Institute for Manufacturing Emerging Industries Programme
Managing Creation and Transitions Project

Emergence Roadmap

Workshop guidance to map an emergent commercial opportunity through demonstrators and actions

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1. Overview

The Emergence Roadmap method described in this document was developed as part of the Institute for Manufacturing’s Emerging Industries Programme (EIP), as a deliverable from the Managing Creation and Transitions Project. It forms part of a suite of related approaches, underpinned by a conceptual framework, with a particular focus on technology-intensive innovation:

a) **Industry Scan**: mapping and understanding historical industrial emergence, evolution, development and change.
b) **Expert Scan**: interview-based mapping of historical industrial emergence, evolution, development and change.
c) **Organisation Scan**: multifunctional workshop method for mapping organisation development and change, capturing lessons learned.
d) **Emergence Roadmap**: workshop method for mapping an emergent commercial opportunity through demonstrators and actions.

The purpose of the Emergence Roadmap method, its context and relationships to other approaches is described below, with detailed guidance provided in subsequent sections.

1.1 Purpose

The purpose of the Emergence Roadmap workshop is to facilitate a structured approach to map out the potential commercial development of an opportunity, through a series of demonstrator steps. It allows a detailed exploration of the opportunity, different stages of progression towards the ultimate goal, and considers who and what should be involved, with the internal and external factors which may help or hinder progress. At the end of the workshop process participants have clarified the opportunity, identified demonstrators, potential enablers and barriers, and specific actions to move forward.

The Emergence Roadmap workshop-based method is intended for use by managers, technologists, consultants and analysts to understand what steps and actions they need to take to efficiently move forward in the science or technology-based industrial emergence they are involved in. It is most useful when applied to a clearly identified commercial opportunity, which it helps to further define and refine.

1.2 Background

The approach described in this document is based on roadmapping principles. Roadmaps are structured time-based graphical representations of strategy, illustrated in Figure 1, widely used to support strategic planning at product, firm and sector levels. The layers in a roadmap represent key dimensions of the system being considered, enabling stakeholder perspectives to be presented in a structured way.

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1 [www.ifm.eng.cam.ac.uk/imrc/eip](http://www.ifm.eng.cam.ac.uk/imrc/eip)
2 [www.ifm.eng.cam.ac.uk/imrc/eip/transitions.html](http://www.ifm.eng.cam.ac.uk/imrc/eip/transitions.html)
The roadmapping method has been used within the Emerging Industries Programme to map historical examples of technology-intensive industrial emergence and development in a wide variety of contexts. Learning from these maps has helped to understand the underlying principles and patterns of such emergence, to improve planning for the future. Key aspects of the resulting framework for mapping industrial emergence are summarised below, together with the set of practical methods that has been developed.

**1.3 Framework for industrial emergence**

Key aspects of the industrial emergence framework are highlighted in Figure 2:

- **Industry lifecycle**, with an emphasis on technology-intensive industries that emerge from the science base, structured according to key phases and transitions, associated with science, technology, application and market dominated activity.

- ‘**Demonstrator chain**’, demarcating the phases and transitions of industrial emergence, providing tangible intermediate targets that can be used to focus strategy.

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The framework emphasises the early stages of technology-intensive industrial emergence, focusing on four phases and the three intermediate transitions (S-T-A-M), together with associated demonstrators:

1. **Precursor phase** (science-dominated emergence): Activities that establish the supporting scientific phenomena (and/or underpinning technology platform), extending through to the first demonstrator(s) of application potential, which stimulate industrial interest and investment in particular market-directed technology feasibility studies.

2. **Science-technology transition** (S-T): Demonstrating the feasibility of a scientific phenomenon (and/or underpinning technology) to support a new market-directed technology platform, showing the feasibility of the supporting science and technology to be integrated into an application-specific functional technology system.

3. **Embryonic phase** (technology-dominated emergence): Improving the reliability and performance of the market-directed technology to a point where it can be demonstrated in a market-specific environment.

4. **Technology–application transition** (T–A): Developing the technology and application to a point where commercial potential can be demonstrated through revenue generation.

5. **Nurture phase** (application-dominated emergence): Improving the price and performance of the application to a point where sustainable business potential can be demonstrated.


7. **Growth phase** (market-dominated emergence): Marketing, commercial and business development leading to sustainable industrial growth.

8. **Mature phase**: Refining established applications, production processes and business models.

9. **Decline / renew phase**: The industry either declines (through competitive disruption) or is sustained or renewed through the development of new science-based technologies that repeat the above phases.

The above framework is a simplified representation of the complex reality of industrial emergence, which is a product of the many decisions and actions of the actors involved, ranging from researchers to firms, government agencies and consumers. However, the framework provides structure within which the behaviour of such systems can be mapped, understood and communicated, and a basis for strategy development and decision-making.

### 1.4 Toolset

A set of four practical methods (tools) has been developed within the EIP project, building on the framework for industrial emergence: a) Industry Scan, b) Expert Scan, c) Organisation Scan, and d) Emergence Roadmap. The methods are specifically designed for technology-intensive industrial emergence, and can also be applied in other situations with appropriate adaptation (where different patterns, phases, transitions, events and milestones may have relevance) – for example:

- Exploring the evolution of technologies, applications and markets to understand how industries develop and emerge.
• Mapping the progress of a corporate venture, to identify learning points for future such initiatives.
• Investigating the various experiences of stakeholders in a regional industrial cluster, to build up a picture of how the set of firms co-evolved.
• Capturing workshop participant perspectives on past innovation initiatives in a firm, to identify strengths and weaknesses as an input into innovation strategy.
• Strategic planning for early stage technology ventures, building consensus about the long term goals and intermediate steps and actions required to move forward.

A modular philosophy has been adopted, in the sense that the methods can be used in isolation or in various combinations, with each other and with other tools and processes. Three of the methods support mapping of the historical emergence and development of industrial systems, to identify patterns, enablers and barriers – the learning from these approaches can be a useful input to strategic planning, which is the focus for the fourth method:

a) Industry Scan (IS): a research method for exploring, understanding and communicating patterns, enablers and barriers associated with historical industrial emergence, supporting policy, strategy and innovation processes.

b) Expert Scan (ES): an interview-based technique for capturing personal perspectives of historical industrial emergence, which can be combined to understand patterns, enablers and barriers, as an input to strategy, policy and innovation processes.

c) Organisation Scan (OS): a workshop-based approach for mapping and sharing experience of a specific historical development within an organisation, to capture lessons learned, from multiple perspectives, as an input to strategy, policy and innovation processes.

d) Emergence Roadmap (ER): a workshop-based roadmapping method, configured to support organisations navigating science and technology-based industrial emergence, clarifying decision making and action plans. Multifunctional workshops enable priority steps to be identified through focussing on a demonstrator chain to commercialisation (the subject of this guide).

The Emergence Roadmap method requires a relatively clear focus, in terms of an identified future opportunity. It can be used in conjunction with the Value Roadmap (VR) workshop-based approach for exploring, identifying and prioritising future opportunities for early-stage technology5.

The relationships between these tool modules are shown in Figure 3, all of which are based on roadmapping principles6, enhanced by the industrial emergence framework where appropriate. The tools are positioned against two dimensions:

1. Time: past (learning from previous experience) and future (strategy).

2. Level: focus for application, ranging from industry/sector to firm and product.

As noted above, the EIP tools can be applied separately or in combination, depending on context and purpose, with the positioning in Figure 3 indicating potentially useful interactions when used together or in combination with other tools and processes. The set of three historical mapping tools can be used separately or together, and are ‘scaleable’ in the sense that they can be applied at industry, firm and product levels, The Expert and Organisation Scan approaches provide

guidance on how to engage with experts through interviews and workshops. The Industry Scan focuses on the map itself, in terms of how to gather, organise and represent information relating to the development and evolution of a complex system, with particular reference to industrial emergence. Learning from the historical scanning methods is a useful input into future-oriented strategic planning processes, including the Emergence Roadmap and other tools and methods such as portfolio management.

![Roadmapping framework](image)

Figure 3 – Tool modules and relationships, positioned against time (past and future) and level (industry, firm and product); the Value Roadmap method (dashed circle) can be used in conjunction with the Emergence Roadmap approach if helpful, to provide focus

In terms of other tools, of particular note is the Value Roadmap method, which is an adaptation of the more general S-Plan roadmap approach, used for general strategic planning at firm and sector levels. The VR and ER methods are particularly suited for strategic planning of early-stage technology, providing alternatives to the ‘Strategic Landscape’ and ‘Topic Roadmap’ modules in S-Plan for this context.

The workshop-based S-Plan approach is based on a modular philosophy, enabling management tools to be combined in various ways around a core roadmapping process. The roadmapping modules operate at two levels: business and topic (option) – see #3 and 7 in Figure 4. Other tool modules that have been incorporated include: intelligence map depicting external drivers (#1), scenario matrix (#2), QFD-style linkage grids (#4), innovation matrix (#5), portfolio matrix (#6) and business case templates (#8). Figure 4 relates to business strategy and innovation applications of S-Plan, which can also be applied at the sector level.

The EIP tool modules can also be positioned within the S-Plan process framework as shown in Figure 4:

- The historical mapping methods can provide an input to roadmapping modules to improve understanding of the past and current situation, so that learning points (development patterns, enablers and barriers) can be taken into account, at both business (#3) and topic (#7) levels. For example, the three methods (ES, OS and IS) might be used together where a clear depiction of the historical emergence of a sector is desired (#3), incorporating perspectives from both expert interviews and workshop engagements. When focusing on a particular innovation opportunity (#7), incorporating a workshop module (OS) prior to the topic

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roadmapping activity may be desirable to ensure that learning from previous developments is identified and incorporated.

- The Emergence Roadmap method can replace the topic roadmap module (#7) for early-stage technology exploitation strategy development (or where more structure than provided by the topic roadmapping approach is desired). Similarly, the Value Roadmap method can replace the Strategic Landscape module (#3), providing a means for identifying and prioritising application opportunities for early-stage technologies, where there may be many potential routes to market, with substantial commercial and technical uncertainties.

*Figure 4 – Positioning of EIP and other strategic management tool modules within the S-Plan strategic roadmapping workshop-based method (business and innovation strategy)*
2. Emergence Roadmap Guidance

2.1 Introduction

As stated in Section 1, the purpose of the Emergence Roadmap approach is to help organisations explore a defined market opportunity, associated with science and technology-based innovation, through use of a demonstrator-centric approach, ideally implemented in a multifunctional workshop environment. The output is a clear articulation of the opportunity, defined milestones (demonstrators) to take it forward, and identified next actions. It is based on the concept of the demonstrator chain which is included within Figure 2. The whole process is summarised in Figure 5.

![Figure 5 – Summary flow chart of the Emergence Roadmap process](image)

2.2 Workshop Preparation

In advance of any workshop, the correct definition of the aims of the workshop is critical. This should be clarified through detailed discussion with a contact in the organisation. Decisions should be made regarding the people to be involved and the timing of the workshop. The context and purpose of the roadmap will determine many of these decisions. Depending on the status of the scientific or technological development being explored, the Emergence Roadmap workshop may be set up as a standalone module or in combination with another strategic activity. A clearly identified opportunity can be explored in a standalone workshop, whereas if there is a need for specification, identification or prioritisation of potential opportunities, then an initial investigation (such as value roadmapping), may be beneficial. Clarification of the aims of the workshop should help to identify potential participants, and whether or not it would be useful to invite external expertise in certain fields to attend, to be able to provide more detailed information than the knowledge available internally.

The workshop scheduling will typically depend on the diary commitments and locations of the participants. The venue chosen should have enough space for A0 wall charts and flip charts to be displayed.

Agreement should be reached as to the preparation required by IfM and by the organisation. Typically this would entail:

**IfM**
- Organisation of the wall charts and consumable materials such as sticky notes, pens, sticky dots for voting, etc.
- Organisation of venue and refreshments, if being held at IfM.

**Organisation**
- Agreement of focus, participants and internal scheduling.
- Organisation of venue and refreshments, if being held on-site.
### 2.3 Emergence Roadmap Workshop

The workshop is based on a PowerPoint presentation (Appendix 1 includes the PowerPoint slides and notes) so a data projector and screen (or flat wall space) are required. Appendix 2 is a facilitator checklist with suggested timings for various actions.

Much of the output is captured on wall charts, and so the workshop venue must allow sufficient space for the wall chart(s), flip chart(s) and participants movement around these. The wall chart used as the basis of the workshop, is shown in Figure 6. The significant technology-based industrial emergence themes listed within Appendix 3 are included within the wall chart as a series of embedded grey text questions to prompt participants to consider different dimensions relating to the opportunity they are exploring.

![Figure 6 – Wall chart used during the Emergence Roadmap workshop](image)

The primary steps involved in the half-day Emergence Roadmap workshop are (see Figure 5 for a summary of the process):

1. **Prepare**  
   Initial discussion with the organisation should clearly define the purpose, focus and aims for the emergence roadmap workshop. This will help to identify who should participate and how the output may assist the organisation. The method has been found to work best when applied to a clearly identified opportunity. If there are several opportunities to explore, it may be useful to undertake a selection or prioritisation process, such as value roadmapping, initially.

2. **Articulate the opportunity**  
   Participants should brainstorm ideas across the Step 1 roadmap layers and work towards clearly articulating the future opportunity in terms of market, application and technology. The goals should be qualified and quantified as much as possible. Clarity at this stage facilitates detail within the following stages, and ensures that participants are all heading towards the same ultimate goal.
3. **Specify demonstrators**
   Demonstrator milestones that will assist in moving towards achieving these goals should be described. The demonstrators should move from the current status through to the ultimate end goal. Participants should consider ‘what’ is being demonstrated to ‘whom’ at each stage. Again, questions are included in the wall chart as prompts of important dimensions to be considered.

4. **Identify enablers and barriers to progress**
   There will be both external factors and internal strengths and weaknesses to consider. It can be helpful to consider the dimensions included in the vertical axis of the framework, as to which may be relevant.

5. **Summarise the defined opportunity**
   Participants should provide a short ‘elevator pitch’ summary of the opportunity they defined in step 1, articulate the first demonstrator to be achieved and the priority actions to be taken.

If multiple groups are involved in the workshop, it is helpful to have plenary feedback sessions after each of the steps so that the different groups can interact and clarify any implicit assumptions.

After the workshop the emergence roadmap and the resultant action plan points should be transcribed and returned to the organisation as a permanent record.

### 2.5 Resource Requirements

- Large conference room with space to walk around and wall space for the chart
- Data projector and screen/clear wall
- Sharpie pens
- Sticky notes – different colour squares, red & orange arrows
- Wall chart
- Digital camera – useful, but not essential, for capturing output
- It may be useful to have a flip chart to act as a ‘car park’ for important ideas that are not directly relevant.
Outline agenda
The process needs to be flexible. It is important to complete steps properly and to take the time required to do that.

Overall structure of the session – in each case this will need to be adjusted according to the number of personnel present and the clarity of thinking/stage of development of the opportunity.
Round table introductions are followed by a short overview presentation of the company/strategic opportunity of interest (given by the company).
The aims of the workshop are explained, together with an overview of the process. The template chart is worked through – looking at the big picture and opportunity being investigated, then breaking this down into specific milestones and particularly using the concept of demonstrators. Then examining what potentially would create enablers or barriers, finishing with a summary of the opportunity and prioritised next steps.

Company presentation – 20 minutes
Focusing on specific opportunity of interest
Aims and workshop approach – 10 minutes
Workshop builds on work undertaken by the emerging industries programme. In this, maps were created for historical industrial emergence, which showed that there are important phases, demarcated by demonstrators. This shows the example of the digital camera industry.

The focus of the map is the digital camera in the consumer market, typified by the Fujifilm MX-600, released in 1999 in the first wave of ‘modern’ digital cameras that have a feature set that would be recognised today: compact format, 1.5 megapixel sensor, 3x autofocus zoom lens, built-in flash, memory card and display screen, priced at about $800 for the consumer market. We can identify several phases and transitions, demarcated by demonstrators.

1) Precursor (supporting science and technology dominated) phase
Thriving market for film-based cameras before the advent of digital technology, and the map includes highlights from these earlier developments, which defined the market and technological context. Although the core technology and business models shifted (from chemical to digital, and away from film processing), market expectations were set by these earlier 20th century developments, and some technologies were directly relevant (for example, optics and flash). Digital technology emerged from the wider developments in semiconductor and transistor technology, with the first description of how to produce still digital photographs using mosaic photosensors by the Jet Propulsion Laboratory in 1961 (applied science demonstrator).

2) Science to technology transition
Building on the concepts proposed by the JPL paper, the charged-coupled device (CCD) photosensor was invented at the AT&T Bell Laboratories in 1969, enabled by further developments in transistor and related technologies. This generated substantial industrial interest in developing this technology, leading to the first commercially available sensor in 1974, which was rapidly incorporated into a prototype camera by Kodak in 1975 (technology demonstrator).

3) Embryonic (technology dominated) phase
Despite Kodak demonstrating that it was possible to produce a digital camera, it would be more than two decades before this technology was widely available to consumers. Performance and price of the core technology required substantial improvements, enabled by specialist markets in the aerospace and defence sectors. The first ‘mass’ market (professional press) was stimulated by a demonstration of the technology by Cannon, where a photograph taken at the 1984 Olympic Games in Los Angeles was transmitted and printed in a Tokyo newspaper (application demonstrator). While the performance and price did not compete with the incumbent film-based cameras, the ability to rapidly process, transmit and publish the images was revolutionary.

4) Technology to application transition
The development of a market for professional digital cameras, combined with further developments in defence and other specialist markets, led to rapid advances in the performance of the core technology, and reductions in cost. In parallel, developments in electronics, software and computing advanced rapidly, leading to the first consumer digital camera product being released by Logitech in 1990 (commercial application demonstrator).

5) Nurture (application dominated) phase
Although digital imaging technology was available to consumers, it was not in a practical format that could challenge the dominant film-based camera industry. The core sensor technology continued to develop, along with related electronics and complementary developments. Key to the emergence of the consumer digital camera was the underpinning computing and communications architecture provided by personal computers and the internet, combined with standards (jpeg), displays, batteries, printing and scanning systems, leading eventually to cameras that could compete with and displace film-based technology (i.e. the Fujifilm MX-600 in 1999 – a price-performance demonstrator, and similar cameras).

6) Growth (market dominated) phase
Once digital cameras had been established in the market place they rapidly displaced film-based cameras during the period 2000-2005, due to the relentless advances in semiconductor and related technologies, and the considerable advantages offered by the new technology. The
dominance of digital cameras was highlighted in 2003 with the release of the first sub-$1000 SLR (single lens reflex) camera with interchangeable lenses aimed at the consumer market. In parallel, applications of digital imaging technology in mobile phone, computer (webcams) and video systems accelerated the process.

Within the quick scan nature of this map, we are able to identify some questions – what happened to astronomy applications? Why was there the split between the space, professional and military markets? what happened in analogue markets? etc?

We can see clearly waves of activity – focussed around different markets and applications. We can also summarise the different phases of activity foci – with transitions between them: Science, technology, application and market.

The maps produced use a canvas with two axes: the horizontal temporal axis is defined by the different phases and transitions, or by a timeline. The vertical axis contains a number of themes, which are important to emerging industries, however the precise themes and their significance will depend on the industry under investigation – therefore the map is very configurable, however the list of themes can also be used as a checklist of dimensions to be considered by the participants.

Typically there are three broad layers: value context (market pull), value capture (organisational products and services and processes) and value creation (resources and capability). These are included on the wall chart for the workshop.

A simplified 'communication roadmap' format for the digital camera, showing the demonstrators and the technical and commercial components at each stage. This format can be used for post-workshop reporting.

Here we can see the phases and transitions in more detail, demarcated by demonstrators. The demonstrators may be demonstrating different aspects to different groups along the development path. These could be:

- the scientific community
- funding agencies/investors
- niche or strategic initial markets
- partners/collaborators
- distributors
- mass market customers.
This background has led to the template of a roadmap focused on a demonstrator chain.

This explores the opportunity, trying to provide quantification, where possible. The questions asked within the template prompt participants to consider the different themes, and whether or not they are relevant within their own area. Information is captured using sticky notes, written by participants.

- The first step explores the opportunity as a whole.
- The second step looks at the different steps required to reach the final goal – what do you need to demonstrate, to whom, and when? What is the difference between where we are now and the end goal (as described by the first step).
- The third step examines what enablers and barriers may be encountered – what is likely to help or hinder progress? How might these be addressed?
- Then the opportunity and actions required to reach the first demonstrator are summarised in a mini elevator pitch.

The template should be populated with sticky notes prepared by participants. The process encourages interactive discussion.

Sticky notes should be written clearly and explained to the other participants when added to the chart.

Colour differentiation can be used for different opportunities or markets, or to identify gaps in current knowledge.

It is a good idea to decide in advance if colour will have a specific role.
Animated slide with completion of wall chart – stepping through the process.
A – 60 minutes
B – 60 minutes
C – 45 minutes
D – 15 minutes

Stop between each section for groups to feedback to each other

Eventually a completed template should provide detailed information and key actions to take forward. The output can be revisited and updated at a later date, according to changes and developments that have taken place.

Wrap up

- Review output and checklist of themes
- Review of next steps

To wrap up the output is reviewed against the checklist of themes. The summary plan is reviewed.

Participants should be provided with an electronic copy of the output.
## Appendix 2 – Organisation Scan Facilitator Checklist

<table>
<thead>
<tr>
<th>Timing</th>
<th>Action</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 weeks before workshop</td>
<td>IfM-organisation discussion to clarify: Focus, scope aims, Likely participants, Venue, date and agenda</td>
<td>IfM</td>
</tr>
<tr>
<td></td>
<td>Logistic arrangements – book meeting room (with wall space, flip chart &amp; pens, data projector), arrange catering, etc</td>
<td>IfM/Organisation contact – depending on venue agreed</td>
</tr>
<tr>
<td>0-1 weeks before workshop</td>
<td>Prepare presentation with bespoke agenda: Gather consumables: • Sharpie pens • Sticky notes: different colours and shapes • Green and red sticky dots • A0 blank sheet – or printed wall chart if architecture very clear</td>
<td>IfM</td>
</tr>
<tr>
<td></td>
<td>Digital camera</td>
<td></td>
</tr>
<tr>
<td>Workshop</td>
<td>Facilitate workshop</td>
<td>IfM</td>
</tr>
<tr>
<td>Workshop + 1 week</td>
<td>Send transcribed outputs to organisation</td>
<td>IfM</td>
</tr>
</tbody>
</table>
## Appendix 3 – Dimensions of industrial emergence

<table>
<thead>
<tr>
<th>Meta-theme</th>
<th>Definition</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value context</td>
<td>The opportunities within the industrial landscape for creating and capturing value.</td>
<td></td>
</tr>
<tr>
<td>Value capture</td>
<td>The mechanisms and processes used by actors within the system to appropriate value through delivering products and services.</td>
<td></td>
</tr>
<tr>
<td>Value creation</td>
<td>The competences and capabilities used by actors within the system to generate products and services.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Context</td>
<td>Market trends &amp; drivers</td>
<td>Macroeconomic factors that cause change in the wider market and which affect the industry.</td>
</tr>
<tr>
<td>Government policy</td>
<td>The course of action or inaction taken by governmental entities with regard to a particular issue or set of issues.</td>
<td>Includes industrial policy to encourage R&amp;D and technology transfer. Makes use of financial incentives to induce or motivate a particular behaviour. These incentives include: (1) procurement, (2) taxes and tax breaks, (3) grants, (4) programs to encourage industries, (5) loans, (6) rebates.</td>
</tr>
<tr>
<td>Regulation</td>
<td>Imposition of rules by government which are intended to modify the behaviour of particular actors within the system.</td>
<td>Four main types of regulation: (1) control and command regulation (prescriptive regulation); (2) incentive, or performance, based regulation (industry allowed to develop their own approach to achieve the desired outcomes); (3) co-regulation (industry or professions regulators set the general framework and industry develops some specific rules); (4) self-regulation (industry manages and enforces its own requirements without regulators being involved).</td>
</tr>
<tr>
<td>Standards</td>
<td>Codified technical document that establishes specifications for products, practices, or operations.</td>
<td>Categorisation of standards based on their economic effect: (1) compatibility/interface standards; (2) minimum quality/safety standards; (3) variety reduction; (4) information/measurement.</td>
</tr>
<tr>
<td>Industrial environment &amp; competition</td>
<td>The factors affecting the group of actors supplying a given market, offering identical or highly similar products and services using similar inputs.</td>
<td>Includes competitors, key players, scale, geographic distribution, market concentration, barriers to entry and existing infrastructure.</td>
</tr>
<tr>
<td>Customers</td>
<td>Those who buy a particular product or service.</td>
<td>Customers define the market segment via buying habits, preferences, features and prices. Their profile specifies the revenue generation mechanisms for the firm: outright sale, renting, licensing, advertising and subscription models, selling and after-sales support models.</td>
</tr>
<tr>
<td>Theme</td>
<td>Definition</td>
<td>Notes</td>
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<tr>
<td><strong>Value Capture</strong></td>
<td><strong>Business models &amp; strategies</strong>&lt;br&gt;How actors position themselves within a market and organise their activities to support their position.</td>
<td>Dimensions include: vision, goals, business model, specialisation, brand identification, channel selection, product type and quality, technological leadership, vertical integration, cost position, value proposition, value-added services, price policy, leverage, relationships with government.</td>
</tr>
<tr>
<td><strong>Applications</strong></td>
<td>The products and services through which actors deliver value to customers.</td>
<td>Products include: physical goods, equipment and software. Services include: consultancy and financial services.</td>
</tr>
<tr>
<td><strong>Support services</strong></td>
<td>Activities offered by actors to enhance or maintain the value of the product or service.</td>
<td>Ensures that the product or service delivers benefits through its useful life. Includes after-sales support services such as maintenance, diagnostics and servicing.</td>
</tr>
<tr>
<td><strong>Sales &amp; marketing</strong></td>
<td>Activities associated with the purchase of the product or service and the inducement to do so.</td>
<td>Requires identifying, anticipating and satisfying customer requirements. Achieved through: advertising, promotion, sales force, quoting, channel selection, channel relations and pricing.</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Physical distribution of the product or delivery of the service to customers.</td>
<td>Activities include: finished goods warehousing, material handling, delivery vehicle operation, order processing and scheduling.</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
<td>The transformation of inputs into the final application form.</td>
<td>Manufacturing activities include: machining, packaging, assembly, equipment maintenance, testing, printing and facility operations.</td>
</tr>
<tr>
<td><strong>Supply networks</strong></td>
<td>The networks through which inputs are purchased, received and stored.</td>
<td>Activities include: material handling, warehousing, inventory control, vehicle scheduling and returns to supplier, developing outsourcing strategies, qualifying new suppliers, procurement of different groups of purchased inputs, ongoing monitoring of supplier performance and the development of supplier associations.</td>
</tr>
<tr>
<td><strong>Value creation</strong></td>
<td><strong>Design</strong>&lt;br&gt;The interpretation of customer/user needs into products and services, drawing on available technologies.</td>
<td>Defines the form and function of the product, or service. Requires consideration of market, social and technical aspects. Includes design for manufacturing, platform planning and component sharing.</td>
</tr>
<tr>
<td></td>
<td><strong>Development</strong>&lt;br&gt;The application of basic research to industrial or commercial purposes, integrating the research outputs into a functioning technology.</td>
<td>It may draw on the physical infrastructure supporting the activities of the actor, and other enabling technologies outside its boundaries.</td>
</tr>
<tr>
<td></td>
<td><strong>Research</strong>&lt;br&gt;Activities directed towards the advancement of knowledge through experimentation and theorising.</td>
<td>Basic research results in the creation of new intellectual capital. Processes include the creation, discovery, verification, collation, reorganisation, dissemination and patenting of knowledge.</td>
</tr>
<tr>
<td>Theme</td>
<td>Definition</td>
<td>Notes</td>
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<td>-----------</td>
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</tr>
<tr>
<td>Management</td>
<td>The processes through which actors organise their resources.</td>
<td>Activities include: general management, planning, performance measurement, human resource management, finance, accounting, legal, government affairs and quality management.</td>
</tr>
<tr>
<td>Relationships</td>
<td>The partnerships and networks that actors draw on to acquire external resources that support and advance their research, development and design activities.</td>
<td>Includes: (1) industrial collaborations such as R&amp;D consortia, joint ventures and alliances, and (2) financial sources such as venture capital funds, banks, Government grant schemes and licensees.</td>
</tr>
<tr>
<td>Resources</td>
<td>The assets that are owned or controlled by actors within or outside the system.</td>
<td>Types include: financial, physical, human, technological, market, reputational and organisational. They differ in the degree of tangibility, mobility and imitability.</td>
</tr>
</tbody>
</table>