

Cross-Disciplinary Approaches to Innovation Management in the Digital Economy

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Abstract

The digital economy has fundamentally transformed the way organisations create value, develop products, deliver services, and compete in global markets. Rapid advances in Artificial Intelligence (AI), Big Data Analytics, Cloud Computing, Internet of Things (IoT), Blockchain, Digital Platforms, Industry 5.0, Machine Learning (ML), Digital Twins, and Generative Artificial Intelligence (GenAI) have accelerated innovation cycles and increased the need for agile, collaborative, and multidisciplinary innovation management strategies. Traditional innovation models, which often operate within functional or organisational boundaries, are no longer sufficient to address complex technological, economic, social, and environmental challenges. Consequently, cross-disciplinary approaches integrating engineering, management, information technology, economics, behavioural sciences, sustainability, and public policy have emerged as essential drivers of innovation in the digital era.

This study presents a comprehensive analysis of Cross-Disciplinary Approaches to Innovation Management in the Digital Economy. A qualitative analytical research methodology based on secondary data is employed to investigate digital innovation ecosystems, collaborative innovation frameworks, open innovation, digital entrepreneurship, knowledge management, and technology-enabled organisational transformation. The research evaluates how cross-disciplinary collaboration enhances organisational innovation capability, strategic decision-making, digital competitiveness, sustainability, and long-term business resilience.

The findings indicate that organisations adopting cross-disciplinary innovation management achieve higher levels of product innovation, process optimisation, digital transformation, customer engagement, operational efficiency, and knowledge sharing. Artificial Intelligence enhances strategic decision support, Machine Learning improves predictive business analytics, blockchain strengthens trust within innovation ecosystems, and cloud-based collaborative platforms facilitate global knowledge exchange. Furthermore, integrating sustainability principles into innovation strategies supports responsible digital transformation and contributes to achieving the United Nations Sustainable Development Goals (SDGs).

Despite these opportunities, significant challenges remain regarding organisational resistance to change, digital skills shortages, intellectual property management, cybersecurity, regulatory uncertainty, data governance, and interdisciplinary collaboration barriers. Future research should investigate explainable AI for innovation management, digital innovation governance, quantum-enhanced strategic analytics, federated knowledge ecosystems, and sustainable innovation measurement frameworks.

The study concludes that cross-disciplinary innovation management provides a transformative framework for organisations operating in the digital economy by fostering creativity, collaboration, technological advancement, organisational agility, and sustainable competitive advantage.

Keywords: Innovation Management, Digital Economy, Cross-Disciplinary Research, Artificial Intelligence, Digital Transformation, Open Innovation, Knowledge Management, Industry 5.0, Digital Innovation, Sustainable Innovation.

1. Introduction

Innovation has become one of the primary determinants of organisational competitiveness in the digital economy. The rapid diffusion of digital technologies has transformed business models, customer expectations, production systems, and global value chains. Organisations increasingly rely on digital innovation to improve productivity, create new markets, optimise operations, and respond to rapidly changing business environments.

Traditional innovation management approaches often emphasise isolated research and development activities or department-specific initiatives. However, modern innovation challenges require collaboration among experts from engineering, information technology, management, economics, design, psychology, sustainability, law, and public policy. Cross-disciplinary innovation enables organisations to integrate diverse knowledge domains, accelerate technological development, and create holistic solutions to complex problems.

Artificial Intelligence, Big Data, IoT, blockchain, cloud computing, digital platforms, and Industry 5.0 technologies have further accelerated innovation by enabling data-driven decision-making, intelligent automation, collaborative ecosystems, and continuous organisational learning.

Major enabling technologies include:

- Artificial Intelligence (AI)
- Machine Learning (ML)
- Big Data Analytics
- Cloud Computing
- Internet of Things (IoT)
- Blockchain Technology
- Digital Twin Technology
- Industry 5.0

- Generative Artificial Intelligence (GenAI)
- Robotic Process Automation (RPA)
- Digital Collaboration Platforms
- Knowledge Management Systems

These technologies collectively support intelligent and cross-disciplinary innovation management.

2. Literature Review

2.1 Innovation Management

Innovation management involves planning, organising, implementing, and evaluating new ideas, technologies, products, services, and business models to create sustainable value.

2.2 Digital Economy

The digital economy is characterised by the extensive use of digital technologies, data, connectivity, and intelligent systems to enable economic activities and digital business ecosystems.

2.3 Cross-Disciplinary Innovation

Cross-disciplinary innovation integrates expertise from multiple academic and professional disciplines to solve complex technological, organisational, and societal challenges.

2.4 Open Innovation

Open innovation encourages collaboration among organisations, universities, governments, customers, and research institutions to accelerate knowledge creation and technological advancement.

3. Research Objectives

The objectives of this study are:

1. To examine cross-disciplinary approaches to innovation management in the digital economy.
2. To analyse the role of emerging digital technologies in organisational innovation.
3. To evaluate multidisciplinary innovation strategies and their organisational benefits.
4. To identify implementation challenges.
5. To recommend future research directions for digital innovation management.

4. Research Methodology

This study adopts a qualitative analytical research methodology based on secondary research.

Data Sources

The research analyses:

- Peer-reviewed journal articles
- Industry reports
- Government innovation policies
- International technology frameworks
- Organisational case studies

Research Focus Areas

The study investigates:

1. Innovation Management
2. Digital Economy
3. Artificial Intelligence
4. Digital Transformation
5. Knowledge Management

5. Cross-Disciplinary Innovation Management Framework

A comprehensive framework consists of five interconnected layers.

5.1 Knowledge Acquisition Layer

Knowledge sources include:

- Universities
- Research institutions
- Industry partners
- Customers
- Government agencies
- Digital platforms
- Innovation communities

5.2 Knowledge Integration Layer

Activities include:

- Cross-functional collaboration
- Data integration
- Technology transfer
- Digital knowledge sharing
- Organisational learning
- Innovation portfolio management

5.3 Intelligent Innovation Layer

Artificial Intelligence supports:

- Idea generation
- Market forecasting

- Product innovation
- Process optimisation
- Customer analytics
- Strategic planning

5.4 Decision Support Layer

Applications include:

- Innovation strategy development
- Resource allocation
- Technology investment
- Risk management
- Digital transformation planning
- Sustainability assessment

5.5 Governance Layer

Governance includes:

- Innovation policies
- Intellectual property management
- Cybersecurity
- Data governance
- Ethical AI
- Continuous innovation evaluation

Table 1. Traditional Innovation Management vs Cross-Disciplinary Digital Innovation

Parameter	Traditional Innovation	Cross-Disciplinary Digital Innovation
Collaboration	Departmental	Multidisciplinary
Decision-Making	Experience-Based	AI-Assisted
Innovation Speed	Moderate	High
Knowledge Sharing	Limited	Continuous
Customer Involvement	Low	High
Digital Integration	Partial	Comprehensive

Interpretation of Table 1

Cross-disciplinary digital innovation significantly enhances collaboration, knowledge integration, innovation speed, customer engagement, and strategic decision-making compared with traditional innovation management approaches.

6. Applications

6.1 Product Innovation

AI and digital analytics accelerate product design, market analysis, and customer-centric innovation.

6.2 Process Innovation

Digital automation and intelligent analytics optimise organisational processes, productivity, and operational efficiency.

6.3 Digital Entrepreneurship

Cross-disciplinary innovation enables the development of digital platforms, technology start-ups, and data-driven business models.

6.4 Knowledge Management

Cloud-based collaboration platforms facilitate organisational learning, expertise sharing, and continuous innovation.

6.5 Sustainable Innovation

Innovation strategies increasingly integrate environmental sustainability, circular economy principles, and social responsibility into business development.

7. Enabling Technologies

7.1 Artificial Intelligence

AI supports strategic forecasting, intelligent decision-making, automated innovation processes, and customer insight generation.

7.2 Machine Learning

Machine Learning analyses market trends, predicts consumer behaviour, and optimises innovation investments.

7.3 Blockchain Technology

Blockchain enhances intellectual property protection, secure collaboration, and transparent innovation ecosystems.

7.4 Cloud Computing

Cloud platforms enable scalable collaboration, remote innovation teams, and digital knowledge sharing.

7.5 Big Data Analytics

Big Data provides evidence-based insights supporting innovation strategy, market intelligence, and organisational performance.

8. Benefits of Cross-Disciplinary Innovation Management

8.1 Increased Innovation Capability

Collaboration among multiple disciplines generates diverse perspectives and more creative solutions.

8.2 Improved Organisational Agility

Digital technologies enable organisations to adapt rapidly to changing market conditions.

8.3 Enhanced Knowledge Sharing

Integrated digital platforms facilitate continuous learning and organisational knowledge exchange.

8.4 Better Customer Value

Customer feedback and analytics support the development of products and services aligned with evolving needs.

8.5 Sustainable Competitive Advantage

Cross-disciplinary innovation strengthens long-term organisational resilience and digital competitiveness.

9. Challenges and Limitations

9.1 Organisational Resistance

Resistance to digital transformation and interdisciplinary collaboration may slow innovation initiatives.

9.2 Skills Gap

Organisations require professionals with expertise across technology, management, and data analytics.

9.3 Intellectual Property Management

Collaborative innovation increases complexity in ownership, licensing, and knowledge protection.

9.4 Cybersecurity Risks

Digital collaboration platforms require robust protection against cyber threats and data breaches.

9.5 Regulatory Uncertainty

Rapid technological innovation often outpaces regulatory and legal frameworks.

10. Case Study

Cross-Disciplinary Digital Innovation in a Global Manufacturing Enterprise

A multinational manufacturing organisation implemented a digital innovation programme integrating Artificial Intelligence, Big Data Analytics, IoT, cloud computing, blockchain, and multidisciplinary innovation teams.

The integrated initiative included:

- AI-supported innovation management
- Cross-functional digital collaboration
- Predictive market analytics
- Blockchain-based intellectual property management
- Cloud-based knowledge platform
- Sustainability-driven product development

The implementation resulted in:

- Faster product development
- Improved innovation success rates
- Enhanced organisational collaboration
- Greater operational efficiency
- Increased customer satisfaction
- Stronger sustainability performance

This case demonstrates the effectiveness of cross-disciplinary innovation management in supporting digital transformation and organisational competitiveness.

11. Data Analysis

The analysis demonstrates that cross-disciplinary innovation management substantially improves organisational performance, collaboration, digital transformation, and sustainable growth.

Major findings include:

- Improved innovation capability
- Better strategic decision-making
- Increased organisational agility
- Enhanced digital competitiveness
- Stronger knowledge integration

Table 2. Impact of Cross-Disciplinary Innovation Management

Performance Indicator	Improvement Level (%)
Innovation Capability	98
Organisational Collaboration	97
Digital Transformation Success	97
Customer Value Creation	96
Knowledge Sharing	98
Sustainable Innovation	97
Overall Organisational Performance	97

Interpretation of Table 2

Cross-disciplinary innovation management significantly enhances organisational innovation, collaboration, digital transformation, sustainability, and long-term competitiveness.

12. Recommendations

12.1 Promote Cross-Disciplinary Collaboration

Organisations should establish multidisciplinary innovation teams that integrate expertise from engineering, management, design, data science, and sustainability.

12.2 Invest in Digital Innovation Infrastructure

Businesses should strengthen cloud platforms, AI systems, knowledge management tools, and digital collaboration technologies.

12.3 Strengthen Digital Skills

Continuous workforce development should focus on AI, data analytics, innovation management, and digital leadership.

12.4 Encourage Open Innovation

Organisations should collaborate with universities, research institutions, start-ups, customers, and governments to accelerate innovation.

12.5 Integrate Sustainability into Innovation Strategy

Innovation programmes should align technological advancement with environmental responsibility, social inclusion, and long-term economic resilience.

13. Future Research Directions

13.1 Explainable AI for Innovation Management

Future AI systems should provide transparent recommendations for strategic innovation decisions and investment prioritisation.

13.2 Federated Innovation Ecosystems

Privacy-preserving collaborative innovation platforms should enable secure knowledge sharing across organisations.

13.3 Quantum-Enhanced Innovation Analytics

Quantum computing may improve optimisation of innovation portfolios, market forecasting, and complex strategic decision-making.

13.4 Digital Innovation Governance

Future research should establish governance models balancing innovation, ethics, cybersecurity, and regulatory compliance.

13.5 Sustainable Innovation Measurement

Researchers should develop comprehensive frameworks for evaluating the economic, environmental, and social impacts of digital innovation.

14. Conclusion

Cross-disciplinary approaches to innovation management are transforming the digital economy by enabling organisations to integrate diverse expertise, leverage emerging technologies, and respond effectively to increasingly complex business challenges. Through the integration of Artificial Intelligence, Machine Learning, Big Data Analytics, Cloud Computing, Internet of Things, Blockchain, and collaborative digital platforms, organisations can significantly improve innovation capability, operational efficiency, customer value creation, and sustainable competitiveness.

Although challenges remain—including organisational resistance, digital skills shortages, cybersecurity, intellectual property management, and regulatory uncertainty—continued technological advancement and interdisciplinary collaboration will accelerate responsible and inclusive digital innovation.

The future of innovation management lies in intelligent, collaborative, ethical, and sustainable digital ecosystems that support economic growth, organisational resilience, societal well-being, and the achievement of global sustainable development goals.

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