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Management of Innovation

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Objectives of the Session

- Understand key concepts in innovation management
- Explore strategic approaches and tools
- Discuss practical cases and frameworks

1. Introduction

- Innovation is essential for organizational growth and survival.
- Shift from linear to collaborative and iterative innovation models.
- Companies like **Amazon** and **Siemens** have successfully embedded innovation into their strategic DNA.
- **Amazon** continuously disrupts markets through a culture of experimentation and customer obsession, from AWS to cashier-less Amazon Go stores.
- **Siemens** has transformed from a traditional engineering firm into a leader in digital industries by investing heavily in industrial IoT and digital twin technologies, aligning innovation with long-term strategic goals.

2. Fundamentals of Innovation

2.1 Types of innovation

- **Product Innovation:** It involves the introduction of new or significantly improved goods or services, which can have profound effects on a company's market position. Tesla's EV Tech, Apple iPhone evolution.
- **Process Innovation:** Lean manufacturing (Toyota), automation, AI in operations.
- **Business model Innovation:** Netflix-Originally a DVD rental service, Netflix transformed its business model by shifting to an online streaming platform, then further innovated by producing original content.
- **Service Innovation:** The development of new or improved services that create **added value** for customers and improve service delivery efficiency e.g. mobile banking, telemedicine.
- **Marketing Innovation:** Refers to new marketing methods involving significant changes in product design, packaging, promotion, or pricing strategies Coca-Cola's personalized bottles.
- **Organizational Innovation:** The adoption of flat organizational structures or cross-functional teams can enhance collaboration and speed up decision-making processes.

2. Fundamentals of Innovation

2.1 Types of innovation

- **Radical and Incremental Innovation:** internet, smartphones.
- **Disruptive innovation:** Netflix disrupting the video rental.
- **Sustainable Innovation:** Tesla's integration of electric vehicles with solar energy and battery storage is a representative example of sustainable innovation.
- **Open Innovation:** is the practice of leveraging both internal and external ideas and paths to market. Lego and P&G

3. Innovation Strategies

3.1 Fostering an Innovation Culture

- **Leadership:** plays a pivotal role in embedding a culture of innovation within an organization. Effective leaders encourage risk-taking by signaling that failure is a part of the innovation process, thereby removing the stigma associated with mistakes.
- **Psychological Safety:** refers to an environment in which employees feel secure in expressing their ideas, asking questions, and experimenting without the fear of negative consequences – **anonymous employee surveys - structured speaking opportunities** (e.g. during meetings).
- **Autonomy:** When employees feel they have the freedom to explore new ideas, solve problems creatively, and make decisions without excessive bureaucracy, they are more likely to contribute to the organization's innovation efforts.
- **Experimentation:** Innovation often comes from trial and error, and companies that create an environment where experimentation is embraced are more likely to find breakthrough ideas.

3. Innovation Strategies

3.1 Fostering an Innovation Culture

- **Cross-functional teams:** Cross-functional teams, which include members from different departments such as marketing, R&D, and operations, can generate more creative ideas and solutions compared to teams with a homogeneous background.
- **Recognition:** To sustain an innovation culture, organizations must recognize and reward innovative behaviors. Organizations can incentivize innovation by offering rewards such as financial bonuses, promotions, or public recognition.
- **Innovation Ecosystem:** fostering an innovation culture requires the creation of an ecosystem that supports the free flow of ideas, knowledge, and resources setting up structures that facilitate idea generation, such as innovation labs or incubators, and promoting external collaborations with universities, research centers, or other firms.

3. Innovation Strategies

3.2 Structuring Innovation Processes

- **Design thinking:** has become one of the most widely adopted frameworks for structuring innovation processes. The process is centered around understanding the needs and pain points of end-users and leveraging that understanding to create innovative solutions. **Empathize – Define – Ideate – Prototype – Test.**
- **Agile methodologies:** The core principles of agile innovation include breaking down large projects into smaller, manageable tasks or "sprints," each with specific deliverables. Teams then work collaboratively on these tasks, with frequent reviews and adjustments to ensure progress aligns with the evolving needs of the market or the customer.
- **Scaling innovation through process:** Organizational inertia—resistance to change or disruption—often hinders the scaling of innovative ideas. Companies must have well-defined processes in place that allow for the smooth transition from prototype or pilot phase to full-scale implementation. **Validation of product-market fit and agility is needed.**

3. Innovation Strategies

3.2 Structuring Innovation Processes

- **Iteration and Feedback:** Innovation often involves uncertainty and ambiguity. By establishing structured processes for collecting feedback and making adjustments, organizations can reduce the risk of failure and increase the likelihood of successful outcomes.
- **Innovation portfolios:** The process of managing an innovation portfolio involves balancing incremental innovations with more radical or disruptive innovations, ensuring that the organization does not focus solely on one type of innovation at the expense of the other.
- **Technology tools:** As the innovation process becomes more complex, organizations are increasingly turning to tools and technologies to streamline their innovation efforts. Recent advancements include the use of artificial intelligence (AI) and machine learning (ML) to automate aspects of the innovation process, such as idea evaluation, trend analysis, and market research.

3. Innovation Strategies

3.3 Scaling Innovation

- **Overcoming Inertia:** One of the primary obstacles in scaling innovation is organizational inertia that is often inherent in large, established organizations. To overcome this, innovation should become part of the organization's DNA.
- **Cross-functional Alignment:** Scaling innovation requires robust coordination and alignment across different departments and teams. In that sense, cross-functional teams are essential to ensure that the scaling phase is well-managed.
- **Resource Allocation:** Scaling innovation requires careful resource allocation (financial and human) to ensure that the innovation can be scaled up effectively without compromising quality or market expectations.
- **Maintaining Integrity:** One of the most difficult challenges during the scaling phase is ensuring that the integrity of the innovation is maintained as it expands. As innovations scale, organizations must be careful not to dilute the original concept, quality, or customer experience.

3. Innovation Strategies

3.3 Scaling Innovation

- **External Partnerships:** Scaling innovation often requires external partnerships to enhance capabilities and accelerate the scaling process. Organizations may need to collaborate with suppliers, distributors, or other partners to manage the increased demands of scaling.
- **Global Scaling:** When scaling innovations, organizations often need to consider global expansion, which introduces additional complexities such as navigating different regulatory environments, understanding local customer preferences, and adapting products to new markets. Scaling globally requires companies to develop a deep understanding of the local market dynamics and adapt their offerings accordingly.

4. Evaluation and Financing of Innovation

4.1 Measuring Economic Impact

Measuring Firm-Level Economic Impact:

- **Productivity growth:** Increased output with the same or fewer inputs due to technological improvements.
- **Revenue growth:** Higher sales driven by new or improved products and services.
- **Profitability:** Improved margins through cost reductions or premium pricing for innovative products.
- **Market share:** The ability of firms to capture a larger portion of the market due to competitive advantages.

Measuring Macro-Level Economic Impact:

- **GDP growth:** Innovation contributes to long-term economic growth by driving improvements in productivity across various sectors.
- **Job creation:** New industries, products, and services created through innovation result in new employment opportunities.
- **Export performance:** Innovative industries often lead to the development of products that can be sold in international markets, improving a country's trade balance.
- **Standard of living:** Innovation drives improvements in healthcare, education, and consumer goods, enhancing overall living standards.

4. Evaluation and Financing of Innovation

4.1 Measuring Economic Impact

Measuring Innovation's Impact Using the Balanced Scorecard

- Kaplan and Norton's **Balanced Scorecard** (1992) framework offers a comprehensive and strategic tool for measuring the impact of innovation. Unlike traditional financial metrics, the Balanced Scorecard evaluates performance across four key perspectives: Financial, Customer, Internal Business Processes, and Learning and Growth.
- **Financial Perspective:** Tracks financial outcomes such as revenues from new products, cost reductions from process innovation, or return on investment from R&D.
- **Customer Perspective:** Assesses customer satisfaction, retention, market share, and value perception related to new offerings.
- **Internal Business Process Perspective:** Evaluates efficiency improvements, speed of innovation processes, and quality enhancements.
- **Learning and Growth Perspective:** Measures employee skills development, knowledge sharing, and innovation culture maturity.

4. Evaluation and Financing of Innovation

4.1 Measuring Economic Impact

Case Example: Apple Inc. and the Introduction of the Apple Watch

- **Financial:** The Apple Watch became a key contributor to Apple's wearables division, helping it exceed \$30 billion in annual revenue by 2021. It opened new revenue streams through hardware, accessories, and subscription services like Fitness+.
- **Customer:** Apple enhanced its customer value proposition by combining technology, health, and lifestyle. Surveys and sales data indicated high customer satisfaction, particularly due to features like heart rate monitoring and seamless integration with the iPhone.
- **Internal Business Processes:** Apple streamlined its design and production processes to introduce yearly model updates. Advanced manufacturing capabilities, such as custom silicon (e.g., S-series chips), enabled performance improvements with energy efficiency.
- **Learning and Growth:** Internally, the Apple Watch project fostered cross-departmental collaboration among hardware, software, health, and services teams. It also reinforced Apple's innovation culture and commitment to expanding its talent in health technology and wearable computing.



4. Evaluation and Financing of Innovation

4.2 Sources of Financing

Financing innovation is crucial for organizations that aim to develop and scale new products, services, or business models.

Venture Capitals / Angels

Advantages:

- Provides high levels of funding, allowing for rapid innovation and scaling.
- Offers non-financial support such as mentorship, strategic advice, and networking.
- VC firms bring credibility to the business, which can help in attracting other investors or partners.

Challenges of VC and Angel Investment:

- Loss of equity control, as investors typically require significant ownership stakes in exchange for funding.
- High pressure to deliver rapid returns on investment, which can lead to a focus on short-term goals over long-term innovation.
- The potential for misalignment between investors and founders regarding the direction of the company.

4. Evaluation and Financing of Innovation

4.2 Sources of Financing

Government Grants and Subsidies

Advantages:

- Grants do not require equity or debt, so companies retain full ownership and control.
- Grants often target innovation in sectors that align with broader societal and governmental goals (e.g., clean energy, healthcare).
- Funding is typically less expensive than venture capital or loans in terms of interest or equity dilution.

Challenges:

- Grants are highly competitive and require organizations to meet specific criteria and deadlines.
- The approval process can be lengthy and bureaucratic, causing delays in accessing funding.
- Grant funding often comes with specific regulatory or reporting requirements that may require additional administrative effort.

4. Evaluation and Financing of Innovation

4.2 Sources of Financing

Corporate Venture Capitals (CVC's) & Partnerships

Advantages:

- Provides financial backing along with strategic value (e.g., market access, technology, or expertise).
- Enhances the chances of successful scaling by aligning innovation with the corporation's business strategy.
- CVC can be a more flexible financing option than traditional VC, as large corporations have greater financial resources and longer-term horizons.

Challenges:

- There may be conflicts of interest, with the corporate investor prioritizing strategic alignment over the startup's original vision or goals.
- The startup may face challenges in scaling if the corporate partner imposes restrictive conditions or too much influence over operations.
- The CVC model can result in slower decision-making processes due to corporate bureaucracy.

4. Evaluation and Financing of Innovation

4.2 Sources of Financing

Debt Financing

Advantages:

- Allows companies to maintain full control and ownership without giving up equity.
- Interest payments on loans may be tax-deductible, which can reduce the overall cost of capital.
- Debt financing is a good option for organizations with predictable cash flows.

Challenges:

- Debt must be repaid regardless of business performance, which can create financial strain if cash flows are unpredictable.
- High levels of debt can increase financial risk, particularly in times of economic downturns or if the innovation does not scale as expected.
- Debt financing is generally harder to secure for early-stage, high-risk innovations with uncertain cash flows.

5. Open and Collaborative Innovation

5.1 Benefits of Collaboration

Open Innovation: emphasizes the importance of collaborating with external partners, including other firms, academic institutions, research organizations, and even customers, to enhance innovation outcomes.

Why?

1. Access to external expertise and technologies
2. Cost-sharing in R&D
3. Faster time-to-market



5. Open and Collaborative Innovation

5.2 Conditions for Effective Collaboration

Trust & Transparency: One of the most critical factors in successful collaborative innovation is the establishment of trust between partners. Trust creates a foundation for open communication and a shared commitment to the innovation process.

- **Regular communication:** Regular meetings and updates ensure that all parties remain aligned and informed about progress.
- **Clear articulation of roles and responsibilities:** Both parties should agree on their respective contributions and expectations from the outset.
- **Building rapport:** Trust-building activities and informal interactions outside of formal meetings can enhance the overall relationship and facilitate smoother collaboration.

5. Open and Collaborative Innovation

5.2 Conditions for Effective Collaboration

Equitable Resource Sharing: Successful collaborations are characterized by fair resource sharing between partners. Both intellectual and material resources should be exchanged in a manner that benefits each party. Unequal distribution of resources—whether in terms of funding, technology, or expertise—can lead to frustration and even the breakdown of partnerships.

- **Transparent agreements on contributions:** Ensure both parties have a clear understanding of what each brings to the table (e.g., financial resources, intellectual property, access to markets, expertise).
- **Formal agreements and contracts:** Well-defined agreements, such as Memoranda of Understanding (MOUs) or partnership contracts, can provide clarity on resource allocation and prevent conflicts.
- **Mutual benefit focus:** Partnerships should be framed as win-win situations, where both parties see tangible benefits from the collaboration.

5. Open and Collaborative Innovation

5.2 Conditions for Effective Collaboration

Intellectual Property (IP) Management: Managing **intellectual property (IP)** is one of the most complex aspects of collaborative innovation, especially when sharing proprietary technologies, patents, or designs. To avoid disputes over ownership and commercialization rights, organizations must carefully negotiate and establish clear IP agreements before embarking on joint innovation efforts.

- **Pre-collaboration IP assessments:** Before initiating a partnership, both parties should assess their existing IP portfolios to understand what can be shared and what needs to be protected.
- **Clear IP agreements:** Written agreements should clearly specify who owns any new IP developed during the collaboration and how it will be exploited.
- **Non-disclosure agreements (NDAs):** Use NDAs to protect confidential information and limit the risk of unintentional knowledge leakage.

5. Open and Collaborative Innovation

5.2 Conditions for Effective Collaboration

Aligned Objectives: Collaboration in innovation is more likely to succeed when all parties share a common vision and are aligned on the goals of the collaboration. Clearly defining the objectives of the partnership ensures that all participants are working toward the same outcomes.

- **Clearly defined project milestones and timelines:** Set measurable milestones that allow for tracking progress and ensuring the collaboration stays on track.
- **Joint strategic planning sessions:** Before the collaboration begins, partners should conduct joint planning sessions to define the objectives, roles, and responsibilities.
- **Continuous alignment checks:** Regular check-ins and updates help ensure that everyone remains aligned throughout the collaboration process.

5. Open and Collaborative Innovation

5.2 Conditions for Effective Collaboration

Effective Communication: Successful collaborations depend heavily on **communication**. Partners must be able to share information, insights, and feedback quickly and efficiently. Open channels of communication foster innovation by ensuring that all team members are informed and can contribute their knowledge.

- **Use of collaboration platforms:** Leverage digital platforms that allow for seamless communication and file-sharing, especially when working with geographically dispersed teams.
- **Establishing communication protocols:** Set up clear guidelines for communication frequency, reporting structures, and feedback loops.
- **Encouraging a knowledge-sharing culture:** Foster an environment where team members feel encouraged to share their knowledge, regardless of hierarchy.

6. Technology Readiness Level (TRL) Assessment

6.1 Tools

Purpose: The primary purpose of the TRL scale is to assess the **maturity** of a given technology, providing stakeholders with a clear understanding of the technology's status. This helps manage the risk associated with technology development, particularly for industries that require significant investment or have high stakes, such as aerospace, energy, and healthcare.

Tools (manual):

- **Expert Interviews:** Experts are typically asked to assess a technology's maturity based on their experience and the current state of the technology. These interviews are often conducted in the early stages of technology development and provide valuable qualitative insights into the viability and potential risks associated with a particular technology.
- **Technology Audits:** Another approach used in manual assessments is conducting **technology audits**, where a team of experts reviews all relevant documentation, performance data, and test results related to a specific technology. These audits help identify whether the technology has met the required criteria for each TRL level.

For manual and expert-based TRL assessments, the European Commission's Horizon Europe platform provides a widely accepted self-assessment tool available at:

- <https://horizoneuropencppportal.eu/store/trl-assessment>

6. Technology Readiness Level (TRL) Assessment

6.1 Tools

Tools (data driven - DSS): To mitigate the subjectivity inherent in expert-based assessments, several **data-driven tools** and **decision support systems (DSS)** have been developed.

1. Innovation Radar (European Commission)

- **Website:** <https://www.innoradar.eu>
- **Description:** Publicly available tool used by the European Commission to assess the market readiness and TRL of EU-funded innovations.
- **Features:**
 - Uses structured metrics and expert evaluations.
 - TRL is one of the key axes.
 - Focus on innovation potential and commercialization.
- **Use Case:** Ideal for Horizon-funded projects.

6. Technology Readiness Level (TRL) Assessment

6.1 Tools

2. TRL Assessment Tool by ESA (European Space Agency)

- **URL:** ESA TRL Calculator
- **Description:** Web-based calculator based on ESA's TRL definitions.
- **Features:**
 - Provides guided Q&A-based evaluation.
 - Transparent logic behind each TRL.
 - Focus on aerospace technologies but can be adapted.
- **Use Case:** Good for structured, step-by-step TRL evaluation.

3. Technology Readiness Assessment (TRA) Toolkit – NASA

- **Downloadable Tool:** Excel-based toolkit for evaluating TRL.
- **Source:** NASA's TRA Deskbook.
- **Features:**
 - Evidence-based criteria per TRL.
 - Weighted scoring and documentation.
 - Includes guidance on evidence required for each level.
- **Use Case:** Engineering and deep tech projects.

6. Technology Readiness Level (TRL) Assessment

6.1 Tools

4. Smart Innovation & Technology Readiness Assessment Tools (SmartIRL)

- **Provider:** Developed under EU-funded projects (e.g., ERDF, INTERREG).
- **Features:**
 - Self-assessment combined with expert validation.
 - Tracks TRL progression across time and stakeholders.
- **Use Case:** SMEs and R&D consortia.

6. Technology Readiness Level (TRL) Assessment

6.1 Tools

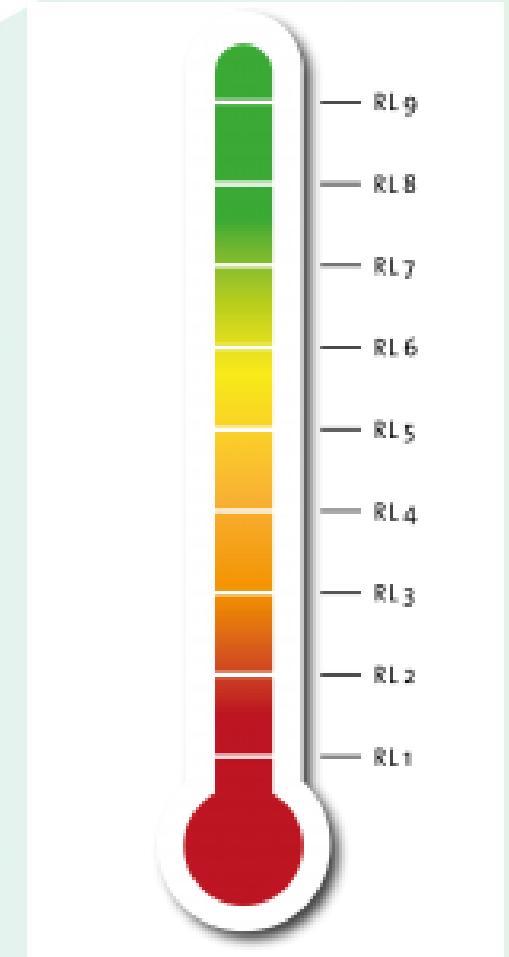
Integration: To enhance the accuracy and comprehensiveness of TRL assessments, many organizations integrate the TRL framework with other existing methodologies and models. By combining multiple assessment tools, organizations can gain a more holistic view of a technology's readiness and potential risks.

- **Risk Management Frameworks:** TRL assessments are often integrated with **risk management tools**, such as **Failure Modes and Effects Analysis (FMEA)** or **Fault Tree Analysis (FTA)**, to evaluate the potential risks associated with a technology at each TRL stage.
- **Technology Life Cycle Models:** The **Technology Life Cycle (TLC)** model, which tracks the various phases of a technology's evolution, is often used in conjunction with TRL assessments.
- **Innovation Management Systems:** TRL assessments can also be embedded within **innovation management platforms**, which track the overall progress of innovation projects across an organization.

6. Technology Readiness Level (TRL) Assessment

6.2 KTH Innovation Readiness Level™: A Multi-Dimensional Tool for Innovation Development

- Developed by **KTH Innovation** (Royal Institute of Technology, Sweden)
- Structured tool to assess and advance innovation projects
- Inspired by NASA's TRL, but **expanded to 6 key dimensions**
- Used by >100 organizations (e.g., Imperial College, Vinnova, Aalto)
- Freely available under **Creative Commons BY-NC-SA 4.0**

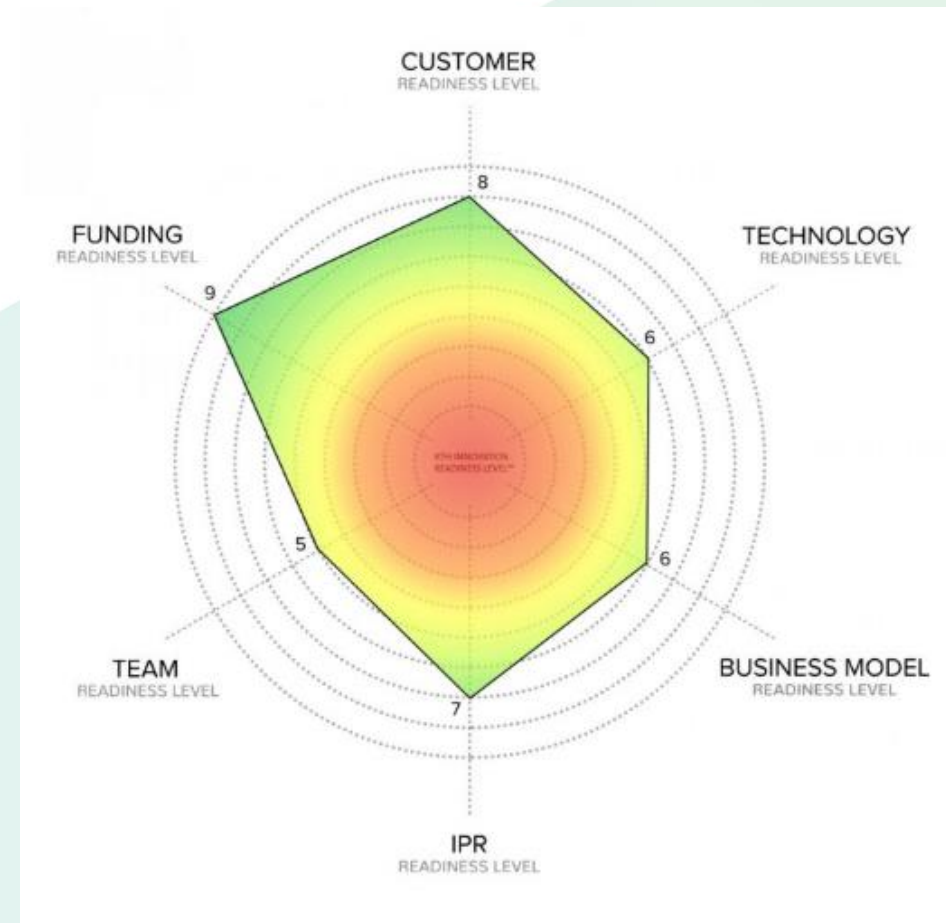


6. Technology Readiness Level (TRL) Assessment

6.2 KTH Innovation Readiness Level™: A Multi-Dimensional Tool for Innovation Development

🔍 Core Structure

- **Six key dimensions**, each rated on a 1–9 scale, much like NASA's well-known TRL model:
- **Technology Readiness Level (TRL)**
- **Customer Readiness Level (CRL)**
- **Business Model Readiness Level (BRL)**
- **IP Registry Readiness Level (IPRL)**
- **Team Readiness Level (TMRL)**
- **Funding Readiness Level (FRL)**
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- Every level comes with **clear definitions, milestones, and suggested activities**, often shown on a “thermometer” scale per dimension. This is visualized together in a spider diagram, giving a comprehensive snapshot of progress.



6. Technology Readiness Level (TRL) Assessment

6.2 KTH Innovation Readiness Level™: A Multi-Dimensional Tool for Innovation Development

Main Benefits

- **Visualization & measurement:** Quickly assess where an idea stands in a structured, objective way.
- **Guidance & structure:** Offers concrete actions and markers to move forward.
- **Communication:** Creates a shared language for innovation—ideal for team discussions, coaching, and stakeholder reporting.
- **Risk reduction:** By providing transparency, it helps teams avoid surprises at market launch and utilize fewer resources more efficiently.
- The model and all supporting materials are accessible online via KTH's platform.
- Offered under a **Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International** license—meaning it's free for non-commercial use but cannot be sold or used commercially without permission.

7. Conclusions

- **Innovation** is fundamentally linked to a company's ability to adapt and thrive in dynamic market conditions.
- The future of innovation management is undoubtedly influenced by the rapid development of **emerging technologies**, which offer new opportunities and challenges. Several technologies, such as **AI, blockchain, and IoT**, are increasingly being recognized for their potential to reshape innovation processes.
- Traditional metrics used to assess the success of innovation, such as **market share** and **revenue generation**, may no longer fully capture the value of innovation in the modern business landscape. As companies increasingly focus on **sustainability, ethical practices, and social impact**, future research should look into new metrics for measuring the broader impact of innovation.
- **Policy and governmental support** play a vital role in enabling innovation ecosystems.

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Thanks!

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