffee, Starbucks in India has innovated in terms of its offerings, store ambiance, and engagement strategies.

## 14. Marketing Innovation

This innovation significantly improves customer-interfacing processes by such things as marketing communications (e.g. Web-based marketing; viral marketing), consumer transactions (e.g. Amazon's



e-commerce mechanisms; e-Bay's online auctions). The marketing innovation may be product-centric and consumer experience-centric.

### 15. Structural Innovation

This innovation capitalizes on disruption to restructure industry relationships. For instance, Fidelity and Citigroup used the deregulation of financial services to offer broader arrays of products and services to consumers under one umbrella, thus becoming fierce competitor to traditional banks and insurance companies. In case of India, another example is Vyom – a universe of new possibilities by Union Bank of India which is one-of-a-kind personalized banking at user fingertips.

#### IN-TEXT QUESTIONS

1. Who has coined the term “disruptive innovation”?
  - (a) Joseph Schumpeter
  - (b) Everett Rogers
  - (c) Michael Porter
  - (d) Clayton Christensen
2. Which one of the following is the first step in the sequence for opening green windows?
 

(a) Experimentation	(b) Public goods
(c) Directed development	(d) Global agendas
3. Suzuki Connect – Automotive Telematics is an example of which innovation type?
 

(a) Responsible innovation	(b) Green innovation
(c) Application innovation	(d) Experiential innovation

## 2.4 Sources of Innovation

Innovation involves translating a conceptual idea into a tangible application within a novel device or operational procedure. Creative ideas may originate from a wide range of sources. It may begin with one individual, as in the popular picture of the lone inventor, or it can come from



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users who create solutions to meet their own needs. University research, government labs and incubators, as well as private non-profit groups, can also produce innovative ideas. Firms are one of the main sources of innovation. Due to their typically greater resources and organizational infrastructure for resource allocation toward collective objectives, companies are well-positioned for engaging in innovation initiatives.

Furthermore, businesses are strongly motivated to develop unique and original products and services, offering them a competitive advantage compared to entities funded by governments or non-profit organizations. But the relationships among these sources are an even more important source of innovation than any one of them alone. Innovative networks that mix information and resources from different sources are among the most powerful forces operating innovation in technology. Hence, we can regard the origins of innovation as integral components of an intricate system, wherein a specific innovation may predominantly arise from one or more elements within the system or the interconnections among them.

Within a company or industry, there exist four areas of potential opportunities: (a) process requirements; (b) incongruities; (c) unforeseen events; and (d) shifts in the market and industry. Three more sources of potential in a company's social and intellectual environment are (a) new knowledge; (b) perception shifts; and (c) demographic changes.

### 1. Unexpected Occurrences

The simplest and easiest source of innovation is an unexpected opportunity, whether it is successful or not. For instance, IBM created the first contemporary accounting machine for banks in the early 1930s. But banks abstained from purchasing new, cutting-edge accounting equipment, which was a major setback to the business. However, IBM's ability to capitalize on an unanticipated success – the desire of the New York Public Library to purchase a machine – saved the company. Thus, IBM supplied libraries with over a hundred machines. Additionally, when companies discovered that computers could perform sophisticated scientific tasks like payroll jobs. IBM saw this right away and confronted the possibility of an unanticipated success when it introduced Univac's payroll machine. Five years later, IBM rose to the top of the computer business.



An equally significant source of opportunity for innovation could come from an unanticipated failure. For instance, the Ford's Edsel was the biggest new-car failure in American history, and much of the Ford's subsequent success was derived from the Edsel's failure. By dividing the market into "lifestyles" and introducing the "Mustang" brand, it gave Ford a new lease of life and restored its position as the top car in the business. As a result, for creative businesses, unanticipated successes and failures can serve as innovative sources of opportunity.

## 2. Incongruities

Incongruities can give rise to opportunities for innovation. The logic or rhythm of a product's production process is one factor contributing to incongruity. Alcon Laboratories, for instance, was one of the 1960s' success stories because Bill Conner, the co-founder of the company, took advantage of a discrepancy in medical technology by extending the shelf life of an enzyme by a few months by adding a preservative to it. The new compound was recognized by eye surgeons right away, giving Alcon Laboratories a global monopoly. However, 15 years later, Nestle bought Alcon Laboratories for a large amount.

An additional cause of the discrepancy is economic realities. An incongruity arises, for example, whenever an industry experiences a continuously growing market but decreasing profit margins, as was the case with the developed world's steel industries between 1950 and 1970. The industry's creative response was to design and develop minimills. Opportunities for innovation may also arise from the third cause of the discrepancy between expectations and outcomes.

## 3. Process Needs

By focusing on the gaps in the current product market, this innovation helps businesses reduce costs and increase profits. As an illustration, the Computational Research Laboratories (CRL) within the Tata Group in India developed a technology for parallel processing libraries. This process innovation enabled CRL to build the world's fourth-fastest computer in 2007, sustaining a speed of 117.9 trillion floating operations per second. In the same way, Tata Steel was



considered as one of the world's cost-effective steel producers prior to its purchase of Chorus. This was due to the company's use of best-in-class process innovations in operations and branding, not to low-cost labor. Another example of process needs innovation is the change of the reflector, which has been in use on Indian highways since the early 2000s and has allowed traffic to flow smoothly with fewer accidents. This innovation took advantage of a process need.

#### **4. Industry and Market Changes**

Changes in the market and industry present many opportunities for innovation. Significant market and industry changes have occurred in India, which have influenced innovation and been influenced by it. The nation's innovation environment has been shaped by a number of significant trends and advancements. Among the noteworthy areas are: digital transformation, start-up ecosystem, agri-tech innovations and healthcare innovations.

#### **5. Demographic Changes**

A nation's changing demographics present chances for innovation, and if policymakers recognize and take advantage of these changes, they may reap significant financial benefits. For example, because they considered demographics, the Japanese are ahead in robotics. Certainly, some of the most advantageous and low-risk business concepts arise from innovation opportunities facilitated by shifts in population dynamics. These changes include factors such as age distribution, educational levels, occupations, and geographic locations.

#### **6. Changes in Perception**

Although they both explain the same phenomenon, "the glass is half full" and "the glass is half empty" but have very different meanings. Considerations of a glass as half full or half empty can be changed to create enormous opportunities for innovation in management. The way people view entrepreneurship has improved, with people becoming more open to taking risks and ready to accept failure as an opportunity for learning. The perception of entrepreneurship has been significantly changed by the success stories of Indian entrepreneurs, such as those behind Paytm, Flipkart, and Ola. A new generation of innovators has been motivated to pursue their ideas with confidence by these examples.



## 7. New Knowledge

Innovations that make history are often those that are founded on new knowledge, be it social, technical, or scientific. They get the money and the attention; they are the superstars of entrepreneurship. When people talk about innovation, they are generally referring to knowledge-based innovations, although it's essential to note that not all of these innovations are necessarily substantial. For example, Cybersecurity is getting greater focus as businesses become more digitally integrated. To protect sensitive information and ensure the security of online transactions, innovations in cybersecurity technologies and procedures are essential. In another example, India's education technology industry has grown significantly. Technology is being used by virtual classrooms, online learning platforms, and personalized learning solutions to increase educational access and improve student outcomes.

### IN-TEXT QUESTIONS

4. Which one of the following areas of potential opportunity does not come within a company or industry?
  - (a) Unexpected occurrences
  - (b) Incongruities
  - (c) Changes in perception
  - (d) Process needs
  
5. The easiest and simplest source of innovation opportunity is:
 

(a) Unexpected success or failure	(b) Incongruities
(c) Changes in perception	(d) Process needs

## 2.5 Path Dependency

Three theories, namely induced innovation, the evolutionary approach, and the path-dependent model, made significant contributions to innovation theory in the latter half of the 20th century. The path dependency approaches focus on the significance of previous choices that could limit innovation in the present. For instance, the path dependent model includes the ideas of learning curves and “lock-in” and is based on the theory



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of increasing returns to adoption. The concept of increasing returns to innovation adoption asserts that a technology is more likely to be adopted on a broader scale as more users or institutions embrace it, thereby lending support to the path-dependent model. Scale effects and learning by doing are two factors that support the process, which usually results in cost savings and small improvements.

Scholarly works have acknowledged that both technologies and institutions can exhibit increasing returns to adoption. This implies that as more users adopt a technology or as an institution becomes more established; the likelihood of further adoption increases. Four main classes of increasing returns were identified by Arthur (1994): network economies, learning effects, scale economies, and adaptive expectations.

As fixed costs are allocated over higher production volumes, scale economies result in lower unit costs, which increase demand. As expertise is acquired in the production and application of a technology, learning effects manifest as enhancements in product quality and reductions in costs. As more individuals adopt current technology, uncertainty decreases and producers and users equally benefit certainty in the functionality, longevity, and quality of the system, leading to the development of adaptive expectations. Technologies that become more useful the more users they have experience network or coordination effects. The internet and mobile phones are two great instances.

Path dependency, however, may give rise to institutional rigidity, technological dominant design, the “lock-in” of created systems and technologies and the “lock-out” of possibly advantageous innovations at both the technological and institutional framework levels. In the 1980s and 90s, Brian Arthur and Paul David developed the theory that a new technology’s innovation and application are dependent upon its development path. Path dependence describes the phenomenon where past decisions, even if they are no longer pertinent, constrain the range of choices available to an entity (individual, company, institution, or entire system) in a given situation. We’ve seen that as adoption rates rise, a technology’s possibility of passing on further increases with its level of adoption. The same process may be applicable to entire systems, meaning that an institutional framework or rule is likely to become more stable the more it is applied. Therefore, this may have an important effect on



the direction of technological advancement and vice versa. As a result, organizations, innovative entities, and technologies can all start to depend on one another. The path encompasses the unique characteristics of the initial markets, the institutional and legal components governing its initiation, and the expectations of customers.

Thus, the so-called path dependency is strengthened by the innovative process. Within an industry, expectations are frequently expressed both explicitly and implicitly, resulting in technological development trajectories that have a chance to become self-fulfilling insights. Institutions and technologies promote and co-evolve one another. The mutual adaptation process between an innovation and its production environment leads to the formation of socio-technical regimes. These regimes involve social rules as institutions, and achieving significant innovation often necessitates overcoming substantial momentum and potential rule changes. Path dependence and increasing returns are linked to several important outcomes:

- ◆ Initially, despite the presence of multiple equally viable options as a new system or market begins to emerge, a dominant design or configuration may successfully “capture” that market or sector.
- ◆ Second, timing is important because the path of development is more strongly defined by early developments than by later ones.
- ◆ Thirdly, infrastructure lock-in can occur, making subsequent system changes progressively challenging and costly, particularly in situations where a network or infrastructure aligned with the dominant design is established.

Therefore, while increasing profits seem to be a “victory circle” for the existing technology or system, this rigidity could have adverse effects for the viewpoint of ambitious new entrants to the market and society at large. It is possible for one technology to completely dominate the market at the expense of a different, maybe better option. The status quo has the effect of “locking out” more radical “disruptive” innovation, such as a step-change in technology or system, while permitting incremental innovation of dominant technologies and systems. Therefore, a common definition of lock-in is the result of path dependence, whereby technological systems and technologies follow predetermined paths from which they are expensive or difficult to deviate. The concept of path dependency suggests that patterns of innovation methodology, resource allocation to



research and development (R&D), institutional structures, and operational modes are all reinforced by increasing returns.

### IN-TEXT QUESTIONS

6. Which one of the following is true with respect to path dependency model of innovation?
- (a) It focuses on the significance of previous choices that could limit innovation in the present.
  - (b) It includes the ideas of learning curves, “lock-in” and increasing returns to adoption.
  - (c) Changes in perception suggests that patterns of innovation process, resource allocation to research and development, institutional structures and operational modes are all reinforced by increasing returns to adoption.
  - (d) All of the above
7. Due to the large volume of production, cost per unit decreases and this refers to:
- (a) Scale economies
  - (b) Learning effects
  - (c) Adaptive expectations
  - (d) Network economies
8. The concept of path dependency is based on:
- (a) Pattern of innovation
  - (b) Learning effects
  - (c) Research and Development
  - (d) Increasing returns

## 2.6 Theories of Innovation

The most widely used theories of innovation includes Joseph Schumpeter’s theory of innovation, Everett Rogers’ Diffusion of innovations, Radical and Incremental theory of innovation, Henderson-Clark Model of innovation, the Afuah-Bahram value-added chain model of innovation, open innovation model and Clay Christensen’s disruptive innovation theory.

### *Joseph Schumpeter’s Theory of Innovation*

This theory views innovation as a process of “creative destruction.” and developed by Joseph Schumpeter. It refers to the process where new



innovations and technologies continually replace or destroy existing economic structures and systems. It asserts that economic progress arises from the continuous replacement of outdated technologies, products, and processes with new and more efficient ones. Innovation is a driving force for economic change and progress. This model focuses on:

- ◆ The introduction of new ideas and technologies leads to the decline and replacement of existing economic structures.
- ◆ Creative destruction is inherent in entrepreneurial activities, market innovations, and the exercise of market power.

### *Schumpeter's Focus on Innovation, Entrepreneurial Activities, and Market Power*

- ◆ **Innovation as a Key Driver:** Schumpeter considered innovation as the primary driver of economic change. He believed that the introduction of new technologies and ideas fuels economic growth.
- ◆ **Entrepreneurial Activities:** Entrepreneurship, according to Schumpeter, involves the application of innovation to bring about radical changes in production processes, products, or services. Entrepreneurs play a crucial role in implementing creative destruction.
- ◆ **Market Power:** Schumpeter highlighted the role of market power in fostering innovation. He argued that firms with significant market power have the resources and motivation to engage in disruptive innovations.

### *Impact of Market Innovations on Capitalist Systems*

- ◆ **Continuous Evolution:** Creative destruction leads to a continuous cycle of economic evolution. As new innovations replace old ones, capitalist systems undergo transformation and adaptation.
- ◆ **Market Adaptation:** The competitive nature of capitalism encourages firms to adopt innovations to maintain or enhance their market position. Those that fail to adapt may face decline or extinction.
- ◆ **Economic Progress:** Schumpeter believed that creative destruction is essential for economic progress. It not only enhances efficiency but also leads to the emergence of new industries, job opportunities, and improved living standards.



### *Critique and Considerations*

Some critics argue that Schumpeter's theory may overlook the negative aspects of creative destruction, such as job displacement and social upheaval. The theory assumes that market forces will naturally lead to beneficial outcomes, but external interventions may be necessary to address certain societal challenges arising from creative destruction.

### *Relevance in Modern Context:*

- ◆ **Innovation Economy:** Schumpeter's ideas remain relevant in today's innovation-driven economy, where disruptive technologies and business models continually reshape industries.
- ◆ **Entrepreneurial Ecosystems:** The emphasis on entrepreneurship and innovation aligns with the focus on fostering entrepreneurial ecosystems to drive economic growth.

Schumpeter's concept of creative destruction underscores the transformative power of innovation and entrepreneurship in shaping and revitalizing capitalist systems. It serves as a foundational idea in understanding the dynamic nature of economies and the role of innovation in driving progress.

### *Everett Rogers' Diffusion of Innovations*

The Diffusion of Innovations theory, developed by sociologist Everett Rogers, explores how new ideas, products, or practices spread and are adopted within a social system over time. The theory focuses on the communication channels and social processes that influence the rate at which innovations are adopted by members of a society or social system. It identifies the factors that influence the adoption and diffusion of innovations across various segments of a population.

- ◆ The diffusion process involves the communication of innovations through specific channels over time.
- ◆ The concept organizes adopters into specific categories, encompassing innovators, early adopters, early majority, late majority, and laggards.
- ◆ Factors like innovation characteristics, decision-making processes, and social systems influence the rate of adoption.



### *Factors Influencing the Adoption of Innovations:*

#### **I. Innovation Characteristics:**

- ◆ **Relative Advantage:** The degree to which an innovation is perceived as better than the existing alternatives.
- ◆ **Compatibility:** The extent to which an innovation is consistent with existing values, needs, and practices.
- ◆ **Complexity:** The perceived difficulty or complexity of understanding and using the innovation.
- ◆ **Trialability:** The ability to experiment with the innovation on a limited basis.
- ◆ **Observability:** The extent to which the results of the innovation are visible and easily observable.
- ◆ **Communication Channels:** The channels through which information about the innovation is disseminated, including mass media, interpersonal communication, and social networks.
- ◆ **Social System Factors:** Characteristics of the social environment, including cultural norms, social structures, and institutions, that influence the adoption process.

### *Categorization of Innovation Adopters:*

- ◆ **Innovators:** The first individuals to adopt an innovation. They are risk-takers, adventurous, and often have a high tolerance for uncertainty.
- ◆ **Early Adopters:** Opinion leaders who adopt innovations early in the diffusion process. They are well-respected and play a crucial role in influencing others.
- ◆ **Early Majority:** Individuals who adopt innovations before the average member of society. They tend to deliberate and gather information before making decisions.
- ◆ **Late Majority:** Skeptics who adopt innovations only after the majority has already done so. They are influenced by social pressure and practical considerations.
- ◆ **Laggards:** The last to adopt innovations. They are typically traditionalists, resistant to change, and may adopt only when it becomes a necessity.

***Adoption Process Stages:***

- ◆ **Knowledge:** Awareness and understanding of the innovation.
- ◆ **Persuasion:** Formation of a positive attitude toward the innovation.
- ◆ **Decision:** Commitment to adopting or rejecting the innovation.
- ◆ **Implementation:** Putting the innovation into practice.
- ◆ **Confirmation:** Reinforcement or adjustment of the decision to adopt based on feedback and experience.

***Diffusion Strategies:***

- ◆ **Innovation Communication:** Effective communication strategies to reach different adopter categories.
- ◆ **Opinion Leadership:** Identifying and leveraging influential individuals to promote the adoption of innovations.
- ◆ **Social Networks:** Understanding the role of social networks in facilitating the spread of innovations.

***Relevance and Applications:***

- ◆ **Technology Adoption:** The theory is widely applied in understanding the adoption of new technologies and innovations.
- ◆ **Healthcare:** It is used to study the adoption of medical treatments and preventive measures.
- ◆ **Marketing:** Businesses use diffusion strategies to promote and accelerate the adoption of new products.

Everett Rogers' Diffusion of Innovations theory provides valuable insights into the dynamics of how innovations spread through societies and the factors that influence the adoption process. It has practical applications in various fields, guiding strategies for successful innovation adoption and implementation.

***Radical and Incremental Theory of Innovation***

This categorization distinguishes between two types of innovations based on their impact on existing knowledge and processes.



### ***Radical Theory of Innovation***

It involves significant technological advancements, rendering existing products non-competitive. Often leads to the establishment of entirely new market structures. Radical innovations introduce groundbreaking, transformative changes that significantly depart from established norms. They often involve new technologies or entirely novel approaches. The Characteristics include:

- ◆ **Revolutionary Changes:** Radical innovations bring about a fundamental shift in how products or services are conceived, produced, or delivered.
- ◆ **High Disruption:** They can disrupt existing market structures, rendering previous solutions obsolete and creating new market dynamics.
- ◆ **Long-Term Impact:** Implementation may take time, and the impact is often felt over an extended period, reshaping entire industries.

### ***The Impact of Radical Innovation includes:***

- ◆ **Market Disruption:** Radical innovations can disrupt established market structures, creating opportunities for new entrants and challenging the dominance of existing players.
- ◆ **Strategic Shifts:** Companies that successfully introduce radical innovations can gain a competitive advantage by establishing new standards or creating entirely new markets.

### ***Incremental Theory of Innovation***

It builds upon existing knowledge, enhancing individual components without fundamentally altering core design concepts. It allows existing products to remain competitive. Incremental innovations involve small, gradual improvements to existing products, processes, or services. They build upon established knowledge and technology. The characteristics include:

- ◆ **Evolutionary Changes:** Incremental innovations represent a continuation of existing practices, often refining features or addressing specific issues.
- ◆ **Low Disruption:** They do not radically alter the existing market landscape and are typically well-accepted by customers.



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- ◆ **Short-Term Focus:** Companies can implement incremental changes relatively quickly, focusing on immediate enhancements.

*The Impact of Incremental Innovations Includes*

- ◆ **Market Evolution:** Incremental innovations contribute to the gradual evolution of markets, allowing existing players to maintain their positions.
- ◆ **Competitive Advantage:** Incumbent firms can use incremental innovations to stay competitive, enhance product offerings, and respond to changing customer preferences.

The categorization of innovations into incremental and radical forms helps understand their different characteristics, impacts on markets, and the challenges and advantages they present for both incumbent and new entrant firms. Companies must carefully navigate the innovation landscape to maintain competitiveness and capitalize on emerging opportunities.

*Abernathy-Clark Model of Innovation (1985)*

According to this model of innovation, there are two types of knowledge that support any innovation: market and technology. When new brand innovation is introduced by the firm or its competitor, it resulted (a) preserved market capabilities and destroyed technological capabilities; (b) destroyed market capabilities and preserved technological capabilities; (c) both preserved market and technology capabilities and (d) both destroyed market and technology capabilities. Therefore, this model explained innovation or innovation adoption when (a) innovations are radical and (b) when a firm concentrates either on marketing capabilities or technological capabilities. However, it failed to explain when innovations are incremental and when both capabilities are equally important for a given firm.

**Table 2.1: The Abernathy-Clark Model of Innovation**

Market capabilities	Technological capabilities	
	Preserved	Destroyed
Preserved	Regular innovation	Revolutionary innovation
Destroyed	Market Niche innovation	Architectural innovation

Source: Oswald A. J. Mascarenhas, Business Transformation Strategies, Sage, p. 340.



### *Henderson-Clark's Model of Innovation (1990)*

Proposed by Henderson and Clark, this model introduces a framework for understanding the knowledge required to develop successful new products. It categorizes innovations based on the types of knowledge involved in their development.

- ◆ Divides knowledge into components and the linkages between them (architectural knowledge).
- ◆ Identifies four types of innovations: incremental, modular, architectural, and radical, based on the interplay between component and architectural knowledge.

This model suggested that since products are normally made up of components assembled, building them must need two types of knowledge: knowledge of the components and knowledge of the linkages between them, known as *architectural knowledge*. An innovation can impact (enhance or destroy) either component knowledge or both or neither.

**Table 2.2: Henderson-Clark's Model of Innovation**

Component Knowledge	Architectural Knowledge	
	Enhanced	Architectural
Enhanced	Incremental innovation	Revolutionary innovation
Destroyed	Modular innovation	Radical innovation

*Source:* Oswald A. J. Mascarenhas, Business Transformation Strategies, Sage, p. 341.

### *Afuah-Bahram's Value-Added Chain Model of Innovation (1995)*

This model considers impact of innovation on various groups of value chain like firm's capabilities, competitors, suppliers, customers, and complementary innovators. It proposed that a firm's innovation strategy must aligned with its entire innovation ecosystem. For example, Ford's electric car had a radical impact on the producer (both technical and market knowledge), on the suppliers (from fuel injection system parts to electric car parts), on the complementary innovators (e.g. oil companies, gas station owners), on customers (e.g. from gas stations to home garage or workplace-based electric charges). In a similar way, the internet



## Notes

and World Wide Web (WWW) significantly impact all parties of the value-adding chain: suppliers, manufacturers, customers, and complementary innovators.

***Open Innovation Model***

Open Innovation model introduced by Henry Chesbrough, highlighted the significance of leveraging both internal and external knowledge sources to advance technology and suggested that firms should utilize both external and internal ideas, as well as internal and external paths to market, to advance their technology and achieve innovation. It focused on:

- ◆ Encourages firms to use external ideas and pathways to market in addition to internal resources.
- ◆ Recognizes the value of purposeful inflows and outflows of knowledge to accelerate internal innovation and expand external use of innovation.

In case of traditional closed innovation model, where internal Research & Development (R&D) efforts lead to internally developed and distributed products, open innovation emphasizes collaboration with external sources.

***Assumptions of Closed Innovation Model:***

- ◆ Internal employees are the smartest and most innovative.
- ◆ Discovering, developing, and shipping by the firm ensures profits.
- ◆ If the firm discovers it, it can bring it to the market first.
- ◆ The firm wins by commercializing the innovation.

***Open Innovation Model Assumptions of Open Innovation Model:***

- ◆ Not all smart and innovative people work within the firm.
- ◆ External research and development can create value for the firm.
- ◆ Profitable research can originate outside the firm.
- ◆ A strong business model is more crucial than being the first to market.
- ◆ Internal and external ideas are necessary for success.
- ◆ The firm can benefit from both its own and others' intellectual property.



### ***In-bound and Out-bound Open Innovation Dimensions:***

#### ***In-bound Open Innovation***

It involves using discoveries made by others, establishing relationships with external firms, and accessing their competencies to enhance the firm's innovation performance.

**Example:** Collaborating with external partners, acquiring external technologies, or licensing innovations from other organizations.

#### ***Out-bound Open Innovation***

It focuses on leveraging the firm's internal ideas, technologies, or knowledge to benefit external entities.

**Example:** Licensing or selling the firm's intellectual property, technologies, or innovations to external partners for mutual benefit.

### ***Benefits of Open Innovation:***

- ◆ **Faster Innovations:**
- ◆ **Rationale:** By tapping into external knowledge and expertise, open innovation accelerates the innovation process, enabling faster development and implementation of new ideas.
- ◆ **Example:** Collaborative projects with external partners may lead to quicker product development cycles compared to relying solely on internal resources.

### ***Strategic Implications of Open Innovation:***

- ◆ **Porous Boundaries:** The model views Research and Development (R&D) as an 'open system' where ideas can come from both inside and outside the organization, making the firm's boundaries porous.
- ◆ **Enhanced Collaboration:** Collaboration with external partners increases technology acquisition and exploitation, providing the firm with a broader pool of resources and expertise.
- ◆ **Flexibility:** The openness to external ideas and paths to market allows for greater flexibility in adapting to changing technological landscapes.

The open innovation model represents a departure from traditional closed approaches, emphasizing the importance of collaboration, both in-bound



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and out-bound, to drive innovation. The model encourages firms to recognize the value of external ideas and paths to market, fostering a more dynamic and collaborative approach to innovation management.

***Clayton M. Christensen's Disruptive Innovation Theory***

The book “*The Innovator's Dilemma*” written by Clayton M. Christensen, first introduced the theory of disruptive innovation. *The theory explains that disruptive innovations can fundamentally alter the dynamics of an industry by attracting to new or overlooked market segments.* According to **Clayton M. Christensen**, disruptive innovation is the process in which a new firm, usually with fewer resources (e.g. capital, skill, experience), can challenge a well-established firm (often known as “incumbent”) by entering at the bottom of the market and continuing to move up-market. This process usually happens in many steps:

- (i) Existing firms innovate and develop their products or services to attract to their most demanding and/or profitable customers, ignoring the needs of underserved customers.
- (ii) New firms target this untouched market segment and gain power by meeting their needs at a reduced cost compared to what is offered by the existing firm.
- (iii) Existing firms do not respond to the new firm, continuing to focus on their more profitable segments.
- (iv) New firms eventually move upmarket by offering solutions that appeal to the existing firm's profitable customers.
- (v) Once the new firm has started to attract the existing firm's mainstream customers, disruption has happened.

***This theory is based on five main themes which are:***

- ◆ **Disruptive Technology:** Disruptive innovation often begins by focusing on underserved segments of the market, using easy, cost-saving, and more accessible technologies than existing products or services.
- ◆ **Value Network:** Disruptive innovation creates new value networks by linking previously unconnected stakeholders, such as customers, suppliers, distributors, and partners.



- ◆ **Business Model:** Disruptive innovation requires new business models, such as subscription-based or on-demand models, to capture the value created by the new technology or value network.
- ◆ **Incumbent:** Disruptive innovations often encounter confrontation from established firms, which may be reluctant or unable to adjust to the new technology or business model.
- ◆ **Paths:** Disruptive innovations often follow different paths than sustaining innovations, which are incremental improvements to existing products or services.

By understanding these five themes, firms can better identify and capitalize on disruptive innovations within their industries.

### *Disruptive Innovation in India: An Example*

Disruptive innovation can be found in various industries, from transportation to finance to healthcare. For example, In India, Uber disrupted the taxi industry by introducing a new business model that permits people to book a ride using their smartphones. This disrupted the traditional taxi industry and created a new market and customer base. The second example is UPI (Unified Payment Interface), a unique idea that disrupted the payment industry in India. Many startups in payment industry in India have now become wealthy companies.

#### IN-TEXT QUESTIONS

9. Open innovation model is given by:
 

(a) Henry Chesbrough	(b) Philip Kotler
(c) Henry Fayol	(d) Joseph Schumpeter
10. Afuah-Bahram's Value-Added Chain model of innovation is introduced in the year:
 

(a) 1996	(b) 1995
(c) 2000	(d) 2005
11. The book "The Innovator's Dilemma: written by:
 

(a) Clayton M. Christensen	(b) Henderson-Clark
(c) Joseph Schumpeter	(d) Michael Porter



12. Abernathy-Clark model of innovation considers two types of knowledge which are:
- (a) Market and Industry                      (b) Market and Money  
(c) Market and Technology                  (d) Market and Firm
13. Which one of the following is not a type of Henderson-Clark model of innovation?
- (a) Incremental                                  (b) Modular  
(c) Architectural                                (d) Open
14. The Diffusion of Innovations theory developed by:
- (a) Michael Porter                              (b) Henderson-Clark  
(c) Joseph Schumpeter                        (d) Everett Rogers
15. Which of the following is not a category of innovation adopter?
- (a) Laggards                                      (b) Late majority  
(c) Early adopters                               (d) Late adopters

## 2.7 Summary

Innovation, in business terms, becomes ‘*the commercial exploitation of ideas*’. Generally, there are product/service innovation (i.e. new or up-graded products or services); process innovation (i.e. new ways of producing, sourcing or manufacturing); market innovation (i.e. new markets or new ways of delivering goods and services) and business innovation (i.e. business transformation, business model innovation and diversification). Creative ideas may originate from a wide range of sources. Within a company or industry, there exist four areas of potential opportunities: (a) process requirements; (b) incongruities; (c) unforeseen events; and (d) shifts in the market and industry. Three more sources of potential in a company’s social and intellectual environment are (a) new knowledge; (b) perception shifts; and (c) demographic changes. The path dependency approaches focus on the significance of previous choices that could limit innovation in the present.



## 2.8 Answers to In-Text Questions

- |                                      |                                |
|--------------------------------------|--------------------------------|
| 1. (d) Clayton Christensen           | 9. (a) Henry Chesbrough        |
| 2. (a) Experimentation               | 10. (b) 1995                   |
| 3. (c) Application innovation        | 11. (a) Clayton M. Christensen |
| 4. (c) Changes in perception         | 12. (c) Market and Technology  |
| 5. (a) Unexpected success or failure | 13. (d) Open                   |
| 6. (d) All of the above              | 14. (d) Everett Rogers         |
| 7. (a) Scale economies               | 15. (d) Late adopters          |
| 8. (d) Increasing returns            |                                |

## 2.9 Self-Assessment Questions

1. What do you understand by the term innovation? Explain the significance of innovation in the corporate world.
2. What are various types of innovation? Explain each type of innovation with the help of an example.
3. What are the various sources of innovation? Explain each source of innovation with the help of an example.
4. What is the path dependency model of innovation? What are the main issues involved in this model and discuss the current relevance of path dependency?
5. What are the various models of innovation? Explain the Joseph Schumpeter's theory of innovation.
6. Distinguish between radical innovation and incremental innovation.
7. Discuss the diffusion of innovation model.

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# Firm and Industry Characteristics and Innovation

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## STRUCTURE

- 3.1 *Learning Objectives*
- 3.2 *Introduction*
- 3.3 *Firm Characteristics and Innovation*
- 3.4 *Industry Characteristics and Innovation*
- 3.5 *Summary*
- 3.6 *Answers to In-Text Questions*
- 3.7 *Self-Assessment Questions*
- 3.8 *References*
- 3.9 *Suggested Readings*

## 3.1 Learning Objectives

- ◆ To understand the nature of innovation.
- ◆ To explain and understand the firm characteristics of innovation.
- ◆ To explain and understand the industry characteristics of innovation.



### 3.2 Introduction

Simply, Inspired by Professor Joseph Schumpeter, innovation has become one of the major areas of interest across disciplines like economics, business management, and commerce. According to Professor Schumpeter, the causative factor in change is “*innovation*,” which is defined as “*doing things differently in the realm of economic life*.” Innovation is rapidly becoming the critical success factor of the twenty-first century. To survive and thrive in the modern business environment requires companies to think differently, to implement breakthrough ideas with rigour and to stand out from their competition – in short, to innovate. In the dynamic landscape of business, the role of innovation is paramount, serving as a catalyst for growth, sustainability, and competitive advantage. Innovation goes beyond the mere development of new products or services; it encapsulates the creation, development, and implementation of novel ideas, processes, or solutions aimed at enhancing efficiency, effectiveness, and overall competitive positioning. It involves recognizing innovation as a dynamic capability that goes hand-in-hand with strategic decision-making, adaptability, and a holistic approach to organizational development. This chapter describes the firm and industry characteristics with reference to innovation.

### 3.3 Firm Characteristics and Innovation

Firm characteristics play a crucial role in shaping the innovation dynamics within an organization. From the significance of innovation in different sectors to the development of innovation as a capability, various factors influence how firms perceive, implement, and benefit from innovation. The dynamic relationship between firm characteristics and innovation is a critical factor influencing the success and long-term viability of businesses. This relationship is multifaceted, encompassing various aspects of organizational traits and behaviors that contribute to fostering or hindering innovation. The following features at the firm level encourage innovation:

- 1. Core Capabilities:** The core capabilities of a firm to innovate either in product or process innovation provide a strategic advantage in the marketplace. Innovative products, services, and processes can differentiate a firm from its rivals and attract customers.



- 2. Entrepreneurial Leadership:** Firms with innovative cultures often have visionary, inspiring and entrepreneurial leadership. Proactive leader promotes performance-driven work culture. For example, Mukesh Ambani's strategic vision and leadership at Reliance Industries, particularly with the launch of Jio, disrupted the telecommunications sector in India. His entrepreneurial leadership drove the company's expansion and digital innovation.
- 3. Adaptability to Change:** Firms that embrace innovation are better equipped to adapt to changing market conditions, technological advancements, and evolving customer preferences. This adaptability is crucial for staying relevant and competitive. For example, Flipkart, a leading e-commerce firm in India, demonstrated adaptability by changing the retail industry through digital adoption. The company's success was attributed to its flexible approach to logistics, customer-focused strategies, and technological adoption.
- 4. Research and Development Investment:** Companies which put great emphasis on research and development and make large investments in it are usually at the forefront of innovation. For example, Biocon, led by Kiran Mazumdar-Shaw, is a pharmaceutical giant that has become a major player in biotechnology through a commitment to research and development and value creation through innovation and differentiation. The company's dedication to innovation has contributed to its global success.
- 5. Collaborative Approach:** Innovative firms frequently promote an inclusive, cooperative culture that promotes idea exchange, team work, mutual respect and cross-functional teamwork. For example, Infosys, a top IT services provider, fosters a collaborative culture that promotes idea exchange and cross functional teamwork. The company's collaborative approach has led to innovative solutions for customers worldwide.
- 6. Corporate Social Responsibility and Sustainability:** Companies that are pursuing innovation are becoming more aware of sustainability and social responsibility. For example, Mahindra and Mahindra integrates sustainability into its business model, focusing on electric vehicles and sustainable farming techniques. The company's commitment to



social responsibility aligns with innovative business practices that contribute to broader societal and environmental objectives.

- 7. Customer-Driven Business Model:** Firms which keep customers' needs first often show the way in innovation. Companies known for innovation build a positive brand image and reputation. Consumers often associate innovation with quality, reliability, and forward-thinking and customer relationship is developed through outstanding products and services. For example, Zomato, a popular food delivery service, maintains its position through a relentless commitment to improving customer experience. The company innovates in app design, delivery logistics, and various deals to enhance customer satisfaction in a competitive marketplace.
- 8. Efficiency and Productivity:** Innovation in processes and operations can enhance efficiency and productivity, leading to cost savings and improved overall performance.
- 9. Market Expansion:** Innovations enable companies to explore new markets and expand their customer base. This expansion is vital for sustained growth and increased revenue.
- 10. Risk Mitigation:** Embracing innovation allows companies to diversify their offerings and reduce reliance on a single product or service. This can mitigate risks associated with market fluctuations.

### ***Core Capabilities: Marketing and Innovation***

Core capabilities in marketing and innovation are integral to the success of modern businesses, playing a crucial role in driving growth, maintaining competitiveness, and building strong brand equity. The synergy between marketing and innovation creates a dynamic environment where customer needs are not only identified but also met with creative and forward-thinking solutions.

#### **A. Marketing and Innovation Synergy**

- 1. Customer-Centric Innovation:** Marketing facilitates a deep understanding of customer needs, preferences, and behaviors, providing valuable insights for innovation efforts. This customer-centric approach ensures that innovations align with market demands, increasing the likelihood of successful adoption.



2. **Brand Positioning and Innovation:** Marketing strategies contribute to the establishment of a strong brand presence. Innovation, when aligned with brand positioning, reinforces a company's unique value proposition, setting it apart from competitors in the minds of consumers.
3. **Market Research and Innovation Insights:** Marketing activities, including thorough market research and competitor analysis, generate insights that drive innovation. Understanding market dynamics and consumer behavior guides the development of innovative products, services, or strategies.
4. **Communication of Innovation:** Marketing is instrumental in effectively communicating innovations to the target audience. Crafting compelling narratives and employing various marketing channels help create awareness, generate interest, and drive the adoption of innovative offerings.
5. **Agile Marketing for Rapid Innovation:** Agile marketing practices allow for rapid experimentation and adaptation. This aligns with the iterative nature of innovation, enabling businesses to quickly test and refine ideas based on real-time feedback from the market.
6. **Market Segmentation and Targeting for Innovation:** Marketing's role in market segmentation and targeting ensures that innovations are tailored to specific customer segments. This personalized approach enhances the relevance and success of innovative products or services.
7. **Feedback Loop for Continuous Improvement:** Marketing channels provide a valuable feedback loop, allowing businesses to gather customer feedback and iterate on innovations. This continuous improvement cycle is essential for staying ahead in dynamic markets.
8. **Brand Innovation as a Competitive Differentiator:** Innovation in branding strategies, such as storytelling and experiential marketing, can be a unique form of innovation. Creative marketing approaches contribute to the overall perception of the brand as innovative.
9. **Cross-Functional Collaboration:** Collaboration between marketing and innovation teams ensures alignment in goals and strategies. This collaboration breaks down silos, fostering a holistic approach to driving business growth.



## Notes

The integration of marketing and innovation as core capabilities enables businesses to understand, engage, and respond to market dynamics effectively. The synergy between these capabilities is instrumental in creating a competitive edge and fostering long-term success.

***Manufacturing Firms and Innovation***

Manufacturing firms play a critical role in driving innovation, not only in the development of new products but also in the optimization of processes. Examining a case study like Johnson and Johnson and understanding the emphasis on process innovation provides valuable insights into how manufacturing companies approach innovation. The following case study of Johnson and Johnson highlights the role of innovation in the manufacturing domain.

**CASE STUDY****Johnson and Johnson**

Johnson and Johnson, a multinational healthcare company, is known for its commitment to innovation across various facets of its operations. The company's approach to innovation encompasses product development, research, and process improvement. The key aspects of Johnson and Johnson's innovation strategy include:

- 1. Innovation as Core Value:** The firm places innovation at the core of its values. It recognizes the importance of continually evolving and adapting to meet the changing needs of the healthcare industry.
- 2. Diverse Innovation Portfolio:** The company has a diverse portfolio that spans pharmaceuticals, medical devices, and consumer health products. This diversification allows for cross-sector learning and innovation.
- 3. Visionary Leadership:** Johnson and Johnson's leadership, including its executives and managers, plays a crucial role in driving innovation. The company fosters a culture that encourages employees to think creatively and contribute to the innovation process.



4. **Process Innovation:** In addition to product innovation, Johnson and Johnson places significant emphasis on process innovation. This involves optimizing manufacturing processes, supply chain efficiency, and operational workflows.
5. **Research and Development:** The company invests heavily in research and development (R&D), exploring cutting-edge technologies and scientific advancements. This commitment to R&D ensures a continuous pipeline of innovative products and solutions.
6. **Adaptability and Learning:** Johnson and Johnson demonstrates adaptability and a willingness to learn from both successes and setbacks. The company's response to challenges, such as the recalls of certain products, reflects a commitment to continuous improvement and learning.

#### ***Emphasis on Process Innovation***

Process innovation is a key aspect of Johnson and Johnson's overall innovation strategy, particularly in the manufacturing domain. Here's a closer look at the company's emphasis on process innovation:

1. **Operational Efficiency:** Johnson and Johnson focuses on enhancing operational efficiency through innovative processes. This includes adopting advanced manufacturing technologies, automation, and data analytics to optimize production workflows.
2. **Quality Assurance and Compliance:** Process innovation is crucial for maintaining high-quality standards and ensuring compliance with regulatory requirements in the healthcare industry. Johnson and Johnson leverages innovative processes to uphold product quality and safety.
3. **Supply Chain Optimization:** The company recognizes the importance of a well-optimized supply chain. Process innovations in supply chain management help streamline logistics, reduce lead times, and enhance overall responsiveness to market demands.



- 4. Sustainability Initiatives:** Johnson and Johnson integrates sustainability into its manufacturing processes. This involves adopting eco-friendly practices, reducing waste, and minimizing the environmental impact of its operations.
- 5. Continuous Improvement Culture:** Emphasizing process innovation reflects a broader culture of continuous improvement within Johnson and Johnson. The company encourages employees at all levels to identify opportunities for innovation in their respective areas.
- 6. Adapting to Technological Advances:** Technological advancements, such as Industry 4.0 technologies, are integrated into manufacturing processes to improve efficiency and flexibility. This includes the use of smart manufacturing, data analytics, and Internet of Things (IoT) devices.

Johnson and Johnson serves as a compelling case study of a manufacturing firm that not only excels in product innovation but also places a strategic emphasis on process innovation. This holistic approach allows the company to remain at the forefront of the healthcare industry by delivering high-quality products efficiently and sustainably.

### *Service Firms and Innovation*

Service firms, operating in sectors such as finance, telecommunications, and information technology, are increasingly recognizing the importance of innovation to enhance customer experiences, streamline operations, and stay competitive. Examining examples from companies like American Express, Mastercard, and HSBC provides insights into how service firms approach innovation.

#### CASE STUDY

**American Express:** It is a global financial services company that has been at the forefront of innovation in the payment industry. The company is known for introducing new financial products and services, including credit cards with unique rewards programs and benefits. It has embraced digital transformation to enhance its customer



experience, offering features such as mobile payments, online account management, and personalized financial insights. The company has introduced contactless cards and digital wallets, enabling users to make secure and swift transactions without the need for physical contact. This aligns with the broader trend of digital payment adoption.

**Mastercard:** It is a leading global payment technology company that continually innovates to facilitate secure and convenient transactions. The company has introduced innovations such as contactless payment options, mobile wallets, and biometric authentication to enhance transaction security. MasterCard's commitment to innovation extends to partnerships with FinTech start-ups, exploring block chain technology, and investing in advancements like tokenization for secure digital payments. Mastercard has been a pioneer in promoting contactless payments globally. The company actively collaborates with financial institutions and merchants to expand the acceptance of contactless technology. Features like tap-and-go payments have become synonymous with Mastercard transactions.

**HSBC:** A multinational banking and financial services company, has demonstrated a focus on innovation in various aspects of its operations. The bank emphasizes digital transformation, offering online and mobile banking services to meet evolving customer preferences. HSBC has implemented innovation initiatives such as hackathons and innovation labs to foster a culture of creativity and collaboration among its employees. HSBC has embraced contactless technology in its banking services, allowing customers to make contactless payments using their debit or credit cards. Additionally, the bank's mobile banking app supports digital wallets and contactless transactions.

The focus on contactless technology in service innovation by companies like American Express, Mastercard, and HSBC exemplifies the industry's commitment to providing efficient, secure, and customer-centric payment solutions. This innovation aligns with changing consumer behaviors and expectations, driving the evolution of financial services in the digital age.



Understanding these case studies provides insights into how firm characteristics, such as adaptability, leadership, R&D, collaboration, social responsibility, and customer-centric focus, influence innovation within organizations. It illustrates the practical implications of these characteristics in driving business success and navigating the ever-evolving corporate landscape.

### IN-TEXT QUESTIONS

1. Who has coined the concept of “core competencies”?
  - (a) Joseph Schumpeter
  - (b) Everett Rogers
  - (c) Michael Porter
  - (d) C. K. Prahalad and Gary Hamel
2. Which one of the following encourages innovation at firm-level?
  - (a) Collaborative approach
  - (b) Adaptability to change
  - (c) Core capabilities
  - (d) All of the above
3. Which one of the following type of innovation is intangible?
  - (a) Product innovation
  - (b) Process innovation
  - (c) Radical innovation
  - (d) Green innovation

Innovative firms are introducing changes in different types like product innovations, process innovation, quality and standard, improvement in the existing product, changes in the input use, use of new or alternative material, introduction of new machines etc. the following points show the types of innovations carried out by the innovative firms.

#### *Type of Innovations*

1. Product innovation
2. Process innovation



3. Product quality and standard innovation
4. Savings or efficient use of inputs
5. Alternative material
6. New business practices
7. Changes in organizing procedures
8. Changes in marketing concepts and strategies

***Factors influencing Innovation Practices of Firms***

The following factors influencing innovation practices of firms:

**1. Cost Factors**

- ◆ Availability of finance within enterprise
- ◆ Availability of finance from outside sources
- ◆ Innovation cost

**2. Knowledge Factors**

- ◆ Availability of skilled manpower
- ◆ Availability of information on technology
- ◆ Availability of information on markets
- ◆ Addressing social issues
- ◆ Reduced materials and energy per unit output

**3. Infrastructure Factors**

- ◆ Availability of infrastructure/test labs within enterprise
- ◆ Availability of facility sharing of tests labs/research labs
- ◆ Met governmental and regulatory requirements

**4. Market Factors**

- ◆ Market dominated by established players
- ◆ To overcome problems entering new market
- ◆ New opportunities to enter niche market
- ◆ To overcome protection barrier for new product/process
- ◆ To meet govt. regulatory requirements



## 5. Others

- ◆ Uncertain demands for innovative goods and services
- ◆ Govt. policy constraints
- ◆ Management barriers/other people barriers

## 3.4 Industry Characteristics and Innovation

Economist Joseph Schumpeter argued that new entrepreneurial firms revolutionize industries through technological innovation and described this process as the *perennial gale of creative destruction*. Understanding industry characteristics is pivotal for businesses seeking to drive innovation and navigate the challenges and opportunities within their respective sectors. Industries vary in terms of size, stability, and sources of profit differences, and recognizing these unique characteristics is crucial for developing effective innovation strategies.

### A. Understanding Industry Characteristics

#### 1. Size and Scope

Industries vary in size, ranging from small niche markets to global sectors. Understanding the size and scope of an industry helps businesses gauge market potential and opportunities for innovation.

#### 2. Stability and Dynamics

Industry stability refers to the level of volatility and changes within the market. Dynamic industries may present more opportunities for innovation, while stable industries may require incremental improvements to existing products or services.

#### 3. Regulatory Environment

Industry characteristics include the regulatory environment, which can influence the ease of market entry, compliance requirements, and the overall innovation landscape. Strict regulations may pose challenges, but they can also create a stable framework for innovation.



## B. Three Categories of Industries

### 1. Capacity-Driven Industries

#### a. Characteristics

- ◆ Capacity-driven industries are characterized by a focus on economies of scale and efficient production processes.
- ◆ Market dynamics are often influenced by production capacity, cost efficiency, and scale of operations.

#### b. Innovation Implications

- ◆ Innovation in capacity-driven industries often involves optimizing production processes, improving efficiency, and achieving cost reductions.
- ◆ Technological advancements may play a crucial role in enhancing production capabilities

### 2. Customer-Driven Industries

#### a. Characteristics

- ◆ Customer-driven industries prioritize meeting the diverse needs and preferences of customers.
- ◆ Market dynamics are influenced by changing consumer behaviors, preferences, and demands.

#### b. Innovation Implications

- ◆ Innovation in customer-driven industries focuses on product differentiation, customer experience enhancements, and addressing evolving consumer trends.
- ◆ Market research and feedback-driven innovation are critical in this context.

### 3. Knowledge-Driven Industries

#### a. Characteristics

- ◆ Knowledge-driven industries rely heavily on intellectual capital, expertise, and innovation.
- ◆ Market dynamics are shaped by advancements in technology, research, and knowledge creation.

**b. Innovation Implications**

- ◆ Innovation in knowledge-driven industries involves cutting-edge research, technological breakthroughs, and the development of intellectual property.
- ◆ Collaboration with research institutions, investment in R&D, and attracting top talent are essential for success.

Understanding these industry categories and their characteristics is fundamental for businesses aiming to tailor their innovation strategies to specific market contexts. It enables organizations to identify the most relevant drivers of innovation within their industry, ultimately contributing to sustained growth and competitiveness.

***Industry Features and Innovation***

Understanding industry features is crucial for businesses seeking to innovate within their specific market contexts. Various factors influence the innovation landscape, and analyzing these features helps organizations develop strategies that align with the dynamics of their industries. The various industry characteristics which encourage innovation are:

**1. Market Structure****a. Characteristics**

- ◆ Market structure refers to the organization and competitiveness of an industry.
- ◆ It includes the number of competitors, the degree of product differentiation, and the presence of barriers to entry.

**b. Impact on Innovation**

- ◆ Highly competitive markets often drive companies to innovate rapidly to gain a competitive edge.
- ◆ Oligopolistic or monopolistic structures may hinder innovation due to reduced competitive pressure.

**2. Regulatory Environment****a. Characteristics**

- ◆ The regulatory environment encompasses industry standards, legal obligations, and government regulations. It defines the rules and frameworks within which businesses operate.

**b. Impact on Innovation**

- ◆ Stringent regulations may impede market entry and innovation.
- ◆ Well-defined regulations can provide a stable foundation for innovation by ensuring compliance and legal clarity.

**3. Technological Intensity****a. Characteristics**

- ◆ Technological intensity measures the extent to which an industry's products, services, and processes rely on technology.
- ◆ It indicates the level of technological sophistication within the industry.

**b. Impact on Innovation**

- ◆ High-tech industries often experience rapid and radical innovation.
- ◆ Traditional industries may undergo slow innovation unless there is a fundamental technological shift.

**4. Research and Development Intensity****a. Characteristics**

- ◆ R&D intensity reflects the amount of investment directed towards research, development, and innovation activities.
- ◆ It highlights a commitment to creating new knowledge and technologies.

**b. Impact on Innovation**

- ◆ Industries with high R&D intensity are more likely to generate significant innovations.
- ◆ Sectors like aerospace and pharmaceuticals often rely on R&D to drive innovation.

**5. Globalization****a. Characteristics**

- ◆ Globalization measures the extent to which an industry operates across borders and has a global market presence.
- ◆ It involves international trade, collaboration, and access to global markets.



**b. Impact on Innovation**

- ◆ Global industries benefit from diverse perspectives and shared efforts, promoting innovation.
- ◆ Access to global markets and resources accelerates the implementation of innovative ideas.

**6. Consumer Behavior and Expectations**

**a. Characteristics**

- ◆ Consumer behavior and expectations encompass the preferences, behaviors, and expectations of consumers within a particular industry.
- ◆ It reflects changing trends, demands, and the need for constant adaptation.

**b. Impact on Innovation**

- ◆ Industries serving rapidly changing consumer needs must innovate quickly to remain relevant.
- ◆ Understanding and anticipating consumer expectations is crucial for innovation in customer-centric industries.

**7. Supply Chain Complexity**

**a. Characteristics**

- ◆ Supply chain complexity refers to the intricacy and global scope of an industry's supply chains.
- ◆ It involves the coordination of various elements in the production and distribution process.

**b. Impact on Innovation**

- ◆ Industries with complex supply chains, such as electronics and automotive, may face challenges in organizing and implementing innovations across the entire value chain.
- ◆ Innovation efforts may need to address supply chain efficiency and collaboration.

**8. Industry Life-cycle**

**a. Characteristics**

- ◆ The industry lifecycle encompasses the stages of growth, maturity, and decline that an industry experiences.



- ◆ It reflects the evolution and dynamics of market demand and competition.

**b. Impact on Innovation**

- ◆ Industries in the early stages of development or facing decline may experience disruptive innovations.
- ◆ Growth and maturity phases may see gradual improvements and incremental innovations.

**9. Risk Tolerance****a. Characteristics**

- ◆ Risk tolerance measures the industry's openness to risk, especially regarding failure and creative experimentation.
- ◆ It influences the willingness to invest in disruptive or unproven ideas.

**b. Impact on Innovation**

- ◆ Industries with higher risk tolerance, such as technology and venture capital, are more open to funding disruptive ideas.
- ◆ Risk-averse industries may be cautious in adopting innovative strategies.
- ◆ Growth and maturity phases may see gradual improvements and incremental innovations.

**10. Environmental and Social Responsibility****a. Characteristics**

- ◆ Environmental and social responsibility refers to the industry's focus on sustainable and ethical practices.
- ◆ It involves considerations for environmental impact and social welfare.

**b. Impact on Innovation**

- ◆ Industries emphasizing environmental and social responsibility may drive innovation in green practices, sustainable technologies, and ethical business models.
- ◆ Innovation aligns with broader societal and environmental objectives.



**IN-TEXT QUESTIONS**

4. Process innovation includes:
  - (a) Optimisation of manufacturing process
  - (b) Efficiency of supply chain
  - (c) Operational workflows
  - (d) All of the above
5. Which one of the following is a cost factor influences innovation practices of firms?
  - (a) Availability of finance from external sources
  - (b) Availability of skilled man power
  - (c) Availability of information on technology
  - (d) Availability of market information
6. Which one of the following is not a type of market structure?
  - (a) Competitive monopoly
  - (b) Perfect competition
  - (c) Duopoly
  - (d) Monopolistic competition
7. Globalisation means:
  - (a) Convergence among countries for international trade and investment
  - (b) Trade barriers among nations
  - (c) Domestic sale and purchase of goods
  - (d) Opening an industry for private investment
8. Innovation is defined as:
  - (a) Invention of new product or process
  - (b) Commercialisation of new product or process
  - (c) New product or process idea
  - (d) New production method



9. “Market-push” innovation value chain includes:
- (a) Be market focused                      (b) Be customer focused  
 (c) Be competition vigilant                (d) All of above
10. Industries with higher risk tolerance such as technology and venture capital are more open to funding:
- (a) Disruptive ideas                          (b) Social ideas  
 (c) Incremental ideas                        (d) Green ideas
11. Which of the following is/are an element of strategies of innovation for firms and industries?
- (a) Sourcing technology                      (b) Sourcing innovation  
 (c) Extent of technology                      (d) All of the above
12. Technological intensity measures:
- (a) The extent to which an industry’s products rely on technology.  
 (b) The extent to which an industry’s products and services rely on technology.  
 (c) The extent to which an industry’s products, services, and processes rely on technology.  
 (d) All of the above
13. The regulatory environment of industry does not include:
- (a) Industry standards                      (b) Industry association  
 (c) Industry culture                          (d) Industry obligations

**Gains from Innovation to Firms and Industries**

**1. Product Outcomes**

- ◆ Increased range of goods and services
- ◆ Entered new markets or increased market share
- ◆ Improved quality of goods and service



## 2. Process Outcomes

- ◆ Improved flexibility of production or service provision
- ◆ Increased capacity of production or service provision
- ◆ Reduced labour costs per unit of output
- ◆ Addressing social issues
- ◆ Reduced materials and energy per unit output

## 3. Miscellaneous Outcomes

- ◆ Reduced environmental impact or improved health and safety
- ◆ Addressing social issues
- ◆ Met governmental and regulatory requirements

### *Strategies for Innovations for Firms and Industries*

There are various ways a firm reaches the innovation end. It depends on wide variety of business practices and allocation of resources for innovation. These are: sourcing innovation; sourcing technology; intra-mural R&D; extra mural R&D; bringing about changes in firm structure and management methods. Broadly they are divided into technological and non-technological innovations. A firm's strategies for innovation would be a mix of some of these means.

#### 1. Sourcing Innovation

The sources include internal sources, external sources and with other enterprise or institutions which include universities/government laboratories etc.

#### 2. Sourcing Technology

Firms acquire technology from external sources to gain technological competencies and to facilitate or upgrade their production system. The firms acquiring patented technology, knowhow or trade secret to upgrade their facilities. Innovative firms acquire patented technology from open domestic markets and from foreign market and collaborators.

#### 3. Extent of Technology

The technologies are acquired either as full set technology or partial technology.



#### 4. R&D Activities of the Innovative Firms

For a firm to innovate it requires synergizing R&D along with sourcing technology. The innovative firms are involved in R&D of any form and mostly these activities are intramural which is also indicative of limited collaboration with research institute or universities to enhance innovativeness.

#### 5. Transactions

How do the firms acquire these new technologies? On what terms and conditions do they acquire these technologies? Firm's mode of acquiring new technology is buying the technology and licensing the technology from external sources.

#### 6. Financing

Availability of fund for innovation is an important aspect of the innovation ecosystem. Most of the firms depend on domestic financial institutes and internal sources for financing innovations. Sources include own sources, domestic financial institution, international source of finance, private sources, govt. funding and profit sharing with supplier.

### *Impact of Firm Characteristics and Industry Features on Innovation*

The dynamic relationship between firm characteristics and industry features plays a pivotal role in shaping the innovation landscape within businesses. Understanding how these factors interplay provides valuable insights into the drivers and constraints that influence a company's ability to innovate. Here, we explore the impact of firm characteristics and industry features on innovation:

#### 1. Strategic Alignment

**Firm Characteristics:** The alignment of firm characteristics, such as adaptability, leadership, and investment in R&D, with the demands of the industry is crucial. Strategic alignment ensures that innovation efforts are targeted and effective.

**Industry Features:** The nature of the industry, including its size, competitiveness, and technological intensity, determines the strategic focus of innovation. Different industries require tailored approaches to address their specific challenges and opportunities.



## 2. Market Responsiveness

**Firm Characteristics:** The responsiveness of a firm to market changes is influenced by its adaptability, customer-centric focus, and risk tolerance. Innovative companies leverage these characteristics to stay ahead in dynamic markets.

**Industry Features:** Industries characterized by rapid changes in consumer behavior, globalization, and technological advancements demand agile and responsive innovation strategies. Understanding industry features is essential for timely and relevant innovation.

## 3. Collaboration and Ecosystem

**Firm Characteristics:** Companies fostering a collaborative culture and engaging in cross-functional teamwork are better equipped to innovate. Collaboration extends beyond organizational boundaries to include partnerships with suppliers, customers, and research institutions.

**Industry Features:** The complexity of supply chains, globalization, and the regulatory environment influence the collaborative ecosystem. Successful innovation often requires collaboration across various stakeholders within the industry.

## 4. Risk Mitigation and Sustainability

**Firm Characteristics:** The risk tolerance of a firm, coupled with a focus on environmental and social responsibility, shapes its approach to innovation. Companies that prioritize sustainability contribute to innovations aligned with societal and environmental goals.

**Industry Features:** The risk tolerance of an industry, as well as its focus on sustainability, impacts the types of innovations that gain traction. Industries with a high risk appetite may be more receptive to disruptive innovations.

## 5. Strategic Decision-Making

**Firm Characteristics:** The ability of a firm to make strategic decisions regarding innovation is influenced by its leadership, organizational structure, and dominant logic. Effective decision-making ensures that innovation efforts align with broader business goals.



**Industry Features:** Understanding industry characteristics is central to making informed strategic decisions. Industries with different regulatory environments, market structures, and customer expectations require nuanced and strategic approaches to innovation.

### *Implications for Stakeholders, Companies, and Policymakers*

The implications of the dynamic relationship between firm characteristics and industry features on innovation extend to various stakeholders, companies, and policymakers:

#### **1. Stakeholders**

**Investors:** Understanding how firm characteristics and industry features impact innovation allows investors to make informed decisions about where to allocate resources. Industries with innovative firms and favorable characteristics may present attractive investment opportunities.

**Employees:** Employees can leverage this knowledge to align their skill development with the innovation needs of their companies. Embracing a culture of innovation and continuous learning enhances career prospects.

#### **2. Companies**

**Strategic Planning:** Companies should conduct a thorough analysis of their firm characteristics and the features of their industry to inform strategic planning. This includes identifying areas for improvement in adaptability, leadership, and collaboration.

**Innovation Culture:** Fostering a culture of innovation, supported by leadership, collaboration, and adaptability, is critical. Companies need to create an environment that encourages experimentation, risk-taking, and continuous improvement.

#### **3. Policymakers**

**Regulatory Frameworks:** Policymakers can shape regulatory frameworks to encourage innovation. Balancing the need for industry standards with flexibility for experimentation can foster a conducive environment for businesses to innovate.



**Supporting Research and Development:** Policies that support R&D initiatives and collaboration between businesses and research institutions can enhance a country's innovation ecosystem. Incentives for sustainable practices can also align innovation with broader societal goals.

The dynamic interplay between firm characteristics and industry features is a key determinant of a company's innovation success. Recognizing and adapting to these dynamics positions stakeholders, companies, and policymakers to navigate the ever-evolving landscape of innovation, fostering growth, sustainability, and competitiveness.

### 3.5 Summary

According to Professor Schumpeter, the causative factor in change is “*innovation*,” which is defined as “*doing things differently in the realm of economic life*.” Firm characteristics play a crucial role in shaping the innovation dynamics within an organization. Core capabilities in marketing and innovation are integral to the success of modern businesses, playing a crucial role in driving growth, maintaining competitiveness, and building strong brand equity. The synergy between marketing and innovation creates a dynamic environment where customer needs are not only identified but also met with creative and forward-thinking solutions. Understanding industry characteristics is pivotal for businesses seeking to drive innovation and navigate the challenges and opportunities within their respective sectors. Industries vary in terms of size, stability, and sources of profit differences, and recognizing these unique characteristics is crucial for developing effective innovation strategies. There are various ways a firm reaches the innovation end. It depends on wide variety of business practices and allocation of resources for innovation. These are: sourcing innovation; sourcing technology; intra-mural R&D; extra mural R&D; bringing about changes in firm structure and management methods. Broadly they are divided into technological and non-technological innovations.



### 3.6 Answers to In-Text Questions

- |   |  |
|---|--|
| 1. (d) C. K. Prahalad and Gary Hamel                                      | 8. (b) Commercialisation of new product or process |
| 2. (d) All of the above   |  |
| 3. (b) Process innovation   | 9. (d) All of above                                |
| 4. (d) All of the above   | 10. (a) Disruptive ideas                           |
| 5. (a) Availability of finance from external sources                      | 11. (d) All of the above                           |
| 6. (a) Competitive monopoly   | 12. (d) All of the above                           |
| 7. (a) Convergence among countries for international trade and investment | 13. (c) Industry culture                           |

### 3.7 Self-Assessment Questions

1. Explain the concept of innovation. Discuss the firm characteristics which have an impact on innovation.
2. What are various types of industries? Explain the various characteristics of industries which have an impact on innovation.
3. Discuss the strategies adopted by firms and industries for innovation.
4. Discuss the various gains from innovation to firms and industries.

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Notes

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# UNIT - III





# Theories of Intellectual Property Rights

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## STRUCTURE

- 4.1 *Learning Objectives*
- 4.2 *Introduction*
- 4.3 *Nature and Types of Intellectual Property Rights*
- 4.4 *Theories of IPRs*
- 4.5 *IPRs and Spillovers*
- 4.6 *IPRs and Appropriability*
- 4.7 *Summary*
- 4.8 *Answers to In-Text Questions*
- 4.9 *Self-Assessment Questions*
- 4.10 *References*
- 4.11 *Suggested Readings*

## 4.1 Learning Objectives

- ◆ To define and understand the term 'Intellectual Property Rights'.
- ◆ To understand the determinants of the use of different appropriability strategies at the firm and sector level.
- ◆ To understand the various theories of intellectual propriety rights.
- ◆ To explain the spillover effects created by IPRs.



## 4.2 Introduction

Globally, innovators and creators use Intellectual Property (IP) to translate their innovative ideas into assets which create social and economic benefits for the society as a whole. Resourcefulness and creativity are crucial because they promote economic expansion, generate new businesses and jobs, and raise standard of living. Intellectual property, or IP, includes works of literature, art, inventions, designs, and names, symbols, and pictures used for commercial purposes. Trade secrets, industrial designs, copyright and related rights, trademarks, and geographical indications, patents are all measured types of intellectual property.

In the information age, IPRs protection takes a central role. IPRs are supposed to assist protect investments into research and development and encourage innovation by providing incentives to invent, progress, develop etc. For example, patents, copyright, and trademarks are legal protections for intellectual property that enable people to profit financially or get recognition for their inventions. The IP system seeks to foster an atmosphere that fosters creativity and innovation by finding the ideal balance between innovators' interests and the common good.

IPRs encompass a wide range of activities and are significant to both the cultural and commercial spheres. IP rights are protected by a number of laws that recognize its importance. IPR law is extremely complex due to the various national laws in various nations and areas of the world, as well as international law, which apply to various forms of intellectual property. IPR is a civil law issue, and businesses are required to monitor their own intellectual property and take reasonable steps to safeguard it.

## 4.3 Nature and Types of Intellectual Property Rights

The capacity for original thought and creation is essential to human advancement and well-being. New inventions must be created and put to use for technological advancement, and a dynamic culture is constantly seeking for new means of self-expression. IPRs are also quite important.

It demands, money, time, effort, and thinking for scientists, artists, inventors, and businesses to create their ideas and inventions. They require the opportunity to profit financially from their investment in order to



enable them to achieve that. This entails granting them the authority to safeguard their creative works.

IPRs, including copyright, patents, and trademarks, can be regarded like any other type of property right. By granting them authority over how their assets are used, they enable the creators or IP owners to get economic benefits. Different legal regimes have traditionally acknowledged IPRs. For instance, as early as 15<sup>th</sup> century, patents were given in Venice to safeguard inventions. The Paris Convention (1883) and the Berne Convention (1886) marked the beginning of contemporary efforts to safeguard intellectual property through international law. Currently, the World Intellectual Property Organization (WIPO) oversees over 25 international intellectual property treaties. Article 27 of the Universal Declaration of Human Rights also protects IPRs.

IPRs are frequently separated into two primary groups:

1. **Industrial Property:** This category includes trademarks, industrial designs, patents and geographical indicators.
2. **Copyright and Related Rights:** This includes broadcasts and performances of literary, artistic, and scientific works.

The goal of the intellectual property arrangement is to make a balance between the rights and interests of many groups, including consumers, companies and their rivals, high-income and low-income countries, and artists. Everyone benefits from an effective and fair intellectual property system, including customers and regular users.

For examples:

- ◆ Without copyright protection, the multibillion-dollar software, film, record, and publishing industries—which provide millions of people with pleasure and amusement globally—would not be able to grow.
- ◆ Patent applications are made accessible to the general public; the patent arrangement not only compensates scientists and inventors but also makes sure they disseminate their expertise, so promoting increased creativity.
- ◆ Trademark protection deters counterfeiting, allowing businesses to compete fairly and giving customers peace of mind that they are purchasing authentic goods.



## ***Types of Intellectual Property Rights (IPRs)***

### Types of IPRs

- Patents
- Trademarks
- Industrial Design
- Copyright and related rights
- Geographical Indications

### ***Patents***

One of the first types of intellectual property recognized by contemporary legal systems is the patent. Every element of life is impacted by patented ideas these days, from the iPhone (patents of Apple Corp.) to electric lighting (patents owned by Edison and Swan). The patentable innovation grants the owner exclusive rights, which allow them to prohibit from using, producing, or commercializing the invention without their consent. The patent is only valid for a specific amount of time—usually 20 years. In exchange, the owner of the patent must provide all inventive information in the published patent paperwork. After the patent expires, the invention is no longer protected by a patent, so anybody can manufacture, market, or use it.

The patent system seeks to benefit all parties in this way:

- ◆ This pays companies and inventors for their property and therefore stimulates new innovation, which in turn benefits to society as a whole.
- ◆ During the patent protection term, companies and inventors can maximize income from their discoveries.
- ◆ By adding to the existing public knowledge, discovery of the invention facilitates and encourages additional study and innovation.

### ***What can be patented?***

A new procedure or product that provides a fresh approach to an old problem or a novel technical solution is referred to as an invention. An innovation must provide something new that does not already exist in



the corpus of knowledge and have some practical application in order to be eligible for patent protection.

Additionally, an invention cannot be categorized as non-patentable subject matter. Patents have territoriality. Within a nation, protection is granted by national legislation. Although the laws in different countries may differ slightly, in general, an inventor or company seeking protection for their invention must submit an application to the patent office that provides a clear and comprehensive description of the invention, enough so that even a person with a basic understanding of the technology can use or duplicate it. Typically, these descriptions contain schematics, blueprints, or drawings.

During the time of patent protection, the special privilege of patent owners to manufacture, trade, allocate, import, and exploit their patented discovery for commercial purposes within the patent's protected territory exists. Business enterprises and inventors need to select the areas of patent protection.

### ***Trademarks***

A trademark is a symbol that can be used to identify one firm's goods or services from those of other companies. Trademarks have existed for a long time. Artists used to sign or label their creations as a way to identify themselves. Laws were eventually developed to protect these markings. Trademarks are now vital to modern business. They exist in various forms and denote a vast range of products and services.

Businesses invest valuable resources in creating their trademarks and identities. A mark's owner can regulate who uses it thanks to legal protection. This refers that firms can grow and advertise their products without worrying about counterfeiters damaging their brand, and that customers can trust that trademarks are authentic.

Words, characters, numbers, symbols, colors, images, three-dimensional signs like packaging and forms, holograms, sounds, even tastes and scents can all be utilized as trademarks. A trademark must be distinctive in order to be suitable for registration. Furthermore, it cannot be unusually alike to a trademark that is already in use or registered for that kind of good or service.



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Trademarks are utilized for more than merely identifying a company's products and services. There exist collective marks as well, which are owned by associations and utilized by their constituents like instance, this type of mark is frequently used by professional groups like architects, engineers, and accountants. Additionally, there are certification markings, like Ecolabels for products with less of an impact on the environment that attest to a good or service's compliance with particular requirements.

The registration a trademark is the strongest defence against infringement. A registered mark's owner has the only authority to decide who may use it. They can exercise it to recognize their own products or services, or they can sell it to third parties or grant licenses for others to use. A copy of the mark and a comprehensive list of the goods and services it would apply to must be submitted to the concerned office by the applicant in order for the mark to be registered in that region. The mark must be sufficiently unique, not infringe upon any already-existing marks, not be deceptive, and not break public command or ethics.

If a person or firm infringes on a trademark after it had been awarded, the owner may file a lawsuit in the appropriate national court. On the other hand, someone claiming that a trademark is mostly alike to their own may file a lawsuit against the owner of the mark.

A trademark is only allowed to be exercised for a specific amount of time—ten years in most countries—but it can be improved as often as the owner wants for as long as they pay extra fees. Therefore, a trademark can effectively be protected eternally. Trademark safety is geographical, just with most IP legislation. On the other hand, numerous nations have built regional and global institutions that facilitate the process of obtaining trademark protection.

***Industrial Design***

Industrial design rights protect a product's decorative or aesthetically pleasing characteristics, like how it feels and looks. In the contemporary economy, these aesthetic qualities can have a significant impact. Consumers today have a plethora of options when it comes to products, many of which provide the same fundamental features. Therefore, if it falls within their budget, they will probably select the one with the most appealing design.



Many different industrial and handmade products, such as automobiles, phones, computers, packaging, containers, watches, jewellery, electrical equipments, etc. are adorned with industrial designs. A product's technical character may be covered by a patent if they fulfil the criteria for patent protection; otherwise, the law for industrial design only protects the product's striking merits.

Two-dimensional elements like patterns, lines, or color can coexist with three-dimensional elements like an object's shape or surface. Most national laws require a design to be fresh and exhibit some uniqueness or individuality, which means it cannot be exactly identical to any other design in order to be protected for industrial design. Additionally, it must be able to be manufactured industrially; hence, original artwork is not covered.

The holder of an industrial design right has the authority to manage the business-related production, importation, and distribution of goods bearing the design. Similar to most other types of intellectual property, owners of design rights have the ability to sell or license them to third parties, use them for their own benefit, or file a lawsuit in the appropriate national court to stop infringement.

This encourages owners to spend in design since it gives them a reasonable chance to recover their costs. The duration of industrial design rights is finite. The maximum duration of protection in each country varies, but it always lasts for at least ten years. If owners wish to maintain the design's protection for as long as feasible, they must renew their registration every few years in various nations. Various nations have various laws protecting industrial designs. To protect a design, a company or designer must often register it. However, certain nations additionally grant partial defence to unregistered designs, and in others, protection is obtained through "design patents."

Certain industrial designs might be considered creative works protected by copyright in some regions. Since copyright protection lasts far longer than registered design protection, this may be beneficial to the owner. It might also be able to use state laws in some nations to safeguard designs against unfair competition. Due to the territorial nature of industrial design rights, designers and companies may have to deal with numerous national systems in order to obtain protection across multiple nations.



### ***Geographical Indications***

A Geographical Indication (GI) is a label placed on goods that are native to a certain area and have characteristics or a certain reputation as a result. There are several examples of geographical indications, which are frequently found in food and drink items like Mexican tequila and Indian Darjeeling tea. In order to safeguard their invaluable reputation, there must be limitations on the exercise of geographical indications. Buyers of goods with such indications want to be certain that the products are indeed made in the specified location and meet all the regulations.

Customers are assured by a GI that a product was made in a certain location and has particular qualities that are unique to that location of production. It cannot change ownership and may be used by any producers in the relevant location who create goods with particular characteristics related to that location.

International law is working to increase protection across national boundaries because different countries have distinct systems of recognition and varied rules protecting geographical indicators. A geographical indicator can be protected in three ways: (i) by means of unique laws pertaining to geographical indicators, often known as sui generis systems; (ii) using collective or certification marks; and (iii) methods focusing on business practices, including administrative product approval schemes.

### ***Copyrights and Related Rights***

The legal term “copyright” refers to the rights that authors, artists, and scientists have over their creative works in literature, art, and science. Books, music, paintings, sculptures, films, computer programs, databases, ads, maps, and technical drawings are just a few examples of the vast array of works that are protected by copyright. In addition, there exist rights pertaining to the authors’ copyright that safeguard the interests of individuals closely linked to works protected by copyright, such as broadcasters, record producers, and performers.

Several state and global laws safeguard copyright. These acknowledge the significant economic worth of creative endeavors in addition to their cultural and societal significance. Copyright law’s fundamental goal is to achieve a just equilibrium between the rights of investors, content



creators, and innovators, and the public's desire to have access to and use creative works.

The inventive description of ideas in a variety of media, including text, immobile or moving images, sound recordings, three-dimensional objects like sculptures and buildings, reference books, and data sets, is defended by copyright laws. Rarely do state copyright laws include a comprehensive list of all the topics they protect. However, ideas themselves, processes, operational techniques, and mathematical concepts are typically not covered by copyright.

Copyright encompasses moral and financial rights. Economic rights basically refer to the authority to manage a work's distribution. Put otherwise, the owner of a copyright can prevent unauthorized use or duplication of a work, including translation, replication, performance, and broadcasting. In addition, copyright protects the creator's moral rights, such as the right to be identified as the creator of a work and the right to keep it from being changed in a manner that could harm their reputation.

Economic rights are generally transferable and divisible. The owner may assign or transfer their rights to a third party, who will become the new owner, or they may consent to allow someone to use their creation with specific restrictions (licensing). In addition, the economic gains of a copyright owner will be passed on to their legal heirs or successors upon their death. The transfer of rights occurs frequently. For instance, in several nations, creators can license or allocate their rights to joint management organizations, which will oversee how works are employed and gather expenses from users on the creators' behalf.

The owners of copyrights can elect to give away their work for free or to allow others to use it freely under certain restrictions. (a) Authors, music composers, and recording artists frequently license or allot their rights to publishers in exchange for costs identified as royalties. For instance, they might permit use, in accordance with common Creative Commons licenses.

Copyright protects the public attention by ensuring that artists receive just compensation for their efforts, which in turn promotes more creative endeavors, as well as by ensuring which works are duly recognized and honored. Copyright starts to exist the moment a work is produced. To obtain protection, a creator does not have to record a work or fulfil any other requirements. Most of the copyrighted works must be confined by



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a country for the duration of the creator's life and for at least 50 years following their passing.

### **Related Rights**

The legal system of a country also safeguards the rights of definite individuals or groups who engage in original work but do not fulfil the needs for copyright defence in numerous jurisdictions. These individuals and groups include broadcasting companies, record labels, and performers like singers and actors. Since they are connected to copyright, these are referred regarded as related rights or surrounding rights.

### **IN-TEXT QUESTIONS**

1. Intellectual Property Rights (IPRs) are safeguarded by which Article of the Universal Declaration of Human Rights?  
(a) 27 (b) 25  
(c) 26 (d) 20
2. The patent is only valid for a specific amount of time, usually  
(a) 20 years (b) 30 years  
(c) 50 years (d) 100 years
3. Certification mark is an example of which:  
(a) Trademarks (b) Patent  
(c) Industrial Design (d) Copyrights
4. The trademark is valid for a specific amount of time  
(a) 10 years (b) 15 years  
(c) 20 years (d) 25 years

### **4.4 Theories of IPRs**

Intellectual Property Rights (IPRs) are based on a number of theoretical frameworks that promote the protection of innovations and intellectual creations. Every theory has benefits and drawbacks because it is challenging to strike a balance between the incentives for producers and the improvement of the public welfare.



## 1. Utilitarian Theory

The fundamental tenet of the utilitarian theory of IPRs is that the protection of IPRs advances the common good by fostering innovation, economic expansion, and widespread social wellbeing. This perspective contends that exclusive rights have more utilitarian advantages than disadvantages and has its roots in consequentialist ethics.

Economists like Bentham and Mill have supported utilitarian theory, which places a strong emphasis on attaining the greatest good for the largest number of people. It states that any policy developed or carried out by any authority must have the ability to ensure the greatest good for the largest number of people. Here, “greatest number” refers to the masses, while “greatest good” refers to the highest level of welfare.

According to the utilitarian principle,

- ◆ Lawmakers should use the “maximization of net social welfare” as a basis to establish property rights. This is the core of utilitarianism.
- ◆ In case of intellectual property, this theory holds that legislators must find the best possible balance between the capability of exclusive rights to boost the creation of inventions and artistic works and the trend of such rights to partially offset the dissemination of public pleasure of those creations.
- ◆ The potential threat associated with this notion is that people who make these products might not be able to recoup their “costs of expression,” which include the time and effort they put into making or writing as well as the costs associated with dealing with record labels or publishers. This is due to the fact that persons with extremely low manufacturing costs can provide consumers the identical goods at a very low cost, undermining the product developers and making them vulnerable to copycat attacks.
- ◆ The inventors will be prevented from creating any intellectual property with social value if this takes place.
- ◆ However, this can be avoided by granting the creators the exclusive authority to reproduce their works for a set period of time. Authors of valuable works for consumers will have the authority



to set prices (for giving public access to their creations) that are significantly higher than what they could command in a market with intense competition. Some ideas within the area of study have been influenced by the utilitarian theorists' arguments.

## 2. Lockean Labor Theory

The Lockean Labor theory of IPRs depends on the theories of John Locke and maintains that individuals have a property right to the goods they have worked hard to create. Since intellectual creations, the theory contends that since inventors invest a great deal of time and effort into their inventions, they ought to be granted exclusive rights to them. It stems from the notion that “a person who labors upon resources that are either not owned or “held in common” has a usual property right to the results of his or her efforts” and that “the state has a duty to respect and enforce that natural right.”

This notion, which has been further developed in John Locke's writings, is also relevant to the discipline of intellectual property, since labor adds substantially to the worth of the final product and raw materials, such as concepts and facts, seem to be “held in common.” Lockean property rights include:

- (a) The liberty to use it without causing harm;
- (b) The power to transfer the property; and
- (c) The right to use it exclusively.

## 3. Personality Theory

The Personality theory of IPRs sets focus on the ethical and personal rights of authors. This point of view, which has its origins in the idea that a person's creative works are an extension of their personality, supports the preservation of the author-creator relationship. According to a thesis based on the writings of Hegel and Kant, private property rights are essential to meeting some basic human needs. In order to efficiently allow people to meet these demands, legislators must establish and distribute rights to resources. According to this viewpoint, the rationale for intellectual property rights is that they protect works of art that writers and artists have created as a means of expressing their “wills”—an activity that is considered essential to “personhood”—from being appropriated or altered.



Justin Hughes established the following principles regarding the proper framework of an intellectual property system, taking influence from Hegel's Philosophy of Right:

- ◆ The results of highly expressive intellectual efforts, like novel writing, ought to get greater legal protection than the findings of less expressive endeavors, such as genetic research.
- ◆ Even while a person's "persona"—his "public image, including his physical character, mannerisms, and history"—does generally come from labor, it merits significant legal protection because it is an essential "receptacle for personality."
- ◆ Writers and inventors should be allowed to profit financially as well as gain the public's respect, honor, and gratitude by selling or distributing copies of their creations. However, they shouldn't be allowed to give up the right to stop others from changing or misattributing their works.

#### 4. Social Justice Theory

By putting an intense focus on equitable access to information, creative expression, and innovation, the Social Justice Theory of IPRs aims to strike a balance between the needs of creators and larger social issues. This philosophy, which is based on inclusion and fairness, handles problems with access, distribution, and democratization of knowledge. It is based on the idea that property rights, in general, and intellectual property rights, in particular, may and should be created with the purpose to help generate a new and appealing culture. The approach has some similarities with utilitarianism, but does not agree to organize a vision for a society richer than the conceptions of "social welfare" given by utilitarians.

Neil Netanel's article, "Copyright and a Democratic Civil Society," provides a suitable example. With the goal of working with "unions, churches, political and social movements, civic and neighborhood associations, schools of thought, and educational institutions," Netanel paints an early image of "a robust, participatory, and pluralist civil society." Everyone would have some degree of financial freedom in the world described, but they would also have a great deal of responsibility for affecting the social and economic climate in their communities. According to Netanel, the survival of democratic



political institutions depends on the continuation of such a civil society. However, such a society cannot develop on its own; the government must provide for it.

### IN-TEXT QUESTIONS

5. Darjeeling tea from India and Tequila liquor from Mexico are example of which type of IPRs?
  - (a) Geographical Indications
  - (b) Copyrights and related rights
  - (c) Patents
  - (d) Trademarks
6. Who is the founder of the Utilitarian theory of IPRs?
  - (a) Neil Netanel
  - (b) Keith Aoki
  - (c) John Locke
  - (d) Jeremy Bentham
7. The Labour theory of IPRs given by:
  - (a) Keith Aoki
  - (b) John Locke
  - (c) Neil Netanel
  - (d) Jeremy Bentham
8. Which of the following theory support this – “property must be protected in order to create a rich and robust cultural environment”?
  - (a) Social Justice theory
  - (b) Labour theory
  - (c) Utilitarian theory
  - (d) Personality theory
9. Lockean property rights include:
  - (a) The liberty to use it without causing harm.
  - (b) The power to transfer the property.
  - (c) The right to use it exclusively
  - (d) All of the above



## 4.5 IPRs and Spillovers

Since they provide inventors and creators legal protection for their intellectual property, IPRs are essential for promoting innovation and creativity. IPRs, however, have an impact that goes beyond individual rights and is referred to as spillover effects. The unforeseen and often beneficial impacts that intellectual property protection can have on society and the economy at large are referred to as these effects. The protection of intellectual property may have consequences for the sustainability of knowledge and innovation. Companies that hold intellectual property rights, for example, have the ability to limit or discourage the investigation of that information, which reduces the knowledge transfer to entrepreneurs. Since dominant companies usually do not market all of the information that their R&D creates, this suggests losses at the society level.

Furthermore, the success of public intellectual property rights implementation has a negative moderate effect, meaning that domestic firms may experience less horizontal output spillovers from FDI inflows in countries where there is strong intellectual property rights law defence and enforcement. This is because foreign firms can exercise market power and stifle domestic firms' competition.

The effects of intellectual property protection within product classes that are comparable are also the subject of investigation. For example, there was no empirical data in the interwar aircraft industry regarding the influence of intellectual property protection granted to manufacturers of one kind of commodity on innovation in related (i.e., complement or alternative) commodities. Three barriers are present in measuring the direct and indirect effects of intellectual property protection on innovation: determining the causal relationship between intellectual property protection and innovation, measuring innovation, and measuring intellectual property protection.

### *Spillover Effects*

- 1. Diffusion of Knowledge:** The spread of knowledge is one of the main side consequences of intellectual property protection. IPRs give the originator exclusive rights, but they also require that information about the production or invention be disclosed. By sharing information across the industry, this disclosure enables other innovators to expand upon previously developed concepts.



- 2. Technological Progress:** Strong intellectual property safeguarding has the potential to foster technological progress. Inventors and innovators are more inclined to fund groundbreaking research when they have confidence that their efforts will be safeguarded. The ensuing advancement frequently goes beyond the original idea, spurring innovation across the whole sector.
- 3. Promoting Investment:** Strong intellectual property protection draws in capital. Projects or businesses that have protected their intellectual property are more likely to receive funding from investors. In addition to helping the original inventor, this financial infusion stimulates the expansion of related sectors, creating jobs and stimulating the economy.
- 4. Increased Competition:** Inversely, robust intellectual property rights can encourage constructive competition. Businesses are encouraged to engage in research and development because they know their discoveries will be protected, which increases market competition. As businesses compete to outperform one another in terms of efficiency and quality, consumers gain from better goods and services.
- 5. Cultural Development:** The development of the cultural and creative industries depends heavily on copyright protection, a component of IPRs. When convinced that their creations will not be misused, artists, writers, and other creators are more inclined to generate original works. This enhances cultural diversity and supports the expansion of the creative economy.

#### IN-TEXT QUESTIONS

- 10.** Which of the following is not a spillover effect of IPRs?
  - (a) Technological Progress
  - (b) Promoting Investment
  - (c) Knowledge Diffusion
  - (d) Appropriability of Technology
- 11.** Knowledge spillovers are:
  - (a) Positive externalities
  - (b) Negative externalities
  - (c) Zero externalities
  - (d) All of the above



## 4.6 IPRs and Appropriability

For an understanding of the workings of IPRs, the idea of appropriability is essential. The capability of people or organizations to reap the financial gains of their inventions or intellectual property is referred to as suitability. Basically, it looks at how successful creators may be in protecting and making money from their intellectual assets when faced with difficulties.

Appropriability refers to the degree to which the potential economic advantages from an innovation can be appropriated by the companies which are engaged in technology development. Where appropriability is high, firms can reap the benefits of their innovation and in case of low appropriability; the profit potential of economic innovation is dissipated through imitation by other firms in industry or ceded to suppliers, distribution channels, and customers. When patents are obtained in the pharmaceutical industry, the developing firms reap the benefits of innovation. Even in high-technology industries, technological appropriability is often largely different for various competitive areas. To describe this point, in the Box 4.1, we compare two high-tech sectors - information technology and biotechnology.

### Box: 4.1

#### **The Appropriability of Technology: Software Industry and Biotechnology**

In the text, we have discussed the idea of appropriability of the benefits of technology and noted the significance of this concept in getting competitive advantage. With increased levels of competition and rapid changes in technological areas, the capability of companies to appropriate long-term benefits from innovation has been eroded. Thus, most of the economic benefits related with innovation are the result of proprietary intellectual property. The more proprietary the innovation, the greater will be the competitive advantage provided to the firm. The capacity of a firm to protect these intellectual property rights (IPRs) is key to its ability to appropriate long-term benefits



from the technology. In some sectors, such as Biotechnology, patent protection may exist for these IPRs. However, if other firms are able to “engineer around” these patents, the patent provides little long-term assurance of appropriability. Further, in industries, such as software and information technologies, the underlying innovation may be easily duplicated. In these cases, patents or copyrights may provide not protection at all.

*Source:* Rosenbloom Richard. “The Future of Industrial Research.” Talk given at the University of Kansas, Center for Management of Technology Workshop Series, January, 1994.

The knowledge, innovation and appropriability play a key role in the growth of biotechnology, ICT and the cultural industries.

Teece (1986) developed a novel theoretical framework to study the relationship between appropriability and innovation. He maintained that the interplay of three sets of elements determines the profitability of innovation: (i) appropriability regimes; (ii) complementary assets; and (iii) the existence or nonexistence of a dominating paradigm in the industry in which enterprises operate.

- ◆ The nature of technology and the effectiveness of the existing legal protection mechanisms serve as the fundamental characteristics of the concept of appropriability regimes. The capacity of businesses to keep more or less of the revenues from their innovations defines tight or flexible appropriability regimes. Certain technologies may be eligible for trade secret protection; this is frequently more practical for process innovations than for product improvements. Conversely, patents are particularly well-suited for inventions like novel chemical compounds and numerous mechanical innovations. Another significant factor is the type of information at play. Since tacit information is implicit and unique and frequently ingrained in a company’s processes and capabilities, it is more difficult to describe and convey than codified knowledge, which is more readily repeatable. Although tacitness serves as a means for knowledge holders to appropriate information, it is nonetheless susceptible to imitation, for example, when people or employees are hired who possess vitally crucial abilities.



- ◆ The idea of complementary assets is highly pertinent since it emphasizes the necessity of production, marketing, and after-sales support, among other things, for an innovation to be successfully commercialized. This indicates that appropriability is mostly dependent on the firms' other capabilities rather than solely on the more or less effective aspects of the technology that needs to be protected.
- ◆ According to the dominant paradigm or dominant design theory, there is a cycle in many industries that moves from a first pre-paradigmatic stage, where firms compete with one another through different designs in an effort to gain market dominance, to a second stage where price becomes more of a factor and economies of scale, learning, and specialized equipment become more important. During this trajectory, there is a change in the kind of innovations and appropriability mechanisms that are used. Therefore, the strategies businesses employ to safeguard their inventions also depend on where their industry is in its life cycle.

Certain factors distinguish the different knowledge appropriation strategies: (i) firm-specific factors (size, capability, innovation strategies, product type); (ii) knowledge-specific factors (tacit vs. codified); (iii) technology-specific factors (product vs. process innovations); (iv) industry-specific factors (life-cycle stages and appropriability regimes); (v) geographic location and the institutional and legal environment that is currently in place.

Thus, the dynamics of innovation-appropriability will differ significantly between most Least Developed Countries (LDCs), which are primarily dependent on traditional agricultural activities and have lower levels of productivity and technology, and advanced developing countries like some Latin American or Asian economies, where industrial, export, and innovation capabilities are more or less strong.

The early research on patents and appropriability demonstrated that patents were crucial for the pharmaceutical industry alone in terms of profiting from innovation. Researchers Levin et al. (1987) examined how businesses employed a range of appropriability tactics, including lead periods, secrecy, quickly progressing through the learning curve, and complementary sales, service, and production facilities.

The ability of an economic agent to profit from its ideas or innovations by briefly gaining monopolistic control over the knowledge it produces



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is known as appropriability. Patents, copyright, trademarks, industrial designs, utility models, and plant breeders' rights are a few examples of IPRs those innovators may employ as appropriability mechanisms.

Other strategies, however, are also at play, such as taking advantage of lead time, learning quickly, utilizing complementary manufacturing skills, and maintaining confidentiality. Human resource management techniques, labor laws, and contracts are also important appropriability mechanisms because labor mobility is a type of technological copying. However, some of those methods can fall under the category of secrecy. In certain businesses, there are additional practical and technological security measures including digital signatures, copy prevention methods, and passwords.

***Main Points on IPRs and Appropriability***

- ◆ Different appropriability procedures are typically used by firms. First, businesses do it sequentially, for example, when an invention is first shielded by secrecy before being patented; second, businesses do it concurrently, for example, when an invention consists of multiple components that can be protected using various appropriability instruments.
- ◆ For the majority of industries and innovation kinds, lead time and secrecy appear to be the most applicable appropriability strategies. Additional methods of appropriability, such as production and marketing capabilities, offer a valuable tool for safeguarding innovations.
- ◆ Compared to SMEs, large enterprises are more likely to patent and view patents as a more effective appropriability approach.
- ◆ To accomplish the goal of “strategic patenting,” which includes patent blocking, lawsuit avoidance, reputation building, cross-licensing, and venture capital attraction, businesses combine patents with other appropriability techniques.
- ◆ When it comes to some industries like biotechnology, certain equipment industries, and the chemical (particularly pharmaceutical) sectors, patents are more pertinent appropriability tools for product innovation than for process advances.

***Importance of IPRs in Appropriability***

1. **Securing Ownership:** By nature of their legal protection, creators get sole ownership and control of their intellectual creations. The ability



for creators to control the use, reproduction, and commercialization of their works makes ownership essential to appropriability.

- 2. Monetization Potential:** Intellectual property rights permit innovators to make money out of their creations. Either by selling patents, licensing agreements, or copyrighted works, people and organizations can make money from their intellectual property. The entire appropriability of intellectual property is enhanced by this capacity to obtain monetary benefits.
- 3. Imitation Prevention:** Illegal use of intellectual property is discouraged by the prospect of penalties for infringement. By discouraging competitors from copying or imitating the protected works, this deterrent impact improves appropriability and maintains the exclusivity provided by IPRs.

### *Challenges to Appropriability*

- 1. Enforcement Issues:** Although IPRs offer a legal framework, it can be hard to enforce these rights. The usefulness of appropriability may be threatened by inconsistent legal systems, differences in the degree of penalty throughout jurisdictions, and the cost of proving infringement.
- 2. Rapid Technological Advancements:** It gets more and more difficult to maintain appropriability in companies which are driven by these developments. Innovations could become obsolete quickly, and the sum of money that inventors can get from their creations might be limited by how long it takes to get and enforce intellectual property rights.
- 3. Difficulty of Patent Systems:** Although created to encourage innovation, patent systems can also make appropriability difficult. Small inventors and entities with limited funds may be discouraged from pursuing protection for their ideas due to the difficulty of patent applications and the time-consuming and expensive process of getting a patent.

### *Strategies for Enhanced Appropriability*

- 1. Strategic Licensing:** By licensing agreements, collaboration can improve appropriability. Creators can increase the audience for their



works while maintaining control and making profit by properly licensing their intellectual property to other companies.

2. **Continuous Innovation:** Over time, appropriability can be preserved with the help of a dynamic approach to innovation. Creators may maintain a competitive edge and ensure the ongoing importance of their original works in the market by consistently growing and updating their portfolio of intellectual property.
3. **Worldwide Intellectual Property Strategy:** Considering that many sectors are worldwide in scope, it is essential to have a thorough international Intellectual Property strategy. To maximize appropriability worldwide, this involves ensuring protection in important markets, managing various legal frameworks, and resolving cultural and regulatory differences.

#### IN-TEXT QUESTIONS

12. The mechanisms for appropriating knowledge vary by just:
  - (a) Firm-specific factors
  - (b) Industry-specific factors
  - (c) Technology-specific factors
  - (d) All of above
13. Teece (1986) argued that the theoretical framework for analyzing IPRs and appropriability is based on:
  - (a) Appropriability regimes
  - (b) Complementary assets
  - (c) Dominant design
  - (d) All of the above
14. Examples of which are patent blocking, lawsuit avoidance, reputation building, cross-licensing, and venture capital attraction:
  - (a) Strategic Patenting
  - (b) Strategic Management
  - (c) Strategic Intent
  - (d) None of the above





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point of view, which has its origins in the idea that a person's creative works are an extension of their personality, supports the preservation of the author-creator relationship. By putting an intense focus on equitable access to information, creative expression, and innovation, the Social Justice Theory of IPRs aims to strike a balance between the needs of creators and larger social issues.

Since they provide inventors and creators legal protection for their intellectual property, Intellectual Property Rights (IPRs) are essential for promoting innovation and creativity. IPRs, however, have an impact that goes beyond individual rights and is referred to as spillover effects. Appropriability refers to the degree to which the potential economic advantages from an innovation can be appropriated by the companies which are engaged in technology development. Securing ownership, monetization potential and imitation prevention increases the importance of IPRs in appropriability. The challenges to appropriability arise due to enforcement issues, rapid technological advancements and difficulty of patent systems. The strategic licensing, continuous innovation and worldwide IPRs strategy are useful for enhancing appropriability.

#### 4.8 Answers to In-Text Questions

- |                                 |                                       |
|---------------------------------|---------------------------------------|
| 1. (a) 27                       | 9. (d) All of the above               |
| 2. (a) 20 years                 | 10. (d) Appropriability of Technology |
| 3. (a) Trademarks               | 11. (a) Positive externalities        |
| 4. (a) 10 years                 | 12. (d) All of above                  |
| 5. (a) Geographical Indications | 13. (d) All of the above              |
| 6. (d) Jeremy Bentham           | 14. (a) Strategic Patenting           |
| 7. (b) John Locke               | 15. (d) All of the above              |
| 8. (a) Social Justice theory    |                                       |

#### 4.9 Self-Assessment Questions

1. Explain the concept of Intellectual Property Rights (IPRs). Discuss the various types of IPRs.



2. What are various theories of IPRs? Explain briefly the rationale and the underlying idea behind them.
3. Write a note with relevant examples on the following:
  - (i) Patent
  - (ii) Copyright
  - (iii) Geographical Indications
  - (iv) Trademark

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# UNIT - IV





# Formulating Technological Innovation Strategy

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## STRUCTURE

- 5.1 *Learning Objectives*
- 5.2 *Introduction*
- 5.3 *Protecting Innovation*
- 5.4 *Timing of Entry for Technological Innovations*
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## 5.1 Learning Objectives

- ◆ Explore the importance of strategic direction to formulate an innovation strategy.
- ◆ To analyse and compare qualitative and quantitative methods to select the innovation projects.
- ◆ To examine the timing of introducing an innovation in the market.
- ◆ To evaluate the standard in formulating the innovation strategy.



## 5.2 Introduction

The strategy for technological innovation begins by evaluating the current state and mapping out future strategic pathways. This phase incorporates essential tools for strategic analysis, enabling managers to tackle crucial inquiries regarding the company's environment, strengths and weaknesses, potential threats and opportunities, sustainable competitive advantages, core competencies, and the essential resources needed to achieve the organization's long-term goals. Navigating the intricate realm of innovation requires a strategic approach, starting with the meticulous selection of innovation projects and the adoption of collaborative strategies. This involves a comprehensive analysis of existing capabilities and market dynamics, supplemented by collaborative efforts such as partnerships and alliances to amplify innovation endeavors. Furthermore, protecting innovation emerges as a crucial aspect, encompassing the safeguarding of intellectual property and proprietary technologies. Balancing the sharing of knowledge for collaboration with the imperative to secure a competitive advantage forms a delicate challenge within this sphere. The timing of entry into the market is equally pivotal, as success often hinges on introducing innovations at the opportune moment, considering factors like market readiness, consumer demand, and competitive landscapes. Lastly, the establishment of standards and achieving design dominance emerges as a strategic thrust, shaping industries and markets. By influencing norms within an industry, organizations can position themselves as leaders, gaining a sustained advantage. This comprehensive approach to innovation strategy covers the intricacies of project selection, collaboration, protection, timing, and strategic positioning through standards and design dominance.

### 5.2.1 Defining the Organization's Strategic Direction

The technological innovation strategy starts with assessing its existing state and outlining future strategic directions. This step also includes fundamental tools for strategic analysis, helping managers address key questions such as threats and opportunities in the firm's environment, key strengths and weaknesses, sustainable competitive advantages, core competencies, and necessary resources for the attainment of long-term



goals of the organization. In 2018, Tesla, known for its electric cars, energy products, and solar technology, faced challenges despite its high market capitalization. Although delivering over 100,000 cars in 2017, production struggles, missed targets, and concerns about financial viability arose. Tesla's history began in 2003 when Martin Eberhard and later Elon Musk envisioned environmentally friendly electric vehicles. The initial success of the Roadster led to the Model S, achieving profitability in 2013. Subsequent models, like the Model X and Model 3, expanded Tesla's reach. Ambitious production goals, Gigafactories, and the acquisition of SolarCity raised questions about the company's focus and pace. Despite criticism, Tesla's innovative approach and growing fan base fuelled its trajectory, leaving analysts to ponder the sustainability of its rapid expansion.

This strategic analysis also helps in choosing Innovation Projects. A well-crafted technological innovation strategy helps the firms in gaining competitive advantage, providing a roadmap for future development. This approach necessitates a precise evaluation of the analysis of external environment and company's internal environment and the clear expression of an ambitious strategic goal, establishing a disparity between the current resources and those required to fulfill the intended objective. Cohesive utilization of all resources around a unified vision by understanding the environmental dynamics enables a business to outperform its rivals, gain a superior market position that is challenging for competitors to replicate.

### 5.2.2 External Environment Analysis

To evaluate the current market position of a firm, strategic analysis tools are employed for external and internal assessments. External analysis involves using tools like Porter's Five-Force Framework (PFCF) and stakeholder analysis. PFCF assesses industry attractiveness and identifies opportunities and threats for a firm by analyzing five forces. Originally designed for industry attractiveness, the model is commonly used to evaluate the dynamics of an organization's external environment. The distinction lies in the perspective: industry-level analysis treats competitors uniformly to determine overall profitability, while firm-level analysis considers how external forces impact a particular firm relative to its competitors, aiming to identify specific threats and opportunities. For instance, examining



the discount retailing industry's attractiveness might highlight general challenges, but focusing on Walmart reveals potential profitability due to its scale, advanced technology use, and strategic locations, granting it significant bargaining power. Emphasizing the latter approach suits the goal of guiding a specific firm's strategic direction.

**(i) Assessing Industry Rivalry**

Examining the degree of existing rivalry in an industry involves considering factors such as the number and size of competitors. While industries with comparable-sized firms tend to be more competitive, exceptions exist. For instance, oligopolistic industries i.e., Telecommunications Industry that is characterized by a few major players that control a substantial portion of the market. Despite having few big player, can become intensely competitive due to factors like price wars. However, strategic choices, like avoiding head-to-head competition or engaging in tacit price collusion, can reduce rivalry. Differentiation among competitors, influenced by factors like unique product focus, also plays a role. Demand conditions impact rivalry, with increasing demand reducing competitive pressure, and declining demand intensifying competition. Exit barriers, such as fixed investments, emotional ties, and other commitments, can further elevate rivalry by discouraging firms from leaving the industry.

**(ii) Threat of Potential Entrants**

Assessing the threat for new entrants involves considering the industry's attractiveness and entry barriers. Factors like profitability levels and expansion of incumbents attract new entrants, but entry barriers limit the entry in this particular sector. High projected growth in a market, for example, may attract potential entrants, but the challenge of competing with established competitors can discourage entry. Effective competition requires significant resources, such as manufacturing, advertising, and distribution capabilities. Partnerships, like utilizing contract manufacturers and mobile phone service providers, can reduce start-up costs for potential entrants.

**(iii) Bargaining Power of Suppliers**

The extent to which an organization depends on suppliers influences its negotiation power. Few, highly differentiated suppliers can limit a firm's choices, reducing its negotiating leverage. Abundant,



undifferentiated suppliers, on the other hand, may compete for the firm's business, enhancing negotiation power. The volume of purchases also matters; if a firm constitutes a significant portion of a supplier's sales, the supplier has less bargaining power. Supplier bargaining power can be influenced by switching costs, supplier vertical integration, and the ability to threaten forward integration into the firm's business.

**(iv) Bargaining Power of Buyers**

Similar factors that affect supplier bargaining power also apply to the bargaining power of buyers. The organization's reliance on a few customers increases buyer bargaining power. Product differentiation can reduce buyer bargaining power, while switching costs for buyers or sellers can impact negotiation dynamics. Threats of backward or forward vertical integration also influence buyer bargaining power.

**(v) Threat of Substitutes**

Evaluating the threat of substitutes involves considering products or services that fulfill a similar role for customers. The more substitutes available, and the more closely they align with the functionalities of the company's offerings, the greater the threat of substitution. Relative pricing also shapes this threat; for example, cheaper substitutes can pose a significant threat. Distinguishing between competitors and substitutes depends on industry definition.

***Role of Complements***

Recognizing the role of complements, products enhancing the usefulness or desirability of another, is crucial. Complements, such as software for computers or gasoline for automobiles, impact industry dynamics. Factors like complement availability, quality, and pricing influence industry threats and opportunities. Understanding complement importance, differential availability, and value capture by rivals' aids in assessing industry attractiveness.

***Stakeholder Analysis***

Stakeholder analysis is also one form of external environmental analysis but with more focus on stakeholders. Stakeholder analysis involves identifying entities with a vested interest in the organization. Stakeholders,



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including external stakeholders including stockholders, suppliers, customers, lenders, the local community, government, and rivals, contribute resources and internal stakeholders such as employees, make claims on the organization. Understanding stakeholder interests and prioritizing them from the firm's perspective is vital for both strategic and ethical considerations. For instance, recognizing how third-party vendors affect printer manufacturers' profits highlights the strategic importance of managing stakeholder relationships.

### 5.2.3 *Internal Analysis*

Internal analysis focuses on identifying the firm's strengths and weaknesses, often by examining activities within the value chain. This model categorizes activities into primary (inbound logistics, operations, outbound logistics, marketing and sales, and service) and support (procurement, human resource management, technology development, and infrastructure) activities. Each activity is assessed for its contribution to overall value and the firm's capabilities and constraints. This internal analysis aids in understanding the firm's core competencies and areas for improvement.

The examination of a firm's internal environment typically commences by identifying its capabilities and constraints. This process is sometimes structured by scrutinizing each component of the value chain. Every task is assessed according to its impact on the overall value created by the company, pinpointing the strengths and weaknesses of the firm in each specific area. For instance, Rachio Smart Watering Devices, a company specializing in smart home devices will have a different value chain analysis. In this analysis, product design and innovation are highlighted as primary activities, while customer support, categorized as a support activity, is given less emphasis. The company gives a significant focus on research and development for designing cutting-edge smart home water device. After identifying key strengths and weaknesses through internal environment and external environment analysis, the firm can evaluate which capabilities and competencies have the potential to differentiate from their competitors and help them to secure a competitive advantage. This assessment provides valuable insights into which activities and resources should be further emphasized in shaping the firm's future strategic objectives.



For a resource to be a possible source of enduring competitiveness, it must possess characteristics such as rarity, value, durability, and inimitability. While resources that are both rare and valuable can confer a competitive edge over its competitors, sustaining this position depends on the firm's ability to retain these resources and prevent imitation by other firms. Take, for instance, a positive brand image—a valuable but rare resource that demands ongoing investment for sustenance. Without the capital to reinvest, the advantage may erode. Many valuable resources face the risk of imitation, as technological progress can easily get reverse-engineered, successful marketing initiatives are duplicated, and technically superior human resource practices are implemented by competitors. However, certain resources resist easy imitation. Tacit resources (not easily codified), path-dependent resources (dependent on specific historical sequences), socially complex resources (arising from intricate interactions among individuals), and causally ambiguous resources (where the value generation process is unclear) are particularly challenging to imitate. Talent is an example of a resource often deemed tacit, as it is considered an inherent trait difficult to train, and the mechanisms behind its acquisition are rarely discussed. A first-mover advantage, being path-dependent, is uncopiable—once a firm secures the first-mover position, others lose the chance to be first. Following this internal analysis, the firm can proceed to identify core competencies and formulate its strategic goal for the years to come.

#### ***5.2.4 Identification of Core Competencies and Dynamic Capabilities***

- (a) ***Core Competencies:*** Core competencies for an organization go beyond mere technological expertise. They are strategic differentiators derived from the fusion and synchronization of diverse core capabilities where the company excels. These competencies often span diverse areas such as market interface management effective infrastructure establishment and management and technological prowess. Sony's proficiency in miniaturization serves as an example, emanating from the harmonization of various technologies and extending into multiple markets. Successful core competencies are contingent



on fostering strong relationships across departments and strategic operating units.

Prahalad and Hamel draw a parallel between core competencies and roots, which bring about the term ‘core products’. These fundamental products, subsequently, result in the creation of business units responsible for manufacturing the diverse final products of the company. An individual business unit may be supported by multiple core competencies, highlighting the need for organizational structures and incentives that foster collaboration and resource exchange across strategic business unit boundaries. Prahalad and Hamel suggest that a company is unlikely to excel in more than five or six core competencies.

Tests proposed by Prahalad and Hamel for identifying core competencies include:

**Significant Basis of Competitive Differentiation:** Does it offer a distinctive hallmark to the organization? Contributing significantly to the perceived value by customers? For instance, Sony’s miniaturization skills impact the utility customers derive from its portable products.

**Transcendence across Businesses:** Are spectrum of both current and novel ventures interrelated? Honda’s core competence in engines enables success across diverse businesses like automobiles, motorcycles, lawn mowers, and generators.

**Difficulty of Imitation:** Is it difficult for competitors to mimic? Competencies stemming from the intricate integration of multiple technologies are generally challenging to replicate. The risk of “core rigidities” arises when a firm becomes excessively dedicated to existing skills and resources, hindering the development of new core competencies. Incentive systems and organizational norms that reinforce existing competencies can deter exploration and innovation. Accumulated knowledge tends to be path-dependent, potentially limiting flexibility.

(b) **Dynamic Capabilities:** In rapidly evolving markets, developing core competencies to respond to change becomes crucial. Dynamic capabilities, in contrast to specific core products, focus on a set of abilities that enable quick organizational reconfiguration and



adaptation to new opportunities. Firms with dynamic capabilities can swiftly adjust to growing markets and technological advancements. For example, Corning's core competency lies in its adaptability, investing heavily in research and managing relationships with Capital Rationing. Capital rationing involves allocating a limited quantity of resources across various potential uses. Creating innovative products and services is not just costly and time-intensive but also inherently risky, given the elevated probability of failure. Firms are confronted with the challenge of selecting worthwhile projects for investment, necessitating a meticulous and well-considered development process. Further section delves into the diverse methods employed to appraise and select innovation projects, by using qualitative to quantitative approaches.

**The Development Budget:** According to the assumptions of project valuation techniques, all valuable projects will secure funding, most companies have limited capital and other resources so the question of capital allocation is of prime importance. In the context of new product development plans, capital rationing is a common approach, wherein the company establishes a fixed research and development budget, often pegged as a percentage of the last year's revenues. The allocation of funds is then determined by prioritizing potential projects through a rank ordering process. Companies might set this budget based on industry benchmarks or their own historical performance benchmarks.

- (c) **Quantitative Methods for Project Selection:** Quantitative approaches for assessing new projects entail converting project details into forecasts of future cash returns. Despite offering rigorous mathematical and statistical analyses, the reliability of these estimates may be uncertain, particularly in dynamic or unpredictable environments. Standard quantitative methods in this context encompass discounted cash flow (DCF) techniques and real options.

**Discounted Cash Flow (DCF) Methods:** DCF analysis is widely used to evaluate the projects by taking following variables into consideration such as payback period, risk, and the time value of money. There are two types of DCF analysis that are widely



used in project assessment: Net Present Value (NPV) and Internal Rate of Return (IRR). NPV determines the project's value today based on expenditures, cash inflows, and a discount rate. On the other hand, IRR calculates the rate of return a project yields. Both methods involve estimating expenditures and cash inflows, allowing decision-makers to incorporate risk measures. Riskier projects may use a higher discount factor. To calculate NPV, managers estimate project costs and anticipated cash flows under various scenarios such as best-case and worst-case cash flow scenarios. Anticipated expenses and cash flows in the future are discounted to their present value, accounting for risk and the time value of money. A positive NPV suggests that, based on the assumptions applied in cost and cash flow calculations, the project creates economic value in future. Secondly, the Internal Rate of Return (IRR) for a project is the discount rate at which the Net Present Value (NPV) becomes zero. Both NPV and IRR methods offer concrete financial estimates, assisting in strategic decision-making by considering investment timing, cash flows, time value of money, and risk. However, they have limitations. Discounted cash flow estimates heavily rely on accurate profit forecasts, potentially underestimating a project's contribution, especially for long-term or risky ventures. This underscores the need for a broader evaluation approach.

**Real Options:** In the realm of new product development, some advocate for assessing projects as real options. Unlike traditional methods, real options recognize that development projects, even seemingly unsuccessful ones, can create valuable future opportunities for a firm. These opportunities may not be apparent when considering only short-term financial returns. Real options draw inspiration from stock options, where investors purchase the right to buy stock at a predetermined price in the future. In the context of real options, the initial investment in research and development (R&D) or breakthrough technologies is akin to buying a call option. The cost of future investment needed to capitalize on the R&D becomes the exercise price, and the returns from the R&D investment are analogous to the value of purchased stock. The value of a call



option in real options rises when uncertainty is reduced. Although the application of real options is still evolving, some methodologies and applications show promise in providing more nuanced insights than traditional cash flow analysis. However, critics caution against applying this approach too liberally, emphasizing the unique challenges and assumptions associated with technology investment scenarios. They highlight the active role of the investor in shaping the value of the investment, distinguishing it from the passive observation in traditional stock options.

- (d) **Qualitative Methods for Choosing Projects:** Quantitative project selection techniques are found to be very useful for the companies but at the same time, qualitative information is also of significant use. Excess quantification leads the organizations nowhere. Qualitative analysis starts with screen questions related to target customers, prospective market size, use and benefits and compatibility of the product with the expectations of the customers. In addition to this, analysis of current capabilities, competitors' capabilities and future capabilities along with project timings and cost.

### 5.3 Protecting Innovation

Generally, a utility patent is filed and granted by the patent office for a novel and useful process, machine, article of manufacture, or composition of matter. Besides that, original works of authorship, such as literary, artistic, musical, and dramatic works are protected by the copyrights in every country. Rules and regulation to protect innovations varies from country to country. Additionally, trade secrets, designs and geographic indications are also protection methods used to protect intellectual properties. Trademarks in 1991, Germany's Fraunhofer IIS developed the MP3 algorithm, revolutionizing music distribution. Facing a dilemma on patent enforcement, Tech Innovators Inc. engaged in a strategic collaboration with Data Solutions Co., leveraging a partially open licensing approach to facilitate seamless real-time data integration and innovation. Napster's 1999 launch allowed easy sharing of MP3 files, triggering concerns for the Recording Industry Association of America (RIAA). Legal battles ensued, but peer-to-peer services continued to emerge. Apple's iTunes,



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introduced in 2003, offered a legal and user-friendly platform. The success of iTunes, coupled with the rise of iPods, led to significant revenues for the recording industry. Challenges emerged, including French legislation on DRM, eventually prompting Apple to negotiate fewer restrictions with record labels. By 2009, iTunes abandoned DRM. The advent of smartphones and streaming services like Spotify and Apple Music marked a shift in music consumption, with streaming subscriptions driving market growth in 2016.

#### 5.4 Timing of Entry for Technological Innovations

UberAIR, unveiled in April 2017, aimed to revolutionize on-demand air travel using electric Vertical Take-off and Landing (VTOL) aircraft. This forward-thinking initiative aimed to ease urban congestion by utilizing three-dimensional airspace. While Uber had already disrupted traditional taxi services through its ride-sharing model, the UberAIR project required significant technological advancements in air transportation, air traffic control infrastructure, and landing pads. Founded in 2009, Uber transformed urban transportation with its ride-sharing service, diversifying into various classes and expanding into food delivery, freight, and autonomous vehicles. By 2018, it operated in over 674 cities globally, boasting an estimated market valuation of \$72 billion. UberAIR encountered challenges in 2018, as more than seventy companies developed eVTOL aircraft. Hurdles included energy consumption, legal and safety issues, and high costs. Uber aimed to address these challenges by utilizing electric propulsion, implementing flexible “skyports,” and eventually introducing fully autonomous eVTOLs, projecting operating costs as low as 44 cents per passenger mile. Despite skepticism, notably from figures like Elon Musk favoring underground solutions, Uber remained committed. CEO Dara Khosrowshahi, initially uncertain, recognized the broader vision of urban mobility. By June 2018, Uber planned to test UberAIR in Dallas and Los Angeles by 2020, with a goal of commercial deployment by 2023. However, competition from companies like eVolo, EHang, and Terrafugia, exploring air taxi services or flying cars, posed a challenge. Uber AIR was the first mover in using electric Vertical Take-off and Landing (VTOL) aircraft space. The crucial question was whether Uber’s



dominance in ride-sharing could translate into success in air ride-sharing and whether such a position could be sustained. Therefore, it is relevant to explore different entry timings along with their respective advantages and disadvantages.

### 5.4.1 Overview of Various Entry Timings

- (i) **First Movers:** first movers are the pioneers in a new product or service category. In a market dominated by digital cameras from Canon, Nikon, Sony, and Samsung, Kodak's digital cameras held a minor share. Despite being an early innovator in digital technology and inventing the digital camera in 1975, Kodak was perceived as a latecomer in the digital camera market. This perception was accurate since Kodak only began promoting digital cameras in the early 2000s, missing the opportune timing.
- (ii) **Early Followers:** Enter the market early but not first. Microsoft: Despite not being the initial developer of an operating system or graphical user interface, Microsoft entered the market early with MS-DOS and later Windows, establishing itself as a dominant player. Samsung: Recognized as an early follower in the smartphone industry, Samsung entered the market subsequent to Apple but swiftly acquired a substantial market share with its Android-based devices.
- (iii) **Late Entrants:** Join the market when the product gains mass popularity or later.

Entry timing involves deciding whether to enter a specific country early or late. Some companies seek first-mover advantages, which are benefits exclusive to the initial market entrants. Examples include "Xerox," "FedEx," and "Google," which have become synonymous with certain actions. In many African countries, "Colgate" is a generic term for toothpaste, emphasizing the impact of early entrants. Late movers, like Unilever, may face challenges as their products are identified in relation to established brands. First movers can gain advantages through proprietary technology, pre-emptive investments, and creating entry barriers for latecomers. Fierce competition within the domestic market might lead fewer dominant firms to venture into foreign markets as a strategic



move to sidestep direct confrontations with dominant competitors. For instance, Japanese companies like Matsushita, Toyota, and NEC, while dominant in Japan, entered the U.S. ahead of their leading counterparts. In industries with increasing returns to adoption, timing is crucial. Early adoption can bring advantages like greater funds, network effects, and reduced uncertainty. However, being too early may lead to failure. Some suggest early entrants have higher returns, while others argue that first movers are prone to failure.

#### 5.4.2 *First-Mover Advantages*

- (i) **Brand commitment and Technological Leadership:** First movers may establish a lasting reputation, brand loyalty, and market share by shaping customer expectations.
- (ii) **Preemption of Scarce Assets:** Early entrants can capture key resources like locations, patents, and distribution channels, preventing competitors from accessing them.
- (iii) **Exploiting Buyer Switching Costs:** Early adoption allows firms to keep customers even when superior alternatives emerge, often due to established switching costs.
- (iv) **Reaping Increasing Returns Advantages:** In industries with increasing returns, early providers gain self-reinforcing advantages, leading to dominant designs.

#### 5.4.3 *First-Mover Disadvantages*

- (i) **Research and Development Expenses:** early entrants bear the brunt of huge R&D costs, facing the risk of investing in unproven technologies.
- (ii) **Undeveloped Supply and Distribution Channels:** Introducing new technologies may require developing or assisting in the creation of supply and distribution networks.
- (iii) **Reliance on Underdeveloped Enabling Technologies:** Relying on other technologies and complementary goods can make first movers heavily dependent on third parties.



Despite attention to first-mover advantages, studies show high failure rates for pioneers. Market perception may misattribute advantages. First movers often face higher costs and lower profits due to significant research expenses and the challenge of developing supply and distribution channels. The decision to be an early adopter involves balancing the potential benefits of timing against the risks and costs associated with pioneering efforts.

#### ***5.4.4 The Optimal Timing of Entry into a Market is influenced by Various Factors***

- (i) Customer Certainty:** The level of certainty regarding customer preferences plays a crucial role. In early stages, customers may struggle to understand new technologies, and their needs may be unclear. The firm must gauge customer reactions and preferences as the technology evolves.
- (ii) Innovation Improvement:** The extent of improvement offered by the innovation compared to existing solutions is vital. A technology that represents a significant improvement over previous generations or alternatives is more likely to gain rapid acceptance.
- (iii) Enabling Technologies:** The reliance on enabling technologies is a critical consideration. The maturity of these technologies significantly impacts entry timing. The maturity level of enabling technologies is a determinant for early entry, with more advanced technologies supporting earlier market participation, while less mature technologies may require waiting for further development.
- (iv) Complementary Goods:** The presence of complementary goods can influence the value of the innovation. Some innovations require new complementary goods, and their availability or development capabilities impact the likelihood of successful entry.
- (v) Threat of Competitive Entry:** The level of threat from potential competitors and the presence of entry barriers are essential factors. In case, entry barriers are high, the firm may have the option to wait. However, if the technology is valuable, the market may attract competition, and low entry barriers could lead to a competitive landscape.



- (vi) **Industry Dynamics:** In sectors where the adoption of innovations leads to increasing returns, late entrants face substantial risks. Early competitors who establish a significant user base can create self-reinforcing advantages, making it challenging for newcomers to catch up. If a dominant design is chosen, and protection mechanisms like patents are in place, late entrants might find it difficult to offer compatible technologies.
- (vii) **Financial Resilience:** Being the first to introduce new innovations involves taking on significant costs and risks. First movers need considerable capital, either from internal sources or external financing, to navigate the initial period of limited sales revenue. The slow initial adoption of innovations, as depicted by the technology diffusion s-curve, can pose financial challenges, especially for startups. Companies with substantial resources may weather this phase more comfortably and even catch up to the first movers by dedicating more funds to R&D and marketing.
- (viii) **Strategic Investment for Market Adoption:** Firms with abundant financial resources not only endure slow market adoption but can also make proactive investments to expedite market acceptance. Through strategic investments in market education, developing suppliers and distributors, and creating complementary goods and services, these firms can actively shape the prompt acceptance of innovations, influencing the trajectory of adoption.
- (ix) **Reputation's Influence on Confidence:** The reputation and trustworthiness of a firm play a pivotal role in deciding the optimal timing of entry. A well-established reputation signals the firm's likelihood of succeeding with new technology. All stakeholders rely on the firm's past performance to gauge its innovative capabilities and competence. A strong reputation diminishes uncertainty for customers, making them more inclined to adopt the innovation. Furthermore, a firm with a reputable standing is more likely to attract suppliers and distributors. Microsoft's entry into the video game console industry exemplifies this, as its robust track record in personal computing attracted industry partners. A solid reputation can lead to earlier adoptions compared to firms lacking such credibility.



## 5.5 Standard Setting and Design Dominance

A dominant design refers to a singular product or process architecture that commands a significant share, typically 50 percent or more, of a product category. Despite lacking official enforcement or acknowledgment, it evolves into an industry standard.

### 5.5.1 Market Trends toward Dominant Designs

The tendency for markets to converge around a single dominant design, rather than embracing diverse technological options, can be attributed primarily to the prevalence of increasing returns to adoption within many industries. This phenomenon signifies that the value of a technology amplifies with its widespread adoption. Complex technologies, in particular, exhibit increasing returns, with the usage leading to continual enhancements.

### 5.5.2 Increasing Returns to Adoption

- (i) **Learning Effects:** Extensive research proves that the more a technology is utilized, there is a high probability that it evolves, becoming more effective and efficient. Sales revenues generated from its adoption are often reinvested in further development.
- (ii) **Learning Curve Impact:** Cumulative production, as represented by the learning curve, showcases that repetition of processes enhances efficiency, resulting in cost reductions and improved productivity.
- (iii) **Absorptive Capacity:** the investment commitment of the organizations in previous learning accelerates future learning, creating absorptive capacity. This capacity allows firms to assimilate information effectively, influenced by their prior related experiences.
- (iv) **Network Externalities:** Many markets exhibit network externalities, where positive relationship has been found between the number of users and the worth of a good. This effect is particularly evident in physical networks and extends to compatibility-driven benefits in non-physical markets.



(v) **Installed Base Significance:** The number of users, known as the installed base, plays a pivotal role. Users often choose a technology based on the size of its installed base, emphasizing compatibility and ease of use.

(vi) **Complementary Goods:** The existence of complementary goods further enhances the attractiveness of a technology.

In conclusion, the selection of dominant designs is influenced by a combination of increasing returns to adoption, driven by learning effects and absorptive capacity, along with network externalities that amplify the value of a technology with a growing user base. This establishes a self-reinforcing mechanism that strengthens the dominance of a specific technology in the market.

#### IN-TEXT QUESTIONS

1. A possible and desirable future state of an organisation is called
  - (a) Mission
  - (b) Strategy implementation
  - (c) Strategy formulation
  - (d) Vision
2. Which of the following is not a major element of the strategic management process?
  - (a) Formulation strategy
  - (b) Implementing strategy
  - (c) Evaluating strategy
  - (d) Assigning administrative tasks
3. Which one of the forces doesn't belong to porter five forces framework?
  - (a) Entry barriers
  - (b) Bargaining power of buyers
  - (c) Industry rivalry
  - (d) Bargaining power of government



4. Innovation does not include:
  - (a) introduction of a new product
  - (b) creation of a new market for goods
  - (c) reorganization of the management structure of the organization
  - (d) invention
5. Which one of the following is not the quantitative Method for Project Selection
  - (a) Delphic method
  - (b) Discounted Cash Flow Methods
  - (c) Net Present Value (NPV)
  - (d) Internal Rate of Return (IRR)

## 5.6 Summary

This guide emphasizes the importance of formulating a technological innovation strategy for organizational competitiveness. It outlines a step-by-step approach covering key aspects such as understanding strategic direction, competitive landscape, defining and evaluating the innovation objectives, considering intellectual property strategies, and assessment of innovation project, timings of entry and design dominance for introducing an innovation technology. The guide underscores the need for ongoing adaptation to dynamic business environments through regular reviews and updates to the innovation strategy.

## 5.7 Answers to In-Text Questions

1. (d) Vision
2. (d) Assigning administrative tasks
3. (d) Bargaining power of government
4. (c) Reorganization of the management structure of the organization
5. (a) Delphic Method



### 5.8 Self-Assessment Questions

1. Define the concept of strategic direction and its components in detail.
2. Explain porter five forces framework with the application of one industry
3. Compare the qualitative and quantitative methods of innovative projects selection.
4. What is the ideal timing to introduce an innovation in the market. Compare first mover and late entrant approaches.

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# Executing Technological Innovation Strategy

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## STRUCTURE

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### 6.1 Learning Objectives

- ◆ To explore the impact of organizational size and structure on technological innovation.
- ◆ To understand the ways to manage product development processes and teams.
- ◆ To learn the process of crafting and implementing an innovation strategy.



## 6.2 Introduction

Implementing a strategy for technological innovation involves putting into action a plan or set of actions aimed at leveraging technology to achieve organizational goals. But it is not as easy as it is seen and perceived. It is very challenging to develop and sustain the competencies and capabilities for innovation. Rather than experiencing difficulty in execution, the organizations face challenges in alignment of the innovation initiatives with overall business and corporate strategy. The innovation strategy can be a good alternative to heaps of approaches such as crowdsourcing and customer co-creation. Hence, the organizations need to build a consistent innovation system that can match the emerging competition in a unique and different manner. This unique approach toward building a consistent innovation system will help the organization to outperform the competitors and create value for the stakeholders. Technological innovation strategy is implemented to know how this will create value and how the organizations will capture the values. Technological innovation is seen from many perspectives either it is being done in an incremental or disruptive manner. This chapter details about the implementation process of technological innovation strategy and covers the following steps: organizing/ coordinating innovation, overseeing the process and teams involved in developing new products, and ultimately formulating a strategy for implementation.

### 6.2.1 *Organizing and Coordinating for Innovation*

To start with the first component, google is a perfect example. Google, founded in 1998, prioritizes innovation with a unique organizational approach. Despite its size, it maintains a small-company atmosphere, emphasizing a flexible and flat “technocracy” structure. Google’s engineers work in small teams, fostering informal communication and collaboration. An essential aspect is the 20%time policy, requiring employees dealing with technology to spend a 20% of their time on personal creative initiatives. The incentive system extends to managers, encouraging a balance between core business, related projects, and entirely new products. Google’s reorganization into Alphabet Inc. in 2015 retained its flat and flexible reporting structures. Allocation of resources and control at Google



is decided on the merit of individuals' ideas rather than their seniority or hierarchical stature. This situation entails how successfully Google has organized its innovation strategy in last two decades.

Second scenario transports the readers back to 2008, a crucial period in Glenmark's history. With three out of four drug development projects failing and signs of trouble in the fourth, the company's stock price has plunged. Financial analysts are urging the management to abandon discovery research and stick to their core strength of generics. Glenmark's CEO, Glenn Saldanha has found himself amidst mounting pressure and resource constraints. This particular situation raises a question on the implementation of innovation strategy in Glenmark and a claim to being an innovation company or not.

After reviewing these two situations, it is evident that organizational structure and controlling mechanism has a bigger role to play. Additionally, the organizational structure and the implementation of formalized procedures significantly impact innovation, project effectiveness, and new product development speed. Some support small, flexible organizations with minimal rules for fostering creativity, while others emphasize well-established procedures for better development decisions and efficient project implementation. Managers must navigate the challenge of choosing the most suitable structure and controls for their firm.

### 6.3 Organizational Size and Structure

Joseph Schumpeter stated that large firms are more effective innovators and also challenged anti-trust law proponents. Schumpeter further enunciated that large firms have more access to finance and they allocate higher budgets for R&D. Additionally, large firms, with higher sales volumes, can spread fixed R&D costs, likely resulting in higher returns. They may also invest in other complementary activities such as marketing or financial planning, making them efficient innovators. Scale and learning effects, along with the ability to undertake large or risky projects, also contribute to their innovation advantage. However, as firms grow, potential downsides emerge. Larger firms may face challenges in R&D efficiency due to managerial control issues, diminishing individual incentives, and governance effectiveness concerns. Bureaucratic inertia, stemming from layers of authority and well-established policies, can hinder large firms'



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responsiveness to change. High employee numbers, large fixed-asset bases, and strategic commitments to existing businesses may further impede agility. In contrast, small size firms in terms of size and sales are often perceived as more adaptable to innovative trends and have a better entrepreneurial spirit. Unburdened by bureaucratic layers and large fixed assets, they can monitor and reward employees more effectively. On the other hand, the smaller firms have limited resources that can compel small firms to choose projects more cautiously and going to increase the product success rates.

Empirical studies assessing the impact of firm size on innovation productivity have shown mixed results. Some studies, scrutinizing the number of patents, the introduction of new drugs, and technological advancements, suggest that small firms often excel in innovation. For instance, research on patenting output indicates that small firms may use their R&D funds more efficiently, yielding more patents per dollar spent. Another study states that in the realm of new business-to-business products, it was discovered that small firms exhibit shorter development cycles compared to large firms, even when accounting for the scale of innovation involved. Though it varies from industry to industry and larger firms are also found to outperform smaller firms in certain cases. Firms, regardless of size, have found ways to foster an entrepreneurial culture by breaking into smaller subunits. This approach has been particularly notable in industries marked by rapid technological change. In such cases, many large hierarchical firms undergo disaggregation into networks of lesser in scale, more specialized, and self-governing divisions or separate entities. Downsizing and the elimination of functions and management layers create leaner, focused, and flexible organizations connected through alliances, supplier relationships, and distribution agreements. This trend has given rise to terms like virtual organization, network organization, and modular organization. Given the dynamic nature of organizational structures, firms often adopt ambidextrous approaches, utilizing the potential of specialized divisions to adjust various structural dimensions discussed above such as extent of formalization vs. standardization and centralization vs. decentralization.

**Situation 1:** leadership and organizational structure changed the attitude towards innovation In 1916, 3M's William McKnight opened the first research laboratory of the company to enhance sandpaper, fostering a culture of innovation with ambitious goals and freedom for individuals



by introducing the target that one-fifth of sales should come from products developed in the last five years and allowing researchers to devote 15 percent of their time on personal creative projects and independent divisional innovations. As 3M expanded, Lou Lehr addressed challenges by consolidating divisions and introducing a three-tiered R&D system in 1980. Under “Jake” Jacobson in 1986, 3M focused on discipline, increasing sales targets and emphasizing team-based development, leading to concerns about eroding the entrepreneurial culture. In 1991, CEO “Desi” Desimone aimed for balance, emphasizing a culture of innovation, respect, and trust between senior management and lower levels.

Seeing the crucial role of R&D in the innovation strategy implementation, it has become important to discuss various comparisons such as Centralization vs. decentralization, Formalization vs. standardization and Mechanistic versus Organic Structures. These differences will give a better understanding of technological innovation strategy implementation by taking all important facets into consideration.

### 6.3.1 *Centralization vs. Decentralization*

Centralization denotes the concentration of decision-making authority at the upper echelons of a firm characterizes centralization, whereas decentralization entails delegating decision-making authority to lower levels. It encompasses both the geographical location of activities and the location of power and authority over those activities. For firms managing higher number of R&D projects, the decision to centralize or decentralize is intricate. Decentralizing R&D allows divisions to tailor developments to their specific needs, fostering a close fit within their operating structure and customer requirements. However, decentralization poses the risk of redundant activities and may hinder economies of scale. In contrast, centralizing R&D maximizes economies of scale, facilitates division of labor among specialists, and ensures coherent new product development. The choice between centralization and decentralization varies by firm type and industry. Research-intensive, highly diversified firms may establish separate R&D centers for communication and innovation transfer, while consumer products companies often opt for decentralized R&D that is customized to local markets. Electronics firms tend to centralize core technical activities such as R&D in competence-focused specialized hubs



primarily known as centres of excellence. The impact of centralization on a firm's adaptability and openness to technological change is debated, with highly centralized firms potentially excelling in making bold directional changes, while decentralized firms may respond more swiftly to certain types of change due to empowered lower-level decision-making.

### 6.3.2 Formalization vs. Standardization

Formalization and standardization are interlinked structural elements within organizations. Formalization is a measure of how extensively a firm utilizes rules, procedures, and written documentation to shape the behavior of individuals or groups within the organization. In contrast, standardization relates to the level of consistency in carrying out activities within a firm. The rules and procedures associated with formalization facilitate the standardization of activities, governing employee behavior and establishing clear expectations and decision-making criteria. Although formalization can serve as a substitute for some managerial oversight, fostering more streamlined operations in larger companies, it can also lead to rigidity if excessively implemented, potentially stifling employee creativity. The Theory in Action example featuring 3M illustrates how increased formalization aimed to enhance efficiency and coherence but resulted in employee resentment, impacting morale and motivation. Similarly, standardization ensures consistent and predictable outcomes but, if taken to extremes, may hinder innovation by limiting variation and impeding creative exploration.

### 6.3.3 Mechanistic Structures vs. Organic Structure

Mechanistic structures, born from formalization and standardization, prioritize operational efficiency, particularly in large-scale production like Dell Computer's streamlined approach. While often linked with high centralization, mechanistic structures can also be highly decentralized through formalization, enabling lower-level decision-making while aligning with top management objectives. However, mechanistic structures are viewed as less conducive to innovation. Their focus on strict observance to standards and reducing variation may hinder creativity. In contrast, organic structures, characterized by low formalization and



standardization, are seen as more favorable for innovation and dynamic environments. Despite being less efficient, organic structures, allowing greater employee autonomy, are considered better suited for fostering creativity and adaptability crucial for innovation.

The advantages and drawbacks of firm size, as discussed earlier, are connected to structural elements such as formalization, standardization, and centralization. With growth, large companies often resort to increased formalization and standardization to address coordination challenges, though this shift may lead to a more mechanistic structure. To counteract this, some larger firms decentralize authority, enabling divisions to operate with the agility of smaller entities. Companies like GE, HP, J&J, and GM adopt a strategy of organizing into smaller groups within the larger corporation, aiming to amalgamate the benefits of both large and small structures. The subsequent section delves into approaches that allow firms to capitalize on the benefits of size and the effectiveness of mechanistic structures while preserving the innovativeness and entrepreneurial dynamism inherent in smaller, organic structures.

### *What Finally Works?*

Tushman and O'Reilly propose the idea of an ambidextrous organization, blending short-term efficiency and long-term innovation. This involves using mechanistic structures for some functions, like manufacturing, and organic structures for areas like research and development (R&D). The approach allows tailored incentives for different divisions, fostering varied employee behaviors. The “Skunk Works” concept suggests that autonomous teams operating independently can prevent convergence on similar ideas, promoting innovation. Research supports the benefits of creating separate teams for new product development within the larger organization.

In managing multiple product divisions, companies may adopt organic structures for creativity in some divisions and more structured approaches for others. For instance, USA Today created a separate division with a distinct structure and culture when establishing its online version, adapting to the unique demands of the online platform. Apple’s creation of the Macintosh division exemplifies this strategy. Steve Jobs established a distinct culture for the team, fostering a free-spirited entrepreneurial atmosphere outside



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the constraints of the larger corporate environment. Internal structures with small-firm incentives within large organizations challenge traditional views on the relationship of firm size with innovation intensity. Firms can cultivate entrepreneurial units by harnessing the resources of the larger corporation while preserving the incentive structures characteristic of smaller organizations, fostering both incremental and discontinuous innovations. Firms can balance mechanistic and organic structures by adopting different structures alternatively. Some companies, like Intel and Hewlett-Packard, maintain a “dynamic tension” between formal, quasi-formal, and informal structures. While formal structures ensure systematic production, frequent reorganization enables adaptability. Quasi-formal structures, such as teams and task forces, provide flexibility and facilitate cross-divisional interaction, promoting employee motivation and idea cross-fertilization. Managing these structures can be time-consuming, and disbanding them may pose challenges due to their informal nature.

#### 6.4 Managing the New Product Development Process and Teams

The Director of Product Development at TechSolutions Inc. is at a crucial juncture as the company shifts from traditional waterfall methods to agile practices in its software development division. Faced with challenges in aligning development outputs with client expectations, particularly in a flagship software project, the Director must decide whether to persist with the Scrum framework or transition to Kanban for better adaptability. This decision not only impacts the current project’s outcomes but also has strategic implications for the organization’s future software development initiatives. Additionally, the Director is contemplating extending the Agile approach to other teams within TechSolutions Inc., aiming for increased organizational agility. The successful implementation of Agile methodologies is paramount, requiring careful consideration of project complexity, team dynamics, and potential benefits against transitional difficulties. These decisions are crucial as the organization grapples with challenges and difficulties arising from the transition to Agile.

Successful new product development hinges on achieving three intertwined yet occasionally conflicting objectives: aligning the product with customer requirements, minimizing development cycle time, and controlling costs.



- ◆ The first objective emphasizes maximizing the product's fit with customer needs, focusing on features, quality, and pricing to surpass competitors. Challenges arise from unclear customer preferences, potentially leading to overinvestment in less valued features. Overestimating a customer's willingness to pay may result in expensive products with limited market penetration. Addressing diverse customer demands poses difficulties in creating a universally appealing product. Even technologically advanced products may fail to meet customer requirements, as seen in Apple's Newton MessagePad and Philips' Compact Disc Interactive (CD-i), both experiencing issues such as impractical size and overestimated feature values.
- ◆ The second objective is to minimize development cycle time, crucial for early market entry advantages like building brand loyalty. Swift product launches provide more time for developing complementary goods, particularly vital in dynamic industries with rapidly evolving technologies. However, rapid product introductions carry risks, including adverse consumer reactions, regrets, and concerns about obsolescence. Critics argue that accelerated development may compromise quality, overlooking design flaws or sacrificing adequate testing. Despite these risks, studies generally indicate a positive relationship between speed and new product success.
- ◆ The third objective involves controlling development costs, ensuring expenses align with market reception. Excessive costs, even with a well-received product, can hinder expense recovery. Balancing effective and efficient development emphasizes continual cost monitoring.

### 6.4.1 *Types of Product Development Processes*

#### 1. **Sequence vs. Parallel**

Before the mid-1990s, the prevalent approach in most U.S. companies involved a sequential development process, progressing from one stage to another. This process featured gates where managers decided whether to advance to the next stage, revise the project, or terminate it. Typically, R&D and marketing played key roles in opportunity identification and concept development, with R&D leading in product design and manufacturing leading in process design. Critics argue



that communication gaps between R&D and manufacturing engineers at the product design stage can lead to issues as manufacturing requirements may not be considered, resulting in extended cycle times due to iterations between product and process design stages. To address these challenges and streamline development, many firms have shifted towards a partly parallel development process. In this approach, some or all development activities overlap, allowing for more direct communication between R&D and manufacturing engineers. This helps prevent issues related to manufacturability and reduces the need for extensive iterations between stages, ultimately shortening the development cycle.

In the new approach, concept development concludes, and the process design initiates well before finalizing product design. This strategy aims to enhance coordination between stages, minimizing the possibility of designing products that are challenging or expensive to manufacture. By eliminating the need for extensive iterations between design stages, overall cycle time is reduced. One specific form of parallel development, concurrent engineering, not only involves simultaneous execution of typical product development stages but also considers downstream stages like maintenance and disposal, providing a comprehensive approach. However, it's crucial to note that parallel development processes face varying degrees of endorsement. While this strategy can streamline development, there are situations where it might significantly increase risks or costs. For instance, if variations in product design necessitate substantial changes to the process design, initiating process design before finalizing product design may lead to expensive rework in the production process. These risks are particularly pronounced in dynamic and uncertain markets.

## 2. Stage-gate Processes

Stage-gate processes play a crucial role in preventing the persistence of projects with negative expected value, offering a mechanism for robust decision-making in product development. A notable model incorporating such decision points is the stage-gate process developed by Robert G. Cooper. This process delineates the progression of projects through different developmental stages, with each stage



featuring a cross-functional team led by a project team leader. The teams engage in parallel activities to mitigate project risks. At the end of each stage, a go/kill gate is positioned, serving as a decisive point for evaluating project continuation, abandonment, holding, or recycling. The process unfolds across stages, from initial investigation and conceptualization in Stage 1 to product launch and full commercial production in Stage 5. The go/kill gates act as filters, ensuring effective and efficient project execution by assessing deliverables and criteria from the preceding stage. This structured approach aids in minimizing the cost of advancing suboptimal projects and contributes to informed decision-making throughout the development cycle.

### 3. Quality Function Deployment (QFD)

Quality Function Deployment (QFD) is a structured problem-solving process originating from Japan, aimed at enhancing communication and coordination among engineering, marketing, and manufacturing teams. The key framework in QFD is the “house of quality,” a matrix aligning customer requirements with product attributes. The process involves:

- ◆ Identifying customer requirements, such as ease of use and safety in a car door.
- ◆ Weighting customer requirements based on their importance.
- ◆ Identifying engineering attributes affecting product performance, like door weight and hinge stiffness.
- ◆ Establishing correlations between engineering attributes, assessing their impact on each other.
- ◆ Completing the matrix, indicating the strength of the relationship between engineering attributes and customer requirements.
- ◆ Calculating the total relative importance of each engineering attribute by multiplying customer importance ratings and relationship strengths.
- ◆ Evaluating competitor products on each customer requirement using a scale of one to seven.
- ◆ Determining target values for design requirements based on relative importance ratings and competitor scores.



- ◆ Creating a product design aligned with the target values and evaluating its performance against customer requirements, comparing it with competitor scores.

### **6.4.2 Metrics to Check the Performance of Newly developed Innovation**

Metrics for evaluating the New Product Development (NPD) process are essential in determining its efficiency and effectiveness. These metrics cover various aspects of the development process and provide valuable insights. Key questions to consider include the average cycle time for projects, adherence to deadlines, staying within budget, and the rate of project completion. Additionally, assessing overall innovation performance involves gauging return on innovation, achievement of sales goals, revenue contribution from recent products, and the success ratio of projects within the total portfolio. Regularly monitoring and analyzing these metrics offer a comprehensive understanding of a company's innovation efforts, aiding in informed decision-making and process optimization.

### **6.5 Deployment Strategy**

Technological innovation's value relies on both capabilities and accessibility. This chapter delves into key deployment aspects: launch timing, licensing, pricing, distribution, and marketing.

#### **1. Product Launch Timing**

The timing of product launches is critical, impacting customer reception and adoption. Strategic considerations, such as leveraging seasonal effects and synchronizing with production capacity, play a role. Balancing cash flow optimization and embracing cannibalization, as seen in Nintendo's 16-bit system delay, is crucial.

#### **2. Licensing and Compatibility**

Open technology adoption can expedite acceptance but poses risks like price erosion. The video game industry's history highlights the need for a delicate balance in licensing—open for support but strict for quality control. Decisions on compatibility with existing technology and backward compatibility influence market positioning.



### 3. Pricing

Survival pricing involves setting the price of a good to cover variable costs and some fixed costs, serving as a short-term strategy without ensuring long-term profits. Penetration pricing, on the other hand, sets a very low (or free) price to maximize the market share of a good. The pricing strategy a firm adopts significantly impacts product positioning, adoption rate, and cash flow. Objectives for pricing models vary, ranging from survival pricing for short-term survival in highly competitive markets to maximizing current profits by setting prices based on costs and demand estimates. In industries with strong learning-curve effects and/or network externalities, firms often prioritize maximizing market share through penetration pricing. For new technological innovations, firms may opt for a maximum market skimming objective by initially setting high prices to signal significant innovation, recouping development expenses, but risking slower adoption.

Freemium, a pricing model, offers a base product or service for free, charging for additional features or services. Firms may adopt pricing strategies below cost, aiming to recoup losses through profits on complementary goods or services, a tactic commonly seen in the video game and printer industries. Manipulating the timing of payment, such as offering free trials or pay-as-you-go options, influences cash flow and customer perception of costs. Introductory pricing, for a limited time, helps firms test market responses without committing to long-term pricing structures.

### 4. Distribution

In distribution, firms can sell directly to users or use intermediaries like manufacturers' representatives, wholesalers, and retailers. Selling direct provides more control but can be impractical; intermediaries offer services like bulk-breaking, transportation, inventory management, and customer transactions. Advances in technology, such as the internet, have led to disintermediation in some industries, reshaping the roles of intermediaries and expanding the services they provide.

To determine the use of intermediaries and suitable types, the firm must answer key parameters:

- ◆ **Fit with Existing Distribution:** Assess how the new product aligns with the firm's current product lines and if there's an existing sales



channel that suits the product. For instance, a large direct sales force may negate the need for additional distribution options.

- ◆ **Customer Characteristics and Needs:** Consider the number and dispersion of customers, along with their need for product education or services. Evaluate if prepurchase trials are necessary. For dispersed customers with moderate education or service needs, intermediaries might be beneficial.
- ◆ **Competing Product Sales:** Understand how competing or substitute products are sold, as this influences distribution channel options and customer expectations. For instance, if customers are accustomed to high-contact retail environments, shifting to a lower-contact channel may affect perceived product quality.

#### *Strategies for Accelerating Distribution:*

- ◆ **Alliances with Distributors:** Forming strategic alliances or exclusivity contracts to incentivize distributors to carry and promote the new product are different strategic options adopted by the organizations. Existing relationships with distributors provide an advantage.
- ◆ **Bundling Relationships:** Another impactful strategy is to accelerate distribution by bundling the new technology with an already widely used product. This leverages the success of the existing product and can create switching costs for customers.
- ◆ **Contracts and Sponsorship:** There are some other important tactics such as establishing contractual arrangements with distributors, complementary goods providers, or large end users to secure technology adoption. This can include price discounts, service contracts, advertising assistance, or other incentives to the organizations and can make the distribution better.
- ◆ **Guarantees and Consignment:** The organizations try to mitigate market uncertainty by offering guarantees or selling products on consignment, especially if uncertainty exists about customer response to the new product.

#### **5. Marketing Strategies for Technological Innovation:**

- ◆ **Advertising:** Craft an effective message for advertising, balancing entertainment and information. Choose media based on target audience, information richness, reach, and cost per exposure.



- ◆ **Promotions:** Use temporary tactics to stimulate purchase or trial, such as offering samples, cash rebates, additional products with purchase, or incentives for repeat purchases.
- ◆ **Publicity and Public Relations:** Leverage free publicity through media coverage or internally generated publications. Explore viral marketing to stimulate word-of-mouth advertising through targeted individuals in social networks. These strategies aim to accelerate distribution, create awareness, and shape customer perceptions of the new technological innovation.

**Table 6.1: Tailoring the Marketing Plan to Intended Adopters**

Parameters	Innovators and Early Adopters	Early Majority	Late Majority and Laggards
<b>Characteristics</b>	Seek advanced technologies, accept some incompleteness, willing to take risks, and may demand customization and technical support.	Look for completeness, ease of use, consistency with lifestyle, and legitimacy	Prioritize reliability, simplicity, and cost-effectiveness
<b>Marketing Approach</b>	Emphasize technical content and highlight leading-edge features.	Emphasize product completeness, ease of use, lifestyle fit, and legitimacy.	Emphasize reliability, simplicity, and cost-effectiveness
<b>Suitable Channels</b>	Channels enabling high content and selective reach are appropriate.	High-reach and high-credibility channels are effective	Channels with high credibility and cost-effectiveness, reducing the cost per exposure.



Parameters	Innovators and Early Adopters	Early Majority	Late Majority and Laggards
<b>Suitable Channels</b>	Focus on high-risk tolerance, premium pricing, and customization.	Bridge the gap between early adopters and early majority, addressing concerns like complexity and cost.	Focus on reducing costs, emphasizing broad accessibility, and targeting simplicity.

Farmos Group is a good example to discuss the marketing plan of innovative products. Farmos group used utilized opinion leaders in veterinary medicine for premarketing and testing. They also involved influential adopters in the testing process acted as a premarketing tool and scientific breakthrough were highlighted in presentations, dissertations, and scientific conferences. These all-successful tactics resulted in rapid adoption and commercial success. Hence, the marketing plan should align with the characteristics and preferences of each adopter category, ensuring a smooth transition from early adopters to the mass market while addressing specific concerns and priorities at each stage of the innovation’s diffusion.

**IN-TEXT QUESTIONS**

1. Competitive advantage can be best described as
  - (a) Increased efficiency
  - (b) What sets an organisation apart
  - (c) A strength and the organisations
  - (d) Intangible resources
2. The strategic management process is
  - (a) Set of activities that are guaranteed to prevent organizational failure
  - (b) A process that is concerned with a firm’s resources, capabilities, and competencies, but not the conditions in its external environment



- (c) A set of activities which has not been used successfully in the not-for-profit sector
  - (d) A dynamic process involving the full set of commitments, decisions, and actions related to the firm
3. Identify the purpose of a successful innovation strategy.
    - (a) To encourage advancements in technology or services.
    - (b) To promote an existing product.
    - (c) To create technology similar to a competitor.
    - (d) To spend little money on research and development for technology.
  4. The way the organization is structured and who reports to whom
    - (a) Strategy
    - (b) Structure
    - (c) Staff
    - (d) System
  5. What are the characteristics of ambidextrous organization according to Tushman and O'Reilly?
    - (a) Blending short-term efficiency and long-term innovation.
    - (b) Dedicate mechanistic structures for manufacturing functions
    - (c) Dedicate organic structures for areas like research and development (R&D).
    - (d) All of the above are correct

## 6.6 Summary

In today's hyper-competitive business landscape, technological innovation stands as a cornerstone for driving organizational growth and ensuring long-term sustainability. Innovations in technology not only enhance operational efficiency but also open new avenues for product development, customer engagement, and market differentiation. This chapter has explored the pivotal role of technological innovation in shaping the success and competitiveness of organizations. In fostering a culture of innovation within an organization, strategic approaches are crucial. Developing a new technology product is a multifaceted process, and its success hinges on careful consideration of various factors. Exploring the impact of organizational size and structure on innovation, this chapter has



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also assessed how different dimensions of an organization influence its ability to foster and sustain innovation. Understanding these dynamics is essential for tailoring strategies to fit the unique characteristics of each organization. Case examples of Google, 3M and Glenmark are used to understand the structural differences among the organizations. Effectively managing the development of new products and coordinating cross-functional teams are another critical component of successful innovation. By exploring real-world examples, learners can grasp actionable insights for implementation. Implementing technological innovations necessitates a well-crafted deployment strategy. Examining the specific components of a successful deployment strategy, crucial factors such as communication, training, and integration were also discussed. Effective communication helps in creating User-centered design and continuous feedback collection that further assists in ensuring scalability.

Formulation of strategy is nothing but the integration of organizational culture, effective management, and deployment strategies that can help in fostering a conducive environment for innovation.

### 6.7 Answers to In-Text Questions

1. (a) Increased efficiency
2. (d) A dynamic process involving the full set of commitments, decisions, and actions related to the firm
3. (a) To encourage advancements in technology or services
4. (b) Structure
5. (d) All of the above are correct

### 6.8 Self-Assessment Questions

- ◆ How do you understand about the differences in innovative activities between large and small firms? Are there any specific instances when large firms are likely to outperform small firms?
- ◆ Discuss the respective pros and cons of using standardization and formalization and its impact on the effectiveness or efficiency of innovation.



- ◆ What are the deterministic criteria to understand the extent of centralization in R&D activities. Can the firms proceed with both centralized and decentralized approaches together?
- ◆ What are the determinants that are considered in tailoring the marketing plan to intended adopters?

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# UNIT - V





# Innovation in Developing Countries: China, India: Role of the Government

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## STRUCTURE

- 7.1 *Learning Objectives*
- 7.2 *Introduction*
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## 7.1 Learning Objectives

- ◆ Importance of innovation and research.
- ◆ Constraints faced by the developing countries in research and innovation.
- ◆ Difference among the developing countries in the field of research.
- ◆ Role of government in promoting research and development.
- ◆ Steps taken by the government in promoting research in the country.



## 7.2 Introduction

The economic development and growth of mankind can be studied in four industrial revolutions. It is a story of gradual scientific developments, innovations and their application for the economic and social purpose. All of it has started with the discovery of fire and innovation of wheel. The first industrial revolution can be said to have started with the mechanization of the manufacturing process. The innovation of steam engine, diesel engine and other power tools has cut short the time taken in production and manufacturing of the products. Thus increasing the speed and volume of the production.

Then came the second industrial revolution which was focused on increasing the efficiency of the production by creating the areas of expertise and specialities. This innovation in the management and process of the production has created experts and their niches in the field of the production. It was centred on the application of principal of mass production along with evolution of assembly lines. In this phase every individual worker gained expertise in one single process of production, thereby, achieving speed and greater accuracy in replicating the same results. This has increased the scale of production and cut of the cost production by economy of scale and making produce and market more affordable and accessible.

Third industrial revolution was ushered in by the advent of computer, internet and mass communication. The ground breaking innovations in computing and communication technology has altered the production process forever. It has given rise to new sectors in economy creating its own products, markets and consumers. It gives rise to new markets and gainful employments such as content creations.

Industry 4.0 or fourth industry revolution which is upon us is the integration of various advance technology and innovations such as AI, internet, big data, IOT, robotics into various industry and aspects of society. Innovation will lead the way in this Industrial Revolution as well. The research and innovation being incremental in nature has become very advanced and technology intensive over time, which makes it even more difficult for the developing countries to compete. It is hard for them to overcome the lead already taken by the developed countries in the field of innovation.



Like factors of production of any other economic process, innovation and research also needs the essential inputs like land, labour, capital and entrepreneurship. These inputs are the factors that most influence the direction, quality and volume of research and innovation. They create the biggest divide between the developed and developing countries. The expenditure on research in the developed countries is many times more than that of the developing countries. If we take the example of the United States of America, in year 2021 their expenditure on R&D was 3.45% of the GDP which amounts to over 70 billion USD and the United Kingdom of Britain has spent over 2.9% of its GDP on R&D.<sup>1</sup> Whereas on the other hand China spent only 2.4%, Brazil about 1.2% of their GDP on R&D. This availability of disposable resources with the developed countries sets these countries apart from the developing countries who have their hands tied with both social and economic backwardness. The developing countries have very little resources to spare after fulfilling their welfare and development needs. That is one of the biggest reason of limited spending by the developing countries on the research and innovation.

In the developed countries of Europe and North America, the private expenditure and investment on the research and innovation is much more than the expenditure of on research by the government. Please see Figure 7.1, if we take the example of composition of research on the R&D expenditure of United State of America, it is clearly visible that over 70% of it has been incurred by the private businesses. On the other hand in India's case the private participation only about half of the participation of businesses in the US. This difference is more clearly visible in the chart below:

The private expenditure in R&D makes the innovations more monetisable thereby increasing the profit of the private businesses which in turn incentivises further expenditure in this field. Whereas the government expenditure on R&D is concentrated more in the field of defence research.

Lack of highly skilled workforce and researchers are also a must to conduct advanced research and development. This is also a factor where the developing countries suffer and the developed countries excel. One of the major reason of this is the lack of availability of quality education. The opportunities for further studies and research available in the developed

<sup>1</sup> Data available on <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>. Accessed on 12.12.2023.

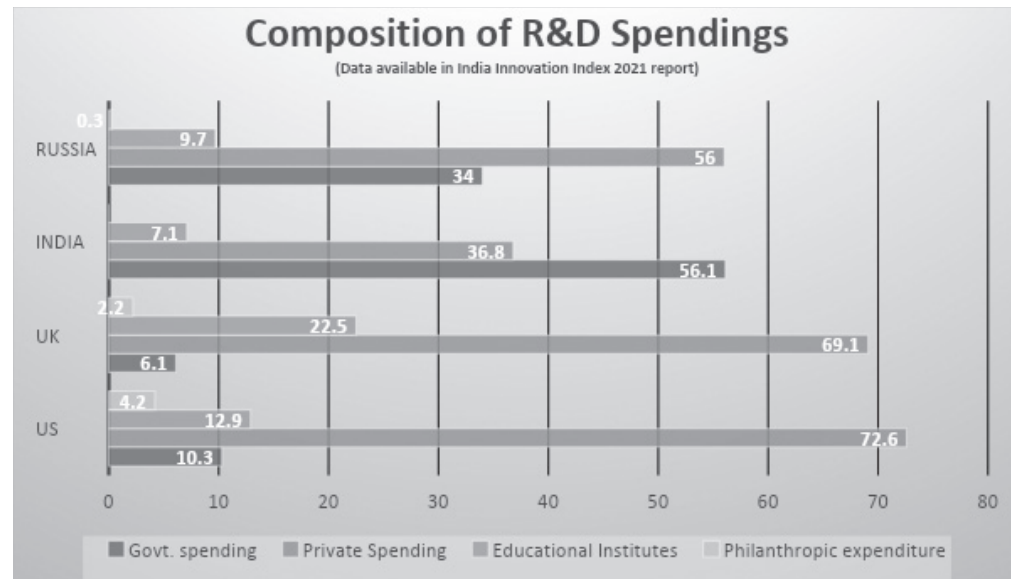


Figure 7.1

countries also attract the best talent in the developing countries to migrate. This brain drain causes a significant impact on the research and development in the developing countries.

### 7.3 Research and Innovation in Developing Countries

Even after all the constraints that are mentioned above, significant research and innovations occur in the developing countries as well. The research and innovation in the developing countries occur in the following manner:

#### 7.3.1 Innovation and Research in the Developing Countries

Developing countries differ from the developed countries in the field of innovation and research because of their obvious differences in the size, form and composition of their economies and the difference in development of human capital in these nations. Owing to these differences the developing countries pursue the innovation and research predominantly in the following manner:

1. International Technology transfer through the introduction of the advanced product and services in the developing countries by the multi-national corporation is one of the leading way in which the



latest technology is introduced in the developing countries. This introduction of the latest technology is the one of the leading contributors to the innovation in the developing countries.

Although this introduction depends on the absorptive capacity of the host country for the advanced technology and the policies of the developing country. If the policies of the host country support technology transfer by providing the adequate protection to the proprietors of the technology from the infringement of their intellectual property rights, the proprietors would be more willing to transfer the technology, thereby increasing the knowledge and technology profile of the host country.

The absorptive capacity of the population of the host country is also one of the leading factors involved in the technology transfer. The absorptive capacity of the Country mostly depends on the skill and education level of its population and the availability of infrastructure essential for the uses and application of the latest technology. A highly skilled population will be able to accept and utilise the advanced technology more readily. Let us take the example of computer and its other accessories, people who can read and write English would be able to use the computer more effectively and the stable supply of electricity is also essential for the introduction of computers. India has very large English educated population which has made the most out of computers and it has become on the most research and development oriented sector in the country.

The transferred technology thereby becomes the base of further research and innovation. Further innovation from the transferred technology occurs in the following manner:

- (i) **Process Innovation:** Where the product or process is modified to suit the host nations conditions and fulfil its requirements. This leads to very little incremental innovation but the process of innovation and acquaintance with the existing technology occurs, which is very helpful in promoting further innovation in that sector or other sectors.
- (ii) **Product Innovations:** New product is created which has significant incremental innovative then the transferred technology.



- 2. Under the Radar Innovation:** Innovations or R&D of any economy or nation are measure by the total number of the patent applications filed in the patent offices of the country and total number of patents that are granted to the innovators. One other measure of the innovations or R&D happening in an economy are the research publications in various peer reviewed journals. But most of the innovation that occurs in the developing countries is not captured or recorded by patents and research publications. The lack of awareness among innovators and lack of availability of quality peer-reviewed journals is one of major reason of the innovation of the developing countries going unnoticed.
- 3. Research by the Government Institutions and Establishments:** In the developing countries government institutions and establishments play a major role in the research and innovation. If we take the example of India itself, over 56% of the total expenditure on research and expenditure is incurred by the government itself. In India, over 30% of the R&D expenditure by the government is incurred in the field of defence and space technology only through the organisations like DRDO, ISRO etc. The problem with government expenditure on the research and development is that it is concentrated in the non-monetisable sectors of economy where the innovation cannot be readily monetised and the return generated cannot be invested in further research.

The research and development in the developing countries follows this peculiar pattern mostly because of the constraints developing countries face in the field of R&D.

### ***7.3.2 Constraints faced by the Developing Countries in the Field of Innovation and R&D***

The developing countries have their peculiar conditions which create various hurdles in the way of their development in the field of innovation and research. Some of these constraints are as following:

- 1. Policy and Legal System:** The laws and policies of developing countries prove to be adequate to protect and promote the innovation. This inadequacy is felt because of the liberal laws and lack of enforcement of the intellectual property laws. The patent offices of the developed countries are backed up with the load of the



applications for patents filed and take a lot of time in disposing off the applications. The lackadaisical and discouraging attitude of the law enforcement authorities in enforcement of intellectual property laws promotes the infringement of the rights of the innovators through unauthorised access and duplication of the work. It has a dual effect as it prevents both the technology transfer from the developed countries due to the fear of infringement of intellectual property rights and unauthorised access, and it also discourages the domestic innovators and researchers.

2. **Path Dependency:** Innovation depends on/ evolves from prevailing/ earlier technological development and prevailing economic conditions may influence future trajectory of knowledge and direction of research in developing countries. But the available technology in the developing countries is mostly imported or transferred technology from the developed countries. These transferred technologies are most of the times protected by the intellectual property laws of the origin countries, which prevents further incremental innovation in these technologies. It deprives the essential path to developing countries for the further research. Lack of adequate infrastructure and equipment: the advanced research and innovation requires the most advanced technology and infrastructure which is very expensive. It becomes a significant hurdle for the smaller companies and institutions, who find it difficult to acquire the equipment and technology required to conduct the research due to lack of enough disposable income or funding.
3. The research in the developing countries is more labor intensive/ less skill intensive, due to lack of availability of the skilled labour force.
4. **Lack of Skilled Workforce:** Research and innovation requires the most skilled and highly educated workforce with an academic and research orientation, which is scarcely available in the developing countries. In the developed countries the higher education institutes and universities hold a large number of very valuable patents, which is not the case with the developing countries. Where as in the developing countries the education institutes fail to instil a sense and enthusiasm for research and innovation in its students.



- 5. Lack of Collaboration between Academia and Industry:** In the developing countries the universities which are major hubs of research rarely collaborate with the industry which has the capacity to monetise the innovations. This collaboration is a symbiotic relation and could help both the industry and universities as the universities can get the funds for further research and the industry can earn profit on its investment and capital.
- 6. Migration of Skilled Workforce to the Developed Countries:** The most skilled and best workforce of the developing countries often migrate to the developed countries in search of better opportunities and lifestyle. This brain drain devoid the developing countries of the most important factor required for the research and innovation.
7. Regions where the economies rely more on manufacturing and agriculture may need to place effort into developing basic awareness among the workforce that the potential for innovation always exists.

#### 7.4 Direction of Research and Innovation

The direction of research and innovation is the culmination of all the decisions made by individuals/firms/institutes/organisations/countries to allocate the human and financial resources in pursuing any particular research or innovation opportunity or area.<sup>2</sup>

There is always very little money in the research and development sector in any country may it be developed or developing. This little money is very thinly spread between the innumerable sectors. Therefore, it becomes very important for any country/company/organisation to set the direction of the research in the most meaningful and beneficial sectors due to the availability of the limited resources. As the research in the right direction can help the country/institution/organisation grow rapidly and solve many problems.

The direction of research and development is determined in any country by various factors such as:

- (a) Local Economic, Social Conditions and Socio-Religious Values:** The economic and social conditions of any country are most important factor that effect the research and development. The economically

<sup>2</sup> World Intellectual Property Report 2022: The direction of innovation. Geneva: WIPO. Available on: <https://www.wipo.int/publications/en/details.jsp?id=4594> accessed on: 14.12.2023.



poor countries also tend to have little social and human capital. Therefore, the workforce is also not adequately skilled. The weak financial condition prevents both public and private investment in the R&D field. The research that is conducted in these countries at the grass root level is not very scientifically advanced and have very little economic value. The socio-religious values also impact the direction of research as some sectors or subjects of research are prohibited in the practice of certain religions for example, Orthodox Christianity opposes to the human embryonic stem cell research etc.

- (b) Technical and Physical conditions of any country also have huge impact on the direction that research takes. Advanced scientific research and innovation requires the most advanced technology and infrastructure which is very expensive. In the absence of these technical requirements the research conducted is not of superior scientific quality. The research is directed non-scientific areas.
- (c) Innovation depends on/evolves from prevailing/earlier technological development and prevailing economic conditions may influence future trajectory of knowledge and direction of research in developing countries. In absence of the transfer of latest technology, the further research could not find an appropriate base and has little relevance.
- (d) The direction given by the government: the government of any nation is also a very important factor in determining the direction of research. The government gives direction to the research in two ways. First one is through investment. The government expenditure and investment in R&D is a major portion of the R&D expenditure in any country. This expenditure is channeled through various institutions and organisations. It is mostly directed towards the defence and medical sectors depending on the socio-economic conditions of the Country. If we take the example of India over 35% of the total public expenditure in R&D is made in the defence and aero-space sector through DRDO, ISRO etc. organisations.

The second way in which the government can influence the direction of research is by encouraging the private businesses and institutions to research in any particular sector by announcing the tax breaks and other incentives. It was the constant government encouragement and incentives that made the Indian pharma companies leading producers of Covid Vaccines in those trying times.



(e) The gender gap in the research workforce also affects the direction of the research. A male dominated research workforce loses the perspective of women and vice versa. In the developing countries this gender gap in research workforce is much more prominent.

The allocation of human and financial resources to different innovation activities can set the direction of innovation of communities, countries and even the world for the decades to come.<sup>3</sup> Therefore it is very important to ensure wise and responsible allocation of these resources.

### IN-TEXT QUESTIONS

1. What are the most important factors giving directions to research?
  - (a) Local economic and social conditions
  - (b) Technical and physical conditions
  - (c) Government
  - (d) All of these.
2. What are the major constraint faced by the developing countries in the field of research and innovation?
  - (a) Lack of financial resources
  - (b) Lack of advanced equipment
  - (c) Lack of skilled workforce
  - (d) All of these.

## 7.5 Innovation in China and India

China and India are both classified as developing countries but the Chinese economy has grown to its mammoth size owing to becoming the major manufacturing hub for the entire world. A lot of the world's multinational companies in an attempt to cut the cost and increase the profit margin shifted their manufacturing operations to China, which lead to transfer of the most advanced technology of China.

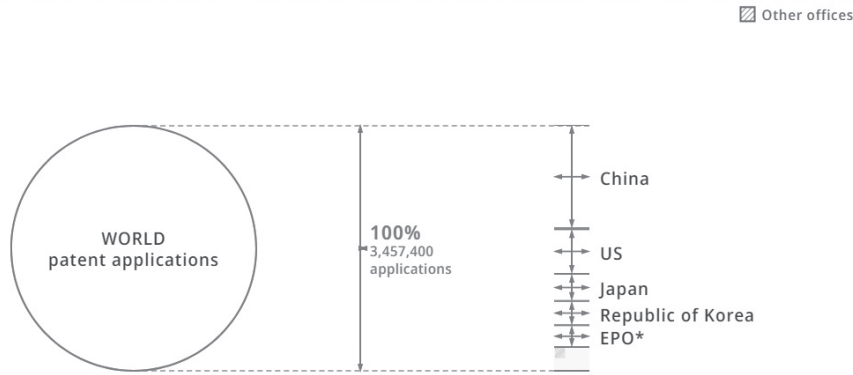
The sustained efforts of Chinese Government and private businesses in China has put China on almost equal footing with the developed countries

<sup>3</sup> World Intellectual Property Report 2022: The direction of innovation. Geneva: WIPO. Available on: <https://www.wipo.int/publications/en/details.jsp?id=4594> accessed on: 14.12.2023.



such as US, Japan etc. It is clearly evident from the volume of patent application filed in patent offices of China.

Which IP offices are receiving the most patent applications?

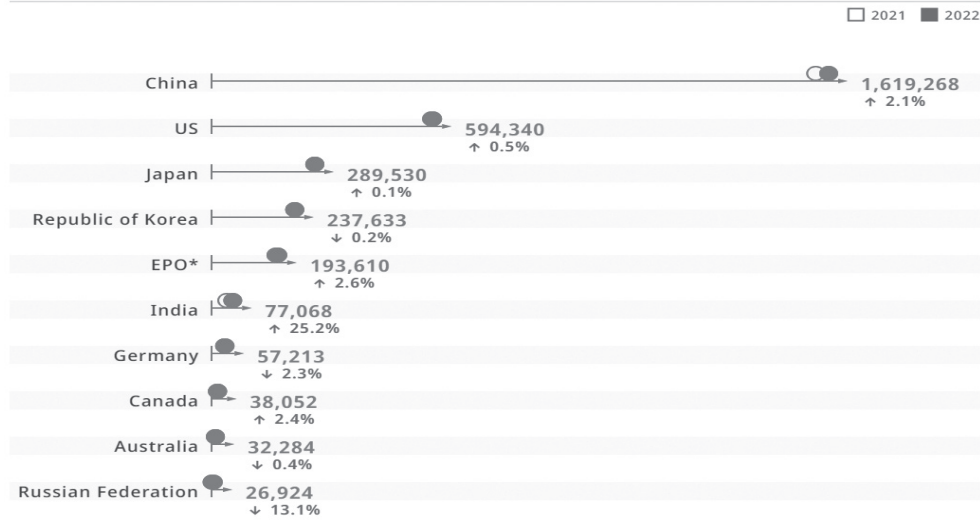


Around 85% of all patent filings in 2022 occurred in the IP offices of China, the US, Japan, the Republic of Korea and the EPO. China accounted for 46.8% of the world total.

Note: \* EPO is the European Patent Office  
Source: WIPO Statistics Database, November 2023

Figure 7.2

Where was patent activity highest?



In 2022, China's IP office received around 1.62 million patent applications. It was followed by the offices of the US, Japan, the Republic of Korea and the European Patent Office. The top 10 offices accounted for 91.6% of the world total in 2022.

Note: \* EPO is the European Patent Office  
Source: WIPO Statistics Database, November 2023

Figure 7.3



## Notes

In this figure it is clearly visible that the China has the highest number of patent application filed in the world, which are almost 3 times of the nearest contender United States of America. Even with the highest number of patent applications filed, the global innovation index, 2023 places China on 12<sup>th</sup> rank out of the 132 countries. The low overall rank of China is due to its lower ranking in market sophistication, creative outputs, business sophistication, human capital and research, infrastructure and institutions. This reflects that the quantity of research work is not enough to exploit the innovative potential of any country.

China spends about 2.14% of its GDP annually on the R&D, which owing to its GDP being second largest in the world, China's R&D spending become many fold in terms of dollar value of the spending of India.

India spends only about 0.7 % of its GDP on the R&D, which becomes even less impressive when seen in terms of per capita expenditure. The Global Innovation Index 2023 puts India on 40<sup>th</sup> rank out of the 132 countries. Figure 7.3 shows that the patent applications filed in India are only about 5% of the patent applications filed in China but the total filings in India increased over 25% from the previous year which is much higher than most of the nations. The patent applications in China has only 2% year on year growth.

It clearly reflects that our nation is on the right track and will soon catch up with developed world. The Global Innovation index identifies the scale of domestic market, information and communication technology service exports as the major strength of India in the field of innovation and research.

### 7.6 Role of Government

As we discussed above, the government plays very important role in determining the volume and direction of the R&D because at least in the developing countries like India, the government is the biggest innovator.

Government of India has contributed to the research and development in the country to a great extent which is clearly visible from the drastically improved ranking of the country in WIPO's Global Innovation Index overtime. The rank of India in the Global Innovation Index was 60<sup>th</sup> out of 127 countries in year 2017. This rank has gradually improved to 40<sup>th</sup>



out 132 countries in the year 2023, due to the sustained effort of the government in this directions.

The Government of India, through NITI Ayog and Department of Science and Technology has started various programs and schemes to promote the curiosity and inquisitive spirit of the school students and instil in them a scientific aptitude. The NITI Ayog has established Atal Tinkering Labs in schools under the Atal Innovation Mission to give shape and realisation to the scientific ideas of school students. This is very important in the case of India as most of its workforce is still engaged in agriculture. And the regions where the economies rely more on manufacturing and agriculture, may need to place effort into developing basis awareness among the workforce that the potential for innovation always exists.

To protect and promote Intellectual Property Rights (IPR) of Startups and to encourage innovation and creativity among them, Government of India had launched a Scheme for facilitating Start-Ups Intellectual Property Protection (SIPP) in 2016. The scheme facilitated startups in filing and processing of their patent, design or trademark application through the assistance of IP Facilitators, whose fee was borne by the Office of the Controller General of Patents Designs and Trademarks, Department for Promotion of Industry and Internal Trade, Government of India. After its successful implementation resulting in a significant increase in IP filings by Start-ups the Scheme was extended for a period of three years till 31st March 2023.

Universities and higher education institutes can become the hotspots for innovation and major hubs for R&D but the teaching and curriculum in these institutes has to be aligned with the demand of the industry. The curriculum of the higher education institutes can be aligned with the requirements of the industry only after allowing them the necessary autonomy and increasing the participation of industry in the higher education institutes. The government in the New Education Policy has tried to provide this opportunity.

Venture capital provides not only the funds necessary to run a business but also the required personnel and expertise to utilise the same. It has gained importance since banks show unwillingness to extend credit to newly established enterprises due to lack of collaterals and a high risk of default. The government is making consistent efforts to promote venture



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capital investment in startups. Many startups like Unacademy, Byjus has become giants and Unicorns thanks to the incentives and encouragement of the government.

All these efforts of the government will help us reap the rich demographic dividend by first adequately training and motivating the youth and then provide them with opportunities for expression of their creative and innovative side.

The government is making sustained efforts and policy interventions to redirect innovation in environmentally sustainable direction with its Make in India push. This will open the new avenue for the employment and also make us a leader in this blooming sector of economy which will have huge demand with the increasing awareness among people about the environment protection.

The theft of our traditional knowledge is also a grave problem before us where the foreign multinational companies are tapping into it and trying to enforce intellectual property rights and excluding us from it. Many foreign companies have tried to patent Neem based product In the year 2021, the government has brought out the Science, Technology and Innovation Policy (STIP) 2020, to keep a sustained effort in this direction. The Government of India is actively making the efforts to protect the traditional and generation wealth of our knowledge from this theft.

To conclude we may say that our government is making sustained effort to remove the constraints in the field of research and innovation and give direction to the R&D to cater the needs of nation regarding sustainable development.

### 7.7 Summary

Innovation has proven to be essential for both the social and economic development of the mankind. It creates the new avenues of further research and generates economic activity essential for economic growth. The further innovation uses the existing innovation as a stepping stone, which makes the acquisition of latest technology an essential. The intellectual property laws enacted to protect the innovation sometimes become a hurdle in the path of further innovation due to limited access and uses restrictions.



The developed and developing countries have huge gaps in this sector owing to the difference in their financial, social and human capital. This gap in the developed and developing countries is clearly visible from their expenditure in the R&D sector. The expenditure of the developed countries in the R&D sector is many fold of that of the developing countries. The composition of this expenditure in R&D sector also reflects the gap in the financial, social and human capital. In the developed countries most of the expenditure is incurred by the private business or organisations where as in developing countries like India most of this expenditure is incurred by the government as the private sector is not either able or willing to carry out this expenditure.

The technology transfer from the developed countries also contributes a lot to the research in the developing countries as they provide a necessary base or path for further research. It also takes some innovation in making the transferred technology suitable to the conditions of the host country, which also promotes research and development. But sometimes the policies and conditions of the host countries prevent technology transfer due to the fear or threat of infringement of the intellectual property rights. The absorptive capability of the host country for the transferred advanced technology is also a determining factor in influencing the technology transfer.

The developing countries face several constraints in the field of research and innovation such as discouraging policies and legal system, path dependency on advanced technology which might not be accessible due to the intellectual property protection, lack of adequate infrastructure and equipment, lack of highly skilled workforce, lack of collaboration between major hubs of research like universities and industry, migration of skilled workforce to the developed countries etc. Even after these constraints the developing countries are making significant improvement in the field of R&D, as is the case of India.

The developing countries themselves does not stand on the same footing, when it comes to the field of the R&D. There are vast differences in the direction research takes in these countries and the volume of it. If we take the example of India and China to compare, the R&D sector in China resembles more to the developed countries even though it is classifies as



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a developing country. The R&D expenditure out of total GDP of China is much closer to the developed countries.

The governments play a very important role in determining both the direction and quantity of innovation and research. Our government has also made sustained effort to remove the constraints in the field of research and innovation and give direction to the R&D to cater the needs of nation regarding sustainable development.

With these efforts our nation would one day stand in the league of most developed countries.

### 7.8 Answers to In-Text Questions

1. (d) All of these.
2. (d) All of these.

### 7.9 Self-Assessment Questions

1. Please write a short note on the importance of research and innovation.
2. Please elaborate, how the research and innovation is different in the developed and developing countries.
3. Please write a short note on the direction of research and development and the factors that affect it.
4. Please describe the constraints faced by the developing countries in the field of research and innovation.
5. Please describe the role of government in promoting research and development.

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# Glossary

**Agile Organization:** A business that is able to quickly adjust to shifting conditions and client demands is considered an agile organization.

**Agility and Flexibility:** The ability of a company or organization to adapt quickly and effectively to changes in the business environment, market conditions, or technological advancements.

**Appropriability:** It refers to the degree to which the likely financial return from an innovation can be appropriated by the companies which are engaged in technology development.

**Capital Rationing:** Since resources are finite, capital rationing is the process by which businesses choose how to divide their capital among several projects.

**Copyrights:** Property rights issuing to the developer of the original act the freedom to publish or dispose of them.

**Creative Destruction:** It accentuates both the novel ideas behind innovations and their power to disrupt markets and industries.

**Creative Destruction:** Joseph Schumpeter's concept of continual innovation replacing or disrupting existing products, industries, or economic structures.

**Creative Environment:** A workplace culture fostering creative thinking, idea generation, and experimentation among employees.

**Deployment of Quality Functions (QFD):** An approach called Quality Function Deployment (QFD) is used to convert client demands and expectations into technical specifications.

**Disruptive Innovation:** It is the process in which a new firm, usually with fewer resources (e.g. capital, skill, experience), can challenge a well-established firm (often known as "incumbent") by entering at the bottom of the market and continuing to move up-market.

**Economic Development:** Sustained, qualitative improvement in a nation's standard of living, encompassing increased income, improved education, and enhanced overall well-being.

**Geographical Indication (GI):** It is a tag or sign used on products for representing their explicit place of origin. It specifies the features, merits and status believed to be in the product because of its connection to a particular geographical place.

**Gigafactory:** A gigafactory is a large-scale production plant that creates rechargeable batteries for use in renewable energy storage applications such as electric automobiles.

**Globalization:** It measures the extent to which an industry operates across borders and has a global market presence.



**Green Innovation:** Creating or introducing new or improved goods and services that leave lighter carbon footprints and open up green windows of opportunity.

**Industry Stability:** It refers to the level of volatility and changes within the market.

**Innovation:** The creation and implementation of new ideas, products, or methods contributing to positive change and advancement. In business terms, it is *'the commercial exploitation of ideas'*.

**Intellectual Property (IP):** Intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce. It includes works of literature, art, inventions, designs, and names, symbols, and pictures used for commercial purposes. Trade secrets, copyright and related rights, industrial designs, patents, trademarks, and geographical indications are all considered forms of intellectual property.

**Intellectual Property Rights:** The legal rights given to the inventor or creator to protect his invention or creation for a certain period of time and to reap economic benefits out of it.

**Market Differentiation:** The process of making a product or brand stand out from competitors through unique features, quality, or branding.

**Market Structure:** It refers to the organization and competitiveness of an industry.

**Mechanistic Organization:** A mechanistic organization consists of specialized functions that operate independently of one another, departmental divisions, and centralized authority.

**NPV:** Net present value (NPV) is a method for calculating the return on investment (ROI) for a project or expenditure.

**Organizational Ambidexterity:** This is the capacity of an organization to effectively handle its present operations while making adjustments for unforeseen circumstances.

**Patent:** A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem.



**Path Dependency:** It suggests that patterns of innovation methodology, resource allocation to research and development (R&D), institutional structures, and operational modes are all reinforced by increasing returns.

**Risk Tolerance:** It measures the industry's openness to risk, especially regarding failure and creative experimentation

**Service Innovation:** It refers to the development and implementation of new or significantly improved services that create value for both customers and the service providers.

**Sustainability:** The ability of a company or economic system to endure and thrive over the long term, considering economic, social, and environmental factors.

**Tacit Resources:** Tacit resources are skills, ideas, and experiences that people have but are not written down.

**Tax Break:** Tax break is a benefit that the government offers that reduces total tax liability to promote specific activities.

**Technological Advancements:** Progress and improvements in technology leading to the development of new tools, equipment, or processes. The process of permanently reducing a company's workforce by eliminating divisions or employees who aren't producing results is known as downsizing.

**Trademark:** A trademark is a word, phrase, symbol, logo or design that distinguishes the source of products (trademarks) or services (service marks) of one company from its competitors. In order to meet the criteria for protection, the mark must be unique.

**Value Chain Analysis:** The process of looking at each of those operations in terms of how much they cost, what value they provide, and how they might be optimized to fit the company's competitive strategy is called value chain analysis.



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