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Innovation management — Tools and methods for managing opportunities and ideas — Guidance

Management de l'innovation — Outils et méthodes de management des opportunités et des idées — Recommandations

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 279, *Innovation management,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 389, *Innovation management,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

The ability to innovate is central to any organization's growth, viability, and impact within society. Managing opportunities and ideas is central to the innovation management process. This document focuses on early-stage opportunities and ideas in the front end of innovation; tools and methods for identifying opportunities, creating innovation concepts, and validating innovation concepts to be considered for development and deployment. It does not address ideas that result from development and deployment activities.

Any organization wishing to innovate needs to bring good opportunities and ideas through to realization to provide a stream of potential innovations. This document gives guidelines for the activities from intention through to selection for development.

0.2 Guidance

This document gives guidelines to organizations and individuals to realize value from their opportunities and ideas at strategic and operational levels.

Opportunities and ideas can come from anywhere, e.g. top down, bottom up, inside or outside the organization. They can span the continuum of innovation types from incremental to radical. Organizations need to manage their efforts at different levels of sophistication and complexity, depending on their size, maturity, context, and ambition.

This document supports these different levels according to type of organization and innovation ambitions. It also can help users select and adapt methods and tools that are appropriate to their specific circumstances.

Types of organizations and users of this document include, for example:

a) established, large organizations (for profit and social value) desiring to be more systematic about their idea and opportunity management activities;

b) small and medium enterprises (SMEs) looking to bring more structure to their innovation activities;

c) start-ups/venture capitalists considering how to evaluate opportunities and ideas more systematically;

d) non-profit organizations seeking to leverage innovation activities to build a more innovative organization for the benefit of their interested parties;

e) non-governmental organizations (NGOs) aiming to transform innovation ecosystems through more effective and efficient innovation activities;

f) individuals inside or outside of an organization looking for a framework for managing opportunities and ideas;

g) universities and research institutions exploring new ways to create value by addressing the needs and expectations of the organization and their interested parties.

0.3 Front end of innovation

Figure 1 presents front end innovation activities in relation to innovation processes as described in ISO 56002. Figure 1 emphasizes the iterative nature of managing opportunities and ideas, with learning cycles that reduce uncertainty and lead toward realizing value.

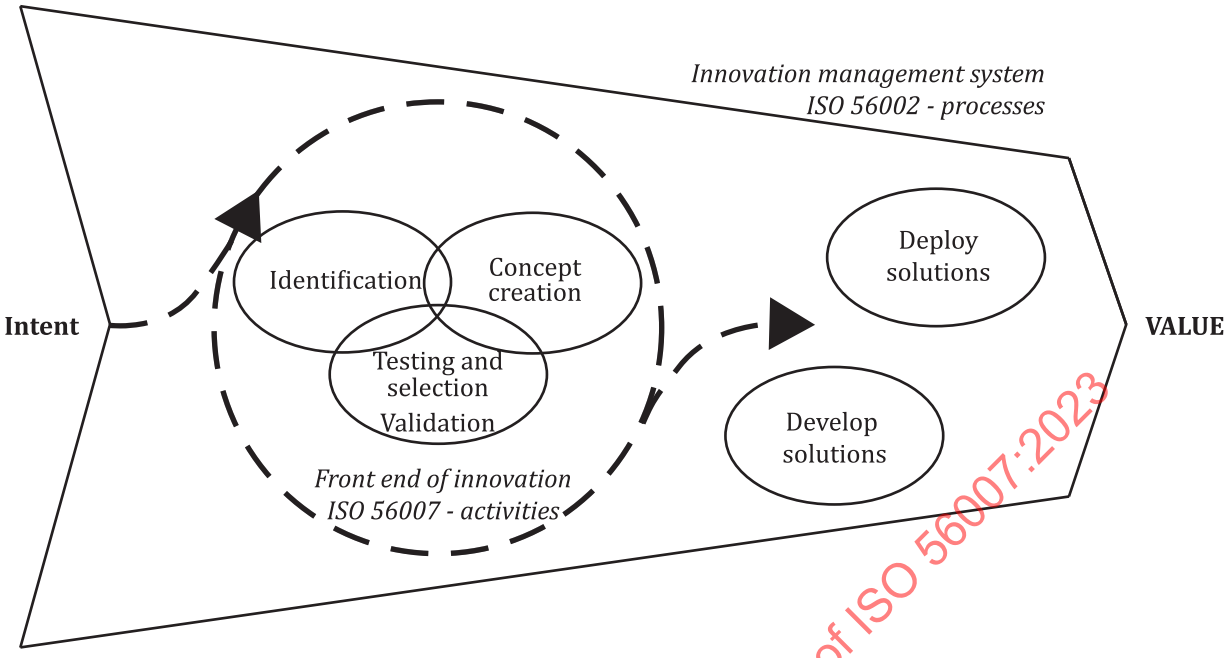


Figure 1 — Front end innovation activities in relation to ISO 56002 innovation processes

The main clauses of this document provide information and guidance as follows:

— Clause 4 focuses on preparing for managing opportunities and ideas, including key terms of reference, fundamental questions to ask, the progression of ideas, innovation drivers to consider, and different methods that can apply;

— Clause 5 focuses on people and organizational considerations and how they can affect managing opportunities and ideas;

— Clause 6 details opportunity and idea management activities and their interrelationships through identification, concept creation and validation (further refined into testing and selection);

— Clause 7 covers review and evaluation of front-end innovation activities and efforts.

0.4 Relationship to other innovation management standards

This document relates to the ISO 56000 family of standards, developed by ISO/TC 279 as follows:

a) ISO 56000 for understanding the main terms, definitions, concepts, and principles of innovation management.

b) ISO 56002 for establishing, implementing, maintaining, and continually improving an innovation management system.

c) ISO 56003 for working together to innovate through innovation partnerships.

d) ISO/TR 56004 for planning, implementing, and acting upon the results of an innovation management assessment.

e) ISO 56005 for establishing and implementing an intellectual property (IP) framework, strategy, and tools for IP management activities.

f) ISO 56006 for developing and providing intelligence to enable strategically driven innovation decisions.

g) ISO 56008[1)] for planning, designing, and selecting indicators and metrics to measure innovation activities and portfolios.

1) Under preparation. Stage at the time of publication: ISO/DIS 56008:2023.

Innovation management — Tools and methods for managing opportunities and ideas — Guidance

1 Scope

This document provides guidance on managing opportunities and ideas by:

— explaining the reasons for and the value of managing ideas effectively;

— describing how to prepare for front end innovation activities;

— addressing people and organization issues, including innovation leadership, culture and strategy;

— detailing innovation activities and their interrelationships;

— outlining activity and process evaluation considerations that are important for innovation success.

A sub-set of processes are addressed as described in ISO 56002, i.e. identifying opportunities, creating concepts, and validating them. The activities within these processes, when managed together, bring forward viable innovation concepts for development. Developing these innovation concepts into solutions and deploying these solutions is addressed by ISO 56002 and is outside the scope of this guidance document.

This document provides guidance for any innovation type along the continuum from incremental to radical innovation, as defined in ISO 56000.

This guidance is intended for:

— any user involved in innovation, whether for an organization or individual;

— any organization type or scale;

— any understanding of value creation and realization, whether for profit, social impact, changes in strategic direction, or any other purpose.

This document can help organizations to systematically manage their opportunities and ideas to realize greater value from front end innovation activities to arrive at go/no–go decisions for development. There is no one method or set of tools for use in all situations. Choice is impacted by a range of related considerations to be addressed in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 56000, *Innovation management — Fundamentals and vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 56000 apply.

NOTE For those definitions that are not included in ISO 56000, they will be included in the next version of ISO 56000.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Preparing for managing opportunities and ideas

4.1 General

To prepare successfully for managing opportunities and ideas, organizations should:

— align on their key terms to create a common language;

— ask the right questions at the right time to enable learning;

— address organizational considerations that are specific to innovation activities;

— gain a clear view of opportunity and idea progression;

— understand how different methods can be applied.

Each of these considerations refers in one way or another to all or parts of three fundamental processes described in ISO 56002: identify opportunities, create concepts and validate concepts.

The progression innovators seek is to learn, iteratively, to reduce uncertainty in order to achieve sufficient clarity to make selection decisions as described in 4.3. The intended outcome of front-end innovation activities is to deliver validated innovation concepts that are ready for development. Clause 6 provides advice on the activities that enable this intended outcome. Annex A provides an overview of related methods.

In this document, validation is further divided into testing and selection. Testing covers all the activities that contribute to reducing uncertainties to achieve an outcome as described in 4.2 and 4.3. Selection covers the decision-making activities that are necessary to identify opportunities or ideas that deserve further attention and ultimately become innovation concepts suitable for development. Selection may also lead to rework or archiving of opportunities, ideas and innovation concepts that are not meeting selection criteria.

4.2 Key terms

The organization should consider the following descriptions of terms to prepare for managing opportunities and ideas:

— whereas "innovation management" is a process for managing the entire innovation lifecycle, this document focuses only on front end innovation activities to prepare innovation concepts for development;

— an "area of opportunity" can address a current strategy or a strategic intent or can emerge due to external and internal changes. It has the potential to sustain, grow or renew an organization;

— an "opportunity" emerges from a set of circumstances that can lead to a potential innovation. It can also lead to ideas or opportunity areas;

— an "idea" can be inspired spontaneously by an opportunity or an area of opportunity. It can address a stated or unstated issue or problem to be solved, need or desire. It can emerge through serendipity or by a direct challenge or brief. It can also link to opportunities or opportunity areas;

— an "innovation concept" is the result of evolving and refining either opportunities or ideas for development, or both;

— an "uncertainty" (as defined in ISO 56000) is a lack of knowledge or understanding across a wide range of considerations that increases the unpredictability of a desired/potential innovation;

— a "risk" (as defined in ISO 56000) is a deviation from the expected arising from uncertainty or an event;

— "value" (as defined in ISO 56000) is the benefit that can be achieved by satisfying the perceived needs and expectations of organizations and interested parties.

In the context of an organization developing an innovation management system, ISO 56002 advises working from "areas of opportunity" to "opportunities" and on to "ideas". In other contexts, such as in a start-up, ideas can come before opportunities or even areas of opportunity.

Figure 2 below represents the relationship of an area of opportunity, opportunity and idea.

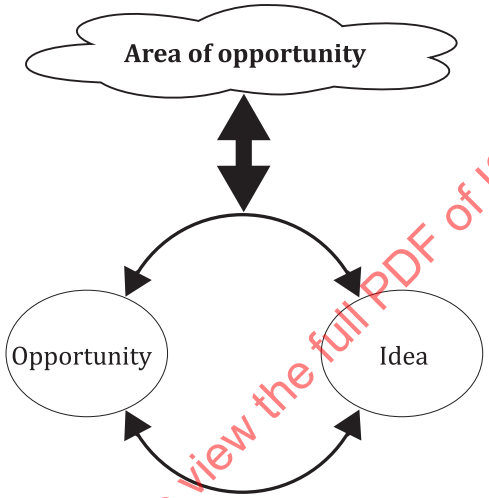


Figure 2 — Relationship of area of opportunity, opportunity, and idea

The organization should treat either opportunities or ideas, or both as the starting points or inputs for front end innovation. These inputs are used to create and validate innovation concepts, which can then be developed and deployed to realize value. Typically, an opportunity is more likely to be the starting point for a radical or breakthrough innovation as more exploration is required to learn about the potential solution. An idea is more likely to be the starting point for an incremental innovation as more is known about the potential solution. Opportunities and ideas can have low, medium, or high levels of uncertainty across different categories based on their maturity and complexity. Annex B provides descriptions of methods and tools for managing uncertainty in these contexts.

Drivers of value can include pursuing new strategic ambitions, identifying specific areas for exploration, addressing organizational challenges, developing new products, services, or operating models, and/or building upon insights about interested party behaviour. An area of opportunity is an exploratory market, domain, or strategic focus area in which to identify an opportunity or idea. It can also be viewed as a theme.

4.3 Uncertainty

4.3.1 General

Uncertainty arises from a state of deficiency of information, understanding or knowledge that increases the unpredictability of a desired or potential outcome. Since front end innovation is about exploring new areas of opportunity, any new opportunity or idea faces different levels of uncertainty expressed as assumptions, questions, unknowns, or potential problems that need to be resolved. These uncertainties address factors, e.g. market need, technological feasibility, social acceptance, maturity of the idea, strategic, resource or business model fit, interested party expectations, environmental responsibility,

estimated cost or time to develop. The focus is on what needs to be learned across a range of factors to reduce uncertainty.

4.3.2 Uncertainties versus risks

Even though they are often confused, uncertainties and risks are not the same. Risks can be analysed and assigned a probability of occurrence. Whereas risks can be mitigated and hedged against based on probability, uncertainties can only be reduced through further investigation, testing and learning to fill gaps in knowledge and understanding. Contrary to risks, a probability of occurrence cannot be assigned to uncertainties. The possibility of finding the information can be assigned a probability but not the uncertainty itself.

The inability to obtain the missing information, understanding, or knowledge, creates the risk that the missing knowledge negatively affects the innovation concept. Risk is an effect of uncertainty and is described as a deviation from the expected, where the consequences of an event and its probability/likelihood of occurrence can in most cases be quantified from available information, experience and/or capabilities.

4.3.3 Uncertainty reduction

The aim of front-end innovation is to identify and reduce uncertainty to a level acceptable for decision-makers by filling gaps in information, understanding or knowledge, through a process of opportunity and idea refinement and the generation of innovation concepts. It requires iteration and re-evaluation against a set of options or selection criteria (see 6.4.1). When uncertainty is reduced sufficiently, and the innovation concept is deemed to be validated, it is then ready for development.

Reducing the level of uncertainty can thus be achieved through exploration and testing methods or tools, such as prototypes, tests, market studies, research projects, pilots, verifying assumptions, iterative creative input, research and data acquisition, simulations, storyboarding, modelling, in-market experiments, or reaching out to internal/external experts within networks to seek answers to questions. Building prototypes is a way to learn and acquire knowledge about feasibility. Using methods, such as lead user or design thinking, are efficient ways to verify user needs or desires as well as suitability of the desired solution for potential customers.

In this document, the activities for obtaining missing information, understanding or knowledge are included as part of testing. Testing, along with selection, is one of the two components of validation. Further information on managing the reduction of uncertainty is outlined in 6.3.4 (cataloguing innovation concept uncertainties) and 6.4.1 (testing).

4.3.4 Screening for uncertainty

As the management of ideas varies considerably with the level of uncertainty, the organization should screen for levels of uncertainty. As outlined in 5.2.4, screening into three levels of low, medium, and high can be effective for innovation portfolio management as well as for selecting innovation management methods.

Annex B provides examples of specific methods and tools to manage uncertainties across organization, technical/implementation, resource, market/mission, and interested party categories and independent of them. Tools include how to screen for, identify, and reduce uncertainties, including calibrating efforts to reduce them.

4.4 Fundamental questions and principles

In understanding the context for managing opportunities and ideas, the organization should consider how the following questions apply to current, planned and future innovation initiatives.

— Why look for new opportunities? There are many reasons for deciding to pursue new opportunities including: competition, new technology, drop in sales/growth, economic, statutory obligation, political and social change, outdated innovations, customer/user engagement, mission ambitions.

— What are the objectives? Make enquiries more specific by asking “How do these objectives help to focus innovation management efforts on types of innovation or on customers or products or service attributes or mission purpose?".

— When will/might this happen? Timing, sequence, identifying milestones are all important considerations for planning and keeping opportunities and ideas on track.

— Who to enrol and engage? Key questions to consider are “Who is involved in creating and validating innovation concepts?” “Do we have the right capabilities and resources?” “Who is to benefit?” “Who might resist or be disadvantaged by this innovation concept?” “Who performs which roles?”

— Where to focus? Expand efforts by asking questions, such as, “Where else might we…?” or focus efforts on “Where will this work best?” for envisioned opportunities and ideas.

— Which innovation management options are best? Choose among a specific set of options, e.g. “Which methods and tools are most appropriate for opportunity and idea refinement or setting up experiments?”.

— How to set this up for success? Once a pain/need/desire is established, seek to ensure that opportunity and idea management efforts are successful. "Which are the best methods to use?". Consider framing questions, such as “How might we…?”.

— What are the right questions to ask? Consider questions based on categories of uncertainty. See Annex B for examples.

These questions provide a learning framework for understanding the considerations and success factors for managing opportunities and ideas.

It is also important to consider these questions through the lens of innovation management principles listed in ISO 56000 that can be specific to front end innovation activities as follows:

— adaptability: developing adaptable structures and processes;

— managing uncertainty: ability to manage uncertainty and risk;

— exploiting insights: effectiveness in capturing insights to successfully exploit them.

4.5 Opportunity identification, idea generation and progression

Front end innovation activities can be managed both within and independent from more complete innovation management systems, i.e. for more comprehensive initiatives as part of a system through to standalone ideas. For illustration, see Figure 1 in the Introduction.

Organizations should have processes to rapidly generate, capture, and screen for opportunities and ideas. More ideas from a diversity of sources can be better at an early stage than a few ideas from a few sources.

The organization should handle opportunities and ideas differently based on their categories and levels of uncertainty. This requires iterating through activities and learning through practice, reducing uncertainty with each iteration, and selecting innovation concepts to progress with or stop based on their potential to deliver value. Questions should be asked, and answers verified, based on assumptions and selection criteria, as outlined in Clause 6. There should be repeated cycles of learning until uncertainty is reduced through the acquisition of knowledge and information. As the goal is to decide if an innovation concept is ready for development, the knowledge and information obtained can help decision making based on the agreed selection criteria.

Figure 3 below illustrates the progression of opportunities, ideas and innovation concepts and their relationship with front end innovation processes. The order of activities is not universal and should be adapted for either the circumstances or the processes, or both. Where this is practiced, it enables more successful decision making.

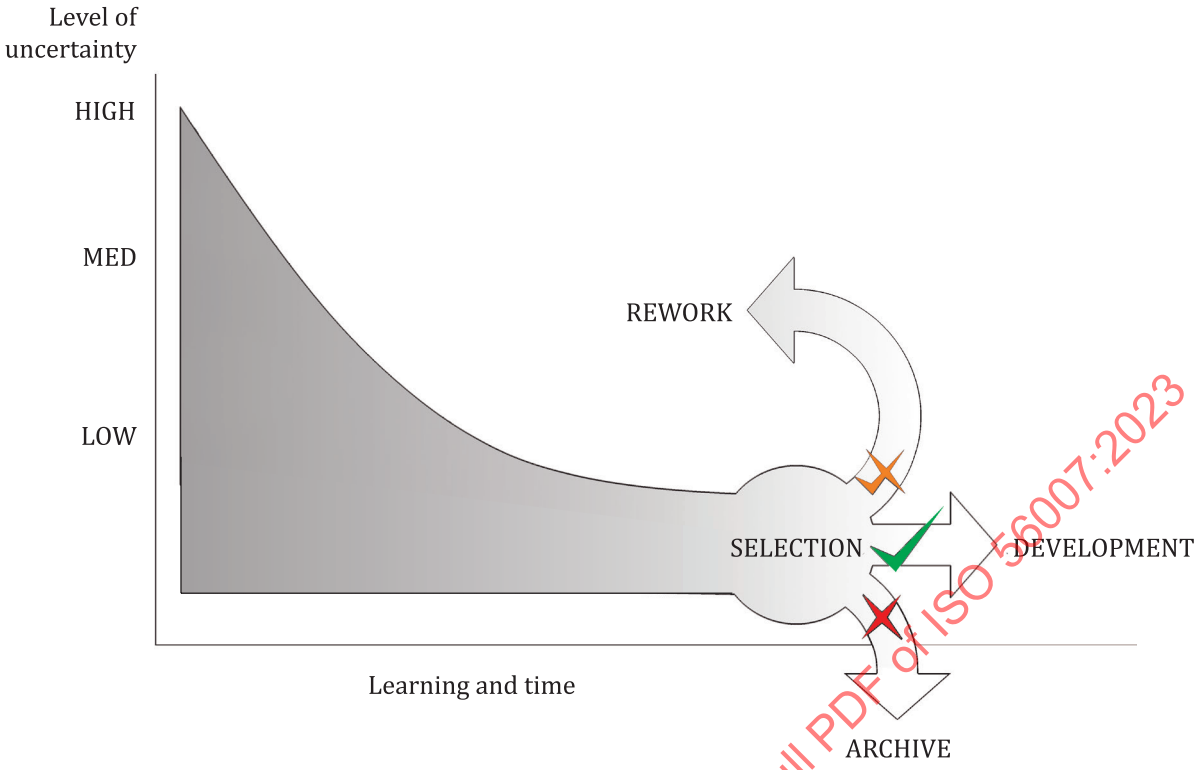


Figure 3 — Progression to selection

To reduce uncertainty, the organization should:

— capture trends, e.g. sector, market, technology, societal;

— conduct market analysis about competition and value potential;

— seek customer/user feedback from prototypes and customer observation about an opportunity, idea, or innovation concept and what features, products, services, and solutions are most likely to be of interest to users and customers;

— use personas and user experience analysis to study pains, needs, desires, and motivations about how a potential customer or user can adopt a new product, service, or solution;

— seek feedback from interested parties, import innovation concepts from experimentation, distribution, and supply chain partners, and get support from internal financial and organizational leaders about the organization's ability to produce and deploy a new product, service, or solution;

— use business, competitive, and strategic intelligence together with brand and IP analysis about return on investment (ROI) and viability related to an opportunity, idea, or innovation concept.

More detailed, practical guidance on front end innovation processes and related activities is provided in Clause 6.

4.6 Front end innovation considerations

Different considerations can influence how opportunities and ideas should be managed, including which methods and tools to use and how to use them. These can include how to think, what to think about, how to assess contributions, and how to make go/no-go decisions.

— Scale and scope

  The origin of the opportunity or idea, effort to manage it or its eventual impact can determine scale and scope. Ideas and opportunities can be trivial or game-changing or anywhere in between.

Scale relates to size and evolution of an opportunity or idea.

Scope sets its boundaries.

Where the scale or scope is not well known, experiment at small scale first and iterate until enough is known to enable further management of the opportunity, idea or innovation concept.

— Uncertainty and risk

Methods and tools can be applied differently along the continuum of uncertainty. Incremental and radical innovations are the bookends from low to high uncertainty, respectively.

Risk appetite and risk management are additional considerations that can impact the choice of tools and methods.

— Value creation and realization

Some innovations create significant value for interested parties whereas others only realize minimal value. Disruptive innovations eventually displace established solutions. Incremental innovations can be less disruptive and bring value to improve or extend the lifecycle of existing solutions.

Interested parties determine value, in terms of e.g. revenue, profit, growth, renewal and safety of offerings, quality of life, social responsibility, sustainability, user/customer impact. This influences the scale, nature, and priority of innovation management efforts.

— Types of innovation

The organization should categorize types of innovation based on their degree of change, internal or external relationship to the organization, performance, cost, and/or customer value. A listing of innovation types is provided in A.3.

— User and organization types

Examples of users and organization types who can be interested in front end innovation initiatives are described in 0.2 in the Introduction. The organization should clarify and refine innovation management choices, identify the type of organization as a starting point and its objectives for innovation management, including its organizational capability.

— Strategy and portfolio fit

The organization should develop opportunities and ideas within the context of either current strategy or strategic intent, or both to guide selection considerations as well as any contributions to innovation portfolio objectives. This can be particularly relevant as an organization matures its innovation management processes and the portfolio grows.

4.7 Methods for managing opportunities and ideas

The organization should prepare, plan for, and choose methods and tools, informed by all the considerations outlined above. Ensuring small, low-cost iterations early in the front-end innovation process is also valuable in enabling efficiency and sustainable success of innovation management efforts. An awareness of the range and uses of available methods enables and simplifies front end innovation planning and decisions.

Some methods can combine characteristics from different categories. Some focus on the innovation management processes themselves, while others focus on the organization, governance, or culture. How opportunities and ideas are generated and managed is different in each method. Hundreds of methods are available. Annex A presents more comprehensive information on methods and tools.

5 People and organization

5.1 General

People and organizational considerations are important enablers to the success of front-end innovation processes and activities. Since they clearly affect the management of opportunities and ideas, any user type should take them into account according to their context.

Organizations and individuals, working inside or outside of an organization, should manage opportunities and ideas based on their ambitions. The scale and nature of appropriate guidance should be matched to the roles, skills and experiences of people involved in innovation management and enable successful planning and execution of these efforts. This applies for individual ideas through to broader initiatives and managing a portfolio of opportunities and ideas.

Where front end innovation activities relate to organization-level initiatives (i.e. top-down), strongly linked to innovation intent and strategy, the guidance framework should be comprehensive and deeply embedded across the organization. The front-end innovation framework fits within a full innovation management system, as outlined in ISO 56002, which provides systematic guidance, covering organization context, leadership, culture, planning and resources. Where front end innovation activities are more loosely connected or on a smaller scale, elements of management system thinking can be useful.

5.2 Leadership

5.2.1 General

Leadership should consider the following factors related to the management of opportunities and ideas.

5.2.2 Top management commitment

Top management should initiate and drive front end innovation initiatives to ensure these efforts align with their organization's context, culture, strategy, ambition, capabilities, principles and for the benefit of internal and external interested parties. The scope of these efforts can vary based on an organization's size and purpose.

Top management should be visible, consistent and address the following elements:

— fostering opportunities, ideas, and broader initiatives;

— ensuring appropriate resources are available and used;

— promoting openness, trust, value orientation, and psychological safety;

— making selection criteria explicit and transparent for all people involved in front end innovation initiatives;

— developing front end innovation capabilities throughout their teams;

— being clear on how to deliver value to the organization and its interested parties;

— continuously capturing insights, including from all and unexpected sources;

— promoting perseverance of effort based on evidence;

— selecting the right people for opportunity identification and idea generation roles.

Leadership should recognize the role and contribution of people who identify opportunities, create as well as validate innovation concepts, and encourage and reward them with the appropriate incentives (both intrinsic and extrinsic motivators).

Those involved in front end innovation should:

— be naturally curious and empathetic to ask thought provoking questions;

— possess technical and business know-how to connect opportunities and ideas with possibilities;

— be excellent communicators and networkers to build compelling value propositions to attract interested parties;

— be comfortable working under conditions of uncertainty.

The organization should seek out and train people to develop individual competence for managing opportunities and ideas.

5.2.3 Strategy

ISO 56002 provides clear guidance on how to develop an innovation strategy. Front end innovation initiatives should align with this strategy and address the question "Why and how to manage opportunities, today and in the future?". Opportunities and ideas can arise from or influence current strategy and strategic intent. These strategies should consider different methods for managing opportunities and ideas.

Leadership should establish opportunity and idea management processes and activities that address an organization's:

— appetite for risk, tolerance for failure and capacity for change;

— benefits for its internal and external interested parties;

— structures, resources, and capabilities in place as well as potential gaps;

— ability to systematically identify opportunities and generate ideas for creation and validation of innovation concepts;

— culture and governing principles to enable successful front-end innovation initiatives.

5.2.4 Governance

Top management should determine the governing principles to support front end innovation processes, the capabilities to apply them consistently and the practices to deliver expected outcomes in learning and value terms.

Governance should address the following for effective and sustained front end innovation initiatives:

— enabling effective use of tools and methods for managing opportunities and ideas;

— allowing for appropriate questions and evaluation criteria based on opportunity and idea maturity;

— managing allocation of resources;

— securing resources from beyond day-to-day sources, such as R&D, market research, ecosystem;

— ensuring appropriate levels of funding;

— clarifying accountability, structures, roles, responsibilities and expectations of decision-makers, teams, and individuals;

— rewarding and recognizing front end innovation efforts;

— investigating where to look for sources of opportunities and ideas;

— assuring effective management of IP and assets;

— managing portfolios of opportunities, ideas, and innovation concepts;

— creating an environment to redirect or stop efforts based on learning.

5.2.5 Front end innovation portfolio

An innovation portfolio is a set of innovation initiatives grouped together. The front end of the innovation portfolio comprises opportunities, ideas and initiatives being identified, explored, conceptualized, tested, and then selected, or not, for development based on a validated innovation concept. Some meet shorter term objectives, driven by a problem to solve, while others, with a more uncertain and longer-term application, can be driven by a strategic ambition of possible options to pursue.

An organization should adopt a portfolio approach when it desires to move beyond managing only a few ideas. Portfolios should be balanced across many considerations, such as extension to current versus creating new offerings, levels of uncertainty, time to value realization, opportunity and idea quality-quantity throughput, and existing versus new resources required.

These considerations can require different processes to manage opportunities, ideas, and innovation concepts within the portfolio. The criteria for managing a portfolio should be determined in a clear and transparent manner. Explicit selection criteria as described in 6.4.2 help manage a portfolio with rigor and decide which opportunity, idea or innovation concept should be pursued or not. No opportunity or idea should be deleted. It should be archived as a record to guide and be a possible resource for future opportunity and idea management.

Opportunities, ideas, and innovation concepts can be organized and managed within portfolios, with different levels of uncertainty regarding their potential of becoming a successful innovation. The organization can build a portfolio that, when combined, covers the innovation continuum as follows:

— incremental innovation, a low degree of change, focusing on generating ideas to improve existing practices;

— adjacent innovation, a medium degree of change, to find next generation products, services, and processes; and

— breakthrough or radical innovation, a high degree of change, focusing on longer term, game-changing opportunities.

See Annex B for additional descriptions and tools for managing uncertainty.

5.3 Enabling factors — Resources

5.3.1 General

Portfolio planning should extend to resource allocation and management, effort, potential, and other factors. Portfolio balancing across uncertainty and risk can be valuable in this respect.

Leadership should determine and provide resources that are sufficient and appropriate to enable successful front-end innovation initiatives. It should also establish a funding policy and regularly review it based on results obtained. Factors to consider are as follows:

5.3.2 Financial resources

The financial prospects, investment risks, and constraints associated with front end innovation activities, including any financial implications and other risks should be evaluated.

An organization should consider appropriate funding principles as follows:

— establishing an effective funding mechanism via a self-funded central budget, local or operational budgets, and/or through customers, partners and government agencies;

— allocating dedicated financial resources for opportunity and idea management activities;

— ensuring the funding, resource capacity and support are aligned to a priority list of opportunities, ideas, and innovation concepts;

— balancing funding for new opportunities across different time horizons with different degrees of uncertainty, investment risk profiles and types of innovation outcomes;

— identifying relevant sources for opportunity identification and idea generation funding and accessing the right internal and external resources to build up competence in managing opportunities and ideas;

— setting aside funds for partnering or acquiring start-ups that have developed new technologies, products, and/or business models.

5.3.3 Time and space

Innovators need time to learn about an opportunity or idea and develop it to a sufficient level to describe it and share it with interested parties. Leadership should consider:

— allocating time for staff to develop opportunities and ideas and build on the ideas of others;

— offering different options to work on opportunities and ideas, such as dedicating fixed time slots, using a percentage of work time, or encouraging staff to use their own time;

— adapting time management to the specific conditions and time constraints within the organization.

Innovators also need the right environment to be creative. Dedicated physical spaces, facilitated creative seminars and creative thinking tools are examples of how to encourage creativity.

5.3.4 Competences and roles

Front end innovation resources with the right competences and mindset to manage opportunities and ideas are important in roles such as idea originators, opportunity recognizers, coaches and facilitators. Organizational support should be provided in technical, business, and personal terms to champion and enable a culture for front end innovation initiatives.

Radical or breakthrough innovations and creation of new markets can require accessing significant technological expertise from outside the organization and building new business development expertise within. Incremental innovations or development projects and addressing new customer needs can require access to sufficient marketing or business development capabilities.

To be successful in their roles, these resources should consider:

— opportunity and idea management objectives, processes, activities, methods, and tools suitable to their context;

— who to involve and the desired outcome;

— user/customer experiences to learn from;

— behaviours required for change.

5.4 Enabling factors — Organizational support

5.4.1 General

Leadership should determine and provide support that is sufficient and appropriate to guide successful front-end innovation activities. Factors to consider are as follows:

5.4.2 Culture, motivation and recognition

Leadership should encourage a positive culture to deliver the desired behaviours and attitudes. It can focus efforts to reflect on organizational values, strategic ambitions, an appetite for innovation and leveraging of current capabilities. Culture and strategy are intricately linked.

Such a culture can also welcome and nurture opportunities and ideas as they emerge. Organizations should continuously provide feedback to encourage learning and progression.

The organization should target a balance between spontaneous bottom-up and more directed top-down contributions. The role of leadership is to encourage and sustain a culture that is characterized by:

— openness, discovery, curiosity, diversity, and respect;

— learning, experimentation, creativity, change, and challenging assumptions;

— networking, collaboration, constructive communication, participation (internally and externally);

— balance of experience and evidence-based input to support the opportunity and idea management process;

— directed and undirected opportunity and idea elaboration processes to promote divergent and convergent thinking.

Innovators are motivated to generate ideas and share them for many different reasons. Recognising the origins of an idea and rewarding the originator(s) for this contribution is an important factor to keep motivation high. It is also part of the organization's ethics and transparency towards its staff and other interested parties.

It is important to understand intrinsic and external motivators and identify which ones apply to which individual in the organization. This will help improve both the quantity and quality of ideas generated.

Motivators can include:

— reciprocity: financial or material reward;

— reputation: personal or collective respect and status, within the organization or beyond;

— altruism: for the benefit of the individual, team, department, organization or even society;

— learning: for the benefit of individuals and teams, to further knowledge and evolve careers.

Some inventors, idea originators and innovators have an intrinsic drive or aptitude for coming up with new ideas and the entrepreneurial talent to frame their ideas within a broader value proposition or business case.

Leadership should consider the following for these individuals:

— carefully evaluate the potential of these individuals and their proposals;

— assess the fit of their proposals within the organization's strategic objectives;

— assess the competences these individuals have to progress their ideas;

— if there is a good strategic and competence fit, allow them to pursue the further enhancement of their opportunity or idea into an innovation concept.

If the strategic fit of the opportunity or idea is parallel to, or outside the organization's strategy/business model, potentially allow them to spin the innovation concept out as a separate entity, while carefully evaluating the amount of control to retain over the spin off and intellectual assets involved.

5.4.3 Idea ownership and intellectual property (IP) management

Ownership of ideas is complex and varies across different jurisdictions around the world. Consultation with both IP and legal specialists is recommended to clarify the position related to the prevailing jurisdiction in order to establish the organization's idea ownership and exploitation policy.

ISO 56005 provides guidance for developing an IP strategy for the opportunity identification, idea generation, and concept creation and validation activities.

5.4.4 Responsible innovation, inclusiveness and sustainability

Organizations should consider other enablers to creating a better world, such as alignment with the UN Sustainable Development Goals (SDGs)[2)]. The SDGs can be areas of opportunity for organizations to come up with solutions that address global and local challenges.

Inclusiveness and diversity are associated with a greater ability to identify opportunities, generate ideas, create innovation concepts, and overall enhanced innovation performance. Managing opportunities and ideas should be made accessible[3)] and inclusive to all people.

6 Front end innovation processes and activities

6.1 General

Within front end innovation, opportunity and idea management activities and their interrelationships form the core of this document. The four activity areas of identification, concept creation, testing and selection are covered in this clause. Innovation processes can vary and are based on sets of these interrelated activities. While the conceptualization of opportunities and ideas is iterative by nature, the learning progression typically happens in a linear, sequential manner as part of front-end innovation processes.

2) https://sdgs.un.org/goals

3) https://www.w3.org/WAI/standards-guidelines/wcag/

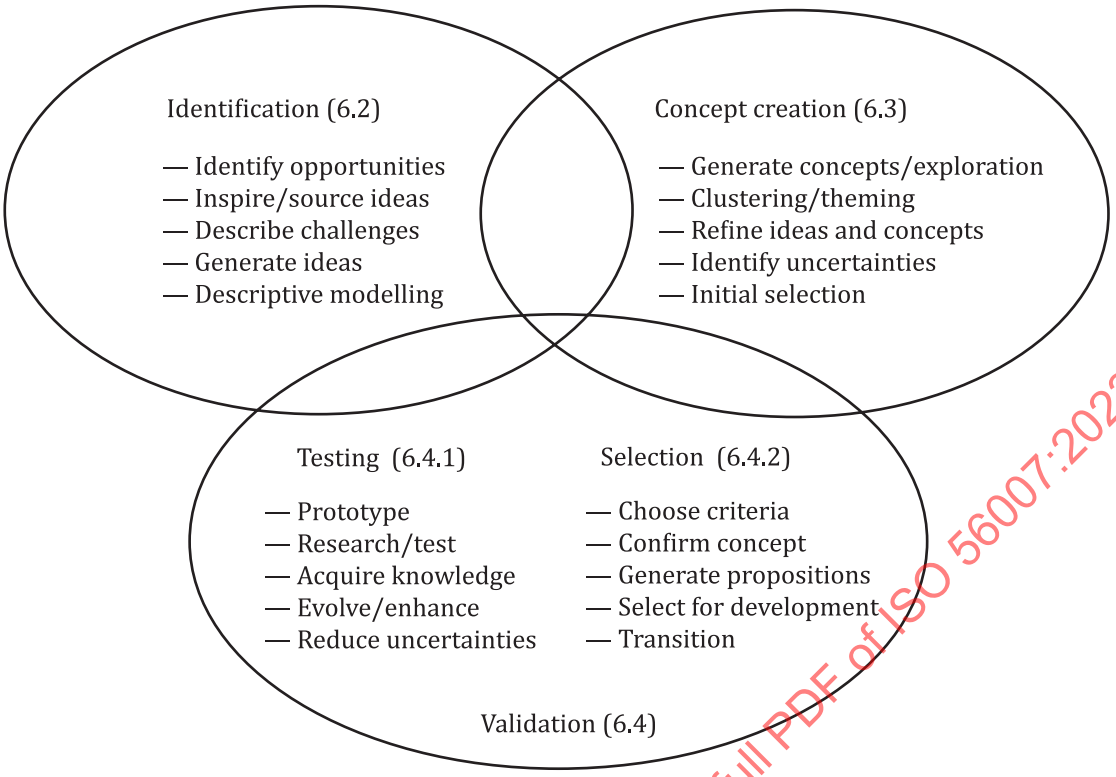


Figure 4 — Front end innovation activities

What is an idea and how does it originate? In its simplest form, an idea is a notion or thought crossing the mind. It can result from serendipity or from a direct challenge or brief. It can be generated within an area of opportunity, driven by a strategic intent.

As discussed earlier in Clause 4, there are many methods for managing opportunities and ideas. They depend on factors and circumstances, such as the nature of the innovation, the innovation processes, the scale of the opportunity or idea, the interested parties, the degree of innovation, the industry. More detailed descriptions of innovation management methods and types of innovation are provided in Annex A.

Each method supports activities organized around one or more processes. These processes can be more applicable than others for different organizations.

This Clause identifies core activities organizations should consider and determine which ones can be most relevant for a given process or approach. As shown in Figure 4, there are three categories of activities which relate to the:

a) identification of opportunities and generation of ideas;

b) concept creation, including exploration;

c) validation of innovation concepts for further development, which includes testing and selection.

6.2 Identification

6.2.1 General

Identification is about finding opportunities and ideas that can become the inputs for concept creation (see 6.3). Innovators and organizations should consider the following:

— sources, methods, and tools for inspiring and generating these opportunities and ideas;

— guidelines for determining if an opportunity or idea qualifies for exploration;

— considerations for selecting the right path based on level of uncertainty.

6.2.2 Selecting the right path

One important consideration is the level of uncertainty of an opportunity or idea. While for most ideas the level of uncertainty will be low or medium, some organizations will have ambitions to pursue strategic opportunities that take them into high levels of uncertainty as described in 5.2.4. Therefore, organizations should consider at least two paths based on uncertainty:

a) low to medium path, more typical of incremental and adjacent innovation;

b) high path more typical of radical/breakthrough innovation.

Incremental and radical innovation are at opposite ends of the innovation continuum. Radical innovation requires the reduction of high levels of uncertainty, whereas incremental innovation requires the management of risk and lower levels of uncertainty. See Annex B for additional background on screening for level of uncertainty.

6.2.3 Inspiring opportunities and ideas

Critical to being able to elaborate upon new opportunities and ideas is understanding how they are inspired and motivated. Figure 5 shows seven focus areas that can drive the creation of new opportunities and ideas. Any of these can be influenced by new scientific or other understandings. One way to get started is to pick a focus first. Annex C contains detailed descriptions of these areas and examples of opportunity elaboration and idea generation methods for each of these focus areas. Some ideas represent incremental improvements, whereas others represent giant leaps forward leading to the creation of new markets and customer behaviours, typically as part of a larger opportunity. For all these approaches, there are different parameters that can influence choice, as presented in 6.2.1.

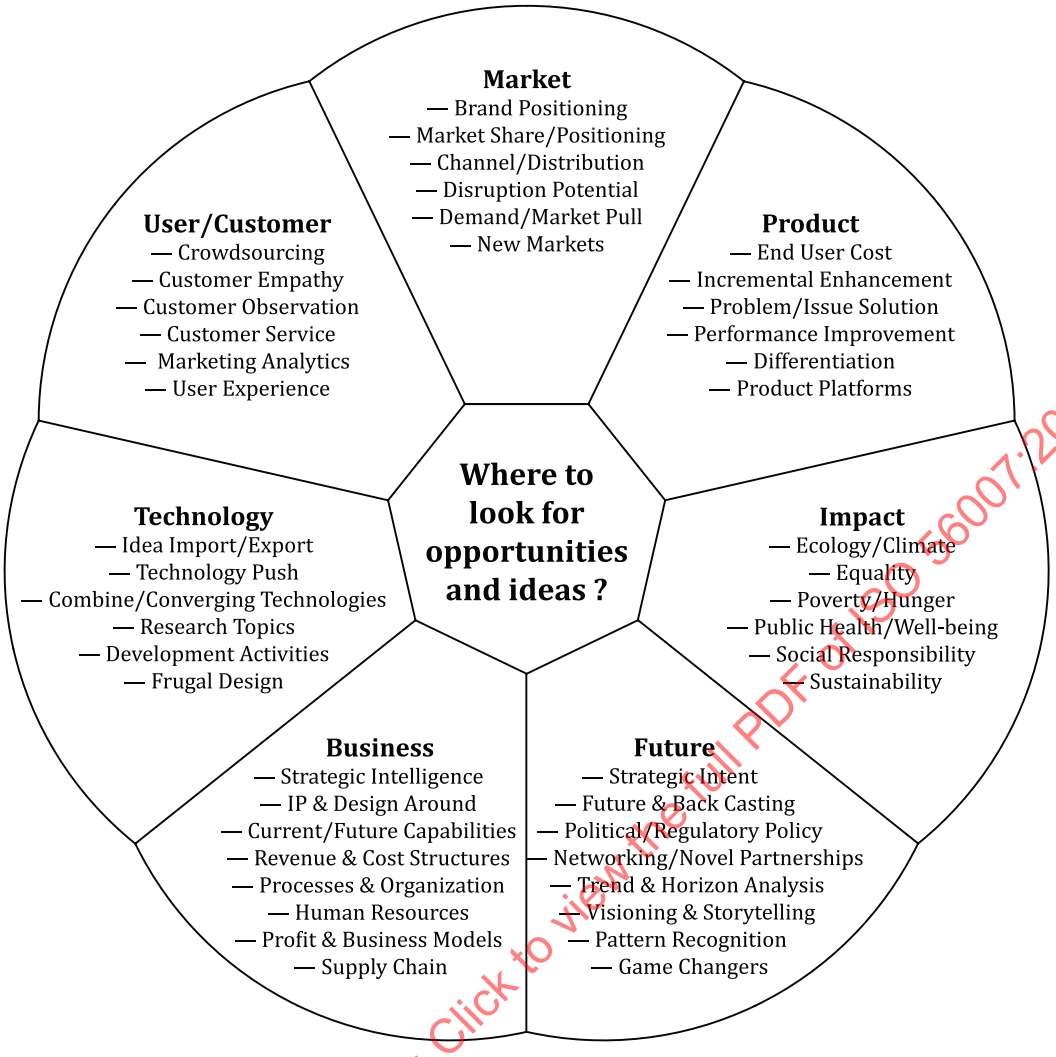


Figure 5 — Opportunity and idea inspiration focus areas

6.2.4 Sourcing ideas

Opportunities and ideas can be sourced from either within the organization or from outside it. They can arise spontaneously outside or within an organization, be bottom up, or top down as part of a managed campaign or strategic intent. To benefit from all sources, decision-makers should put in place the appropriate strategic and operational processes and structures as addressed in Clause 5.

Whether opportunities and ideas aim to address a specific problem/issue or a broader search for new directions, an appropriate plan should be made. Examples of different approaches to source opportunities and ideas are as follows:

— informal open-ended call or request for proposal: Ongoing effort to capture inputs, usually from many internal and/or external interested parties;

— opportunity identification or idea generation project: Approved, as a standalone, single piece of work carried out by one individual or a team to address a problem or an area of opportunity;

— challenge or campaign: Seek opportunities and ideas across an organization or, more openly, amongst interested parties outside the organization, which can be open (looking for possibilities) or closed (searching for answers on a topic) or even can be in answer to a specific threat.

6.2.5 Generating and capturing opportunities and ideas

Depending on the sources for inspiration within the seven focus areas in Figure 5, there are different opportunity identification and idea generation methods to select from. Examples of considerations are provided below and a more complete list is available in C.2:

— creating the right environment: This requires addressing organizational aspects such as breaking down barriers or silos, supporting creative and constructive contributions, using third party facilitators, retreating to an offsite venue;

— reward schemes: This outlines how contributors are rewarded or recognized;

— facilitating interactions: When facilitating the identification of opportunities and generation of ideas, consider aspects such as user centred focus, skills available or required, assumptions being made, expected level of detail or maturity of submissions, path from innovation concept to customer and match of opportunity or idea to capability. Providing stimulus material and break-out activities can help to maintain enthusiasm and energy levels;

— applying methods: Brainstorming and lateral thinking methods can help with the generation of ideas by tapping into different perspectives. Crowdsourcing methods can help to generate ideas from the market or academia and lead to opportunities. Hackathons can help to solve specific problems. Storyboarding, sketching and gamification can help to envision and simulate the experience. Biomimicry and strategic visioning can help to generate more strategic opportunities or areas of opportunity. Tools such as anthropology, design reduction, video recording, whiteboarding, suggestion box, observe and play, and field trips are ways to capture opportunities and ideas;

— capturing ideas: All opportunities and ideas that are generated should be captured in a database, online system, or other archive for easy access by opportunity identifiers, idea generators and others. Archived opportunities or ideas, recorded learning and their disposition can be used as a source of inspiration or analysis for future opportunities and ideas.

6.2.6 Scoping opportunities and ideas

Once the activity stage of opportunity identification and idea generation is complete, there will be potentially a high number of opportunities and ideas to consider. Organizations should scope these opportunities and ideas for concept creation, considering exploration activities such as the following:

— describing or enhancing an opportunity or idea, e.g. presentation of a collage or an idea canvas;

— collecting media and artefacts, photographing and video recording opportunities and ideas for digital capture;

— scoring, evaluating, and selecting opportunities and ideas for further progress using a scoring process or stage evaluation. This selection process is further described in 6.4.2;

— preparing opportunities and ideas for handing over to the next stage, concept creation;

— ensuring those responsible for sharing opportunities and ideas do so in a structured way, i.e. in a formal meeting, allowing for questions and explanation. Deliver all descriptive models such as artefacts, mock-ups, storyboards;

— assessing positive and negative IP implications;

— recognizing individuals and teams involved in opportunity identification and idea generation activities via prizes, rewards, announcements.

6.3 Concept creation

6.3.1 What is an innovation concept?

An innovation concept is the result of the evolution of the understanding of an opportunity, refinement of an idea, or integration of related opportunities and ideas to be developed and deployed as an innovative solution. It defines a proposal for creating, realizing or redistributing value. The proposal can provide an understanding of critical uncertainties and assumptions and/or an initial assessment of risks, degree of novelty and its implications for further development in terms of processes, structures, etc. Decision-makers should validate the attractiveness of the innovation concept for potential development.

For the evolution and refinement of an opportunity or idea into an innovation concept, the organization should establish hypotheses for the following:

— What is the problem or set of problems to be addressed?

— Who are the interested parties and their needs or wants in relation to the problem(s)?

— What is the solution or set of solutions?

— What value is to be created by the application of the solution and for whom?

Hypotheses can be in the form of an assumption that can be tested, questions that can be answered or in the form of an identified unknown that needs to be explored.

The objective of concept creation is to transform an opportunity, idea or collection of ideas into a viable innovation concept through an evolving and iterative process of enhancement, refinement, and review.

6.3.2 Clustering/theming

The purpose of clustering or theming is to map and categorize the result of one or many ideas into an opportunity or innovation concept. The more ideas that feed into the process, the greater the likelihood of a more compelling value proposition. Many innovations are rarely traceable back to one single idea, but rather to a collection of ideas. There can be ideas that:

— are similar;

— approach a specific need or desire from different directions;

— explore different potential features/benefits/attributes that deliver on the same need or desire;

— improve the outcome or impact.

The organization should determine those responsible for clustering prior to identifying opportunities and generating ideas. One method is to visually capture the ideas on sticky notes on a wall and manually move similar ideas together into ‘clusters’. This can also be done electronically via collaboration boards or through discussion.

Refining or clustering ideas is an iterative process and can result in a five- to ten-fold reduction of ideas into clusters that should be classified for selection, rework, or archiving. Idea clusters may need fresh creative input or be elaborated on, to provide higher value or to be more easily understood. To optimize the quantity to quality value ratio, the set of ideas under consideration should be compared, combined, refined or put on hold. The purpose should be to relate the ideas to the problem or their potential to maximize value realization.

One of the benefits of clustering is to remove bias such that the ownership becomes neutral. However, it can be useful to be able to trace/track back any single idea to its originator to enable reward management systems and feedback.

Criteria for how ideas are brought together into clusters and the themes of the clusters should be categorized/organized according to different parameters, for example:

— dimensions, common themes, patterns, business functions;

— innovation potential from incremental to breakthrough;

— levels of uncertainty, time to develop;

— technical feasibility, novelty, potential value, strategic relevance;

— knowledge as in previously captured ideas, market surveys.

Clusters should be consistent and understandable, to facilitate further work for transformation into innovation concepts.

6.3.3 Concept generation

Concept generation involves envisioning the ideal solution and generating a hypothesis (what it could be) that captures the qualities of the potential solution. It should result in a description of the innovation concept, which is understandable by others. It should easily express what is novel and/or unique in the value proposition.

Part of an innovation concept is a high-level outline of the business or innovation concept case that identifies the potential value. It should give enough information so that it is understood, what need it is addressing and how value can be realized. It should identify interested parties, the potential value of the innovation concept for them and any insight into the parties themselves, their process, and motivations in which the innovation concept has been built upon.

Organizations should develop an initial innovation concept description that includes the following, as appropriate:

— the root causes of the problems and pain/need/desire(s) that the innovation concept is targeting;

— the potential target group(s) for the innovation concept, who may be presented as personas;

— the context in which the innovation concept can occur, such as the environment and/or situation;

— scenarios for how the innovation concept can be applied by the target group(s) in the specific context;

— functionality descriptions of the specific innovative attributes/features of the innovation concept;

— how the innovation concept fulfils specific requirements set by the target group(s), the context, the scenarios, or the functionalities of the innovation concept, such as usability or security requirements;

— how value can be created and captured.

The innovation concept should identify, document, and catalogue the uncertainties (assumptions/questions/unknowns/potential problems that need to be resolved) as the innovation concept is refined through testing and selection. Uncertainties can be identified across five categories of uncertainty or independent of categories. See Annex B for descriptions and tools for how to screen for and identify uncertainties and catalogue critical unknowns/uncertainties.

In addition, when developing an innovation concept description, it should include:

— estimating the potential cost/time for reducing the remaining identified uncertainties. Provided that as many uncertainties as possible have been identified, this estimate should provide a scale of the effort necessary to go through the testing activities;

— deciding an appropriate level of IP protection, e.g. keep secret, non-disclosure agreement, patent, based on to whom and when the innovation concept is to be exposed (see ISO 56005).

6.3.4 Cataloguing innovation concept uncertainties

Before any selection outcome can be determined, an innovation concept, or components of that concept, can require that critical uncertainties be reduced through validation. An inventory of as many identifiable uncertainties as early as possible will allow for a more realistic assessment of the effort required for validation. The sequence for reducing critical uncertainties can have a significant impact on the use of resources. Therefore, choosing the most efficient sequence can only be achieved if cataloguing of as many uncertainties as possible has been done during the concept exploration phase. The more complete the catalogue of uncertainties, the more efficient the process for reducing them will be. A learning plan can be used to systematically reduce uncertainty across categories and/or an inventory of critical uncertainties can be catalogued with a resourcing plan. See 6.4 for uncertainty reduction through validation.

6.3.5 Selecting innovation concepts

Decisions as to whether to proceed further with an opportunity or idea, and later an innovation concept, are made throughout their refinement process. Selection is made at minor and major points during the exploration and testing phases. Some decisions can be made by the individual/team, while others require the involvement of top management/leadership. Originators should receive feedback following the selection decision according to the organization's selection criteria. See 6.4.2 for how to define selection criteria.

6.4 Validation of innovation concepts

6.4.1 General

Validation of innovation concepts is the result of using tools and methods to test assumptions, answer questions and reduce uncertainty raised by an opportunity, idea, or an emerging innovation concept. It should provide sufficient evidence, to the satisfaction of relevant parties that confirms an initial hypothesis against established selection criteria. The purpose of selection is to determine whether innovation concepts are suitable for development, rework or archiving.

Validation is an iterative process that comprises testing and selection. As validation is one of the most crucial and resource-consuming steps of front-end innovation activities, its objective is to 'succeed or fail fast', in order to minimize time and resources used.

The results of validation are used both iteratively throughout the iterative process as well as at key go/no go decision points. The outcomes of validation should include:

— resources used for validation to date;

— the reduction of uncertainty achieved;

— determining the remaining level of uncertainty and its potential impact on the feasibility of the innovation concept;

— further validation recommendations;

— likely future commitment of resources.

6.4.2 Testing

6.4.2.1 What is testing?

Testing is about obtaining missing information to provide an opportunity for organizations to learn and integrate these outcomes into their understanding of an innovation concept.

Testing includes different forms of activity. The types of testing tools or methods to use to inform the selection process depend on the:

— maturity of the innovation concept;

— type of uncertainty or assumption identified.

As the level of tolerance for uncertainty varies for both individuals and organizations, it should be determined to what extent each uncertainty should be reduced.

6.4.2.2 Why do it?

New opportunities and ideas often rely on assumptions and learning, where information, knowledge or understanding is missing. Some uncertainties challenge the feasibility and success of an innovation concept. Reducing them through testing is critical to verify if selection criteria are met in a satisfactory manner.

The results of testing are used to modify or adapt an innovation concept and ultimately to refine it until it is ready for selection.

6.4.2.3 When to do it?

Testing takes place when it is appropriate to reduce uncertainties, validate assumptions or obtain missing information, knowledge or understanding.

Testing methods should be chosen to suit the nature of each uncertainty as well as the stage of innovation concept evolution or refinement.

Organizations should set key decision points, as appropriate, during the opportunity and idea management process, where decision-makers evaluate the results of testing when:

— sifting through and grouping underdeveloped ideas;

— defining ideas and scoping opportunities;

— evaluating innovation concepts;

— formally selecting propositions for transition to development.

6.4.2.4 Who does it?

Testing procedures can be carried out by people within or even from outside the organization, such as:

— opportunity or idea originators, who may initially 'test' it before exposing it to third parties;

— individuals or teams for refining the opportunity, idea, and/or innovation concept;

— opportunity and idea promoters within and outside the organization;

— people not directly championing the opportunity or idea to bring objectivity.

6.4.2.5 What is the process?

Methods for generating early-stage innovation concepts and for validating them in the later stages increase in effort and cost for each iteration. The principle is to learn as quickly and inexpensively as possible. Early innovation concepts may be tested with simple mock-ups or prototypes and by conducting initial tests with end users.

Which testing process to use is driven by the:

— categories of uncertainty;

— level of maturity of an innovation concept;

— levels of uncertainty (see 4.3 and 5.2.4);

— cost of testing;

— time required;

— selection criteria (see 6.4.3.5.3).

There is a wide range of testing methods to build understanding regarding an idea's viability, or a particular aspect of its viability, such as:

— novelty and functionality;

— technical feasibility and usability;

— marketability and manufacturability/implementation.

Examples of testing options include:

— reviewing literature;

— interviewing experts and interested parties;

— conducting market studies;

— undertaking R&D or experiments;

— creating proof of concepts (PoC) or simulations;

— building mock-ups or prototypes;

— using story boards for simulating the experience and mood boards for capturing feelings;

— reading documents, such as the strategy plan to verify alignment with strategic objectives;

— assessing IP protection potential and freedom to operate.

It is important to choose an appropriate option to deliver the missing information, understanding, or knowledge for the uncertainty being addressed. One or more may be applied to either refine an innovation concept further or to support decision making for selection.

Testing of uncertainties can lead to identifying additional uncertainties. New uncertainties can require modification or further testing of the innovation concept.

6.4.3 Selection

6.4.3.1 What is selection?

Selection is about categorizing opportunities/ideas /innovation concepts for one of the following:

— continued development, synthesis with other opportunities and ideas;

— iteration and rework;

— parking or archiving for later development or reference.

There are two aspects to selection:

— defining the questions and selection criteria;

— deciding if an opportunity/idea/innovation concept sufficiently answers the questions and meets the criteria.

6.4.3.2 Why do it?

Selection is necessary so that resources can be allocated efficiently to only support opportunities, ideas, and innovation concepts with the highest chances of providing value.

6.4.3.3 When to do it?

The most critical selection is the go/no go decision that should be formalized in a proposition document to support an innovation concept moving into development and becoming a project. Sometimes a no go for an opportunity, idea or innovation concept can lead to a research project for further learning.

Selection also occurs at key points during the earlier phases of the process. The timing and frequency of earlier decisions varies depending on the opportunity or idea generation and refinement method being used (see Annex A).

6.4.3.4 Who does it?

Those involved in creating innovation concepts and identifying potential solutions make micro-selections throughout the process.

Who the decision-makers are for selecting innovation concepts for development depends on the organization's context, size, culture, and structure. They can be investors, owners, senior leaders, innovation committees, heads of R&D or innovation experts.

Decision-makers should make selections:

— at interim stages using agreed criteria to evaluate whether an opportunity or idea meets the minimum requirement to progress to the next stage;

— to move incremental innovation ideas forward more quickly, where uncertainty is low.

At critical selection points, these decision-makers make a judgement whether to proceed, iterate or archive opportunities and ideas using the selection criteria relevant for that stage.

6.4.3.5 How does this work?

6.4.3.5.1 General

There are two different phases of this iterative activity:

a) Selection during identification, concept creation and testing

Since each opportunity or idea consumes resources (e.g. time, skills, money), the decision to continue exploring it requires evaluation of its potential to reach development. Appropriate decision criteria should be chosen for these earlier stages. These can be a combination of quantitative and qualitative criteria, which include indicators (see Clause 7) and informed opinion.

b) Go/no-go selection to proceed to development

This decision usually implies allocation of significant resources, often with strategic implications. This decision point is critical, providing the gateway for innovation concepts into development. Criteria to enable this decision are presented in Table 1 below. An example of a decision tree to support such a decision can be found in Annex C.

Depending on the nature or maturity of an opportunity or idea, decision-makers will likely have to make selections without the desired level of knowledge. The selection process is, therefore, strongly influenced by the decision-makers' level of tolerance to uncertainty.

6.4.3.5.2 How to determine selection criteria?

The criteria used to determine whether an innovation concept is ready for transitioning to development are the most critical. They should not be bypassed. They should be predetermined and, as such, can influence those selection criteria used in early exploration. This knowledge will influence the evaluation and selection during earlier phases. For that reason, they are considered here first.

6.4.3.5.3 How many criteria should there be?

Opportunity/idea/innovation concept selection is not a simple process and itself should be iterated over time and from experience to improve it.

The choice of criteria is dependent on various considerations, such as:

— complexity of the opportunity/idea/innovation concept;

— resources allocated to exploring it;

— urgency for results;

— profit potential;

— social impact potential.

Fewer criteria can mean a shorter and less resource consuming process (proceed or fail fast) but with the consequence of ignoring certain criteria that can impact the feasibility of the innovation concept. A higher number can provide more accurate and broader evaluation data, thereby reducing uncertainty, but take longer and consume more resources.

6.4.3.5.4 Selection for development

Decision-makers should select innovation concepts (go/no go) based on meeting a number of core criteria. The relative importance of the criteria is influenced by considerations, such as operational context, organization size, capabilities, strategic priority, or ecosystem. They need to be adapted to the specific requirements of the organization.

Core selection criteria should be agreed upon and set by the decision-makers. For transparency purposes, and to ensure that these criteria are properly addressed by everyone involved in innovation activities, they should be shared throughout the organization.

Decision-makers should be informed of all the corresponding risks, implications and residual uncertainties associated with each selection criteria for their understanding to be as complete as possible of the innovation concept. This will allow them to make a more accurate judgement of the appropriateness and level of residual uncertainty of each criterion.

Judgement should nevertheless be exercised to ignore the criteria that may not be relevant for some specific circumstances or types of organization. Decision-makers should assess their relevance for their own context. The following selection criteria should be considered. Subclause C.3 contains a more detailed explanation of each of these criteria.

Table 1 — Key decision areas and criteria for innovation concept selection

Key decision areas	Innovation concept criteria
Market (or mission) alignment (see C.3.1)	a) Customer/user fit
	b) Ecosystem fit
	c) Market/mission fit

Table 1 *(continued)*

Key decision areas	Innovation concept criteria
Organization alignment (see C.3.2)	a) Strategic fit
	b) Scope fit
	c) Desired business/mission model fit
	d) Definition of success/Return on investment (ROI)
	e) Innovation pipeline and portfolio objectives
	f) Timeline expectations
	g) Risk exposure
	h) IP considerations
Resource alignment (see C.3.3)	a) Resource investment requirements
	b) Appropriate team
	c) Innovation capability building requirements
Interested party alignment (see C.3.4)	a) Interested parties' acceptance
	b) Sustainability and durability
	c) Collateral effects
Implementation (or technical) feasibility (see C.3.5)	a) Acceptability of other factors that hinder or boost implementation
	b) Effort to reduce remaining uncertainties
	c) Feasibility of the action plan for development
	d) Overall coherence with innovation ambitions

6.4.3.5.5 Early-stage selection

The criteria applied to determine innovation concept viability should become more exacting as an opportunity or idea evolves and as the amount of time, money and human effort to realize it increases. The sooner an opportunity or idea can be categorized, as one with potential versus one that should be parked or archived, the better. However, in the early stages, opportunities and ideas should be judged positively, such as how ambitious or unconventional they are versus hard go no/go criteria.

During an opportunity's or idea's early stage, refinement criteria should be regarded as questions to be answered rather than a filter. At the selection points, a judgement call needs to be made about whether each question has been answered sufficiently. The decision-makers can decide to proceed even if further information, understanding, or knowledge is needed.

Selection criteria can be:

— predetermined from the Go/no-go criteria above;

— developed in response to issues raised by the opportunity or idea as it evolves.

The type of selection criteria and when to apply them is guided by the:

— type of innovation being sought, incremental, adjacent or breakthrough;

— innovation method being used, such as phase-gate, spiral, agile innovation;

— opportunity or idea source, general call for ideas, challenge, sandbox, brainstorming, serendipitous discovery, bottom up, top down, etc.

The priority and degree to which an opportunity or idea meets a criterion can be weighed by factors, such as obtaining a patent being more important than strategic fit or a process only needing to be 85 % efficient to be effective.

6.4.3.6 Proposition document

To allow decision-makers to make a judgement using appropriate criteria, as described in 6.4.3.5.3, each innovation concept should be described in a suitable proposition document. This document should typically satisfy each criterion at an appropriate level for the corresponding selection stage and type of organization.

Different formats for this document can be considered, such as a:

— business proposal or plan, that includes both the justification of the project and how it is going to be handled;

— business or innovation concept case that provides the justification only with the action plan in a separate document.

Examples of proposition documents are in Annex C.

6.4.3.7 In the case of transition after selection

In some cases, it is necessary to formalize a transition to development once an innovation concept has been selected for further work possibly by an owner other than the one currently working with the innovation concept. However, transitions add complexity, which can result in loss of knowledge or less favourable results.

The new owner or receiving party should receive the proposition. The transition plan that complements it or is included in the proposition should be as detailed as possible.

When preparing for transitioning an innovation concept, an individual or organization should also consider:

— why/for what purpose it is being transitioned;

— identifying who the receiving party is (e.g. internal or external) as well as the type of organization (e.g. large organization, SME, start up, NGO, individual);

— to what extent the receiving party has the necessary skills, motivation, time, influence, and network to handle the development phase. An NDA is likely required if the receiving party is external;

— what knowledge needs to be retained by the sending party;

— what knowledge, documents, prototypes, specifications, information should be provided to the receiving party;

— ensuring a thorough knowledge transfer between the parties by clarifying the nature and extent of the transition activity, including who is responsible and for what, how much transition support or retaining ownership is required;

— remaining innovation concept uncertainty level and development path with corresponding resources needed;

— agreement outlining the rules governing the current and future interactions and responsibilities between the sending and receiving parties, such as a collaboration agreement. See ISO 56003 for further guidance.

7 Evaluation

7.1 General

The organization should review and evaluate its front-end innovation efforts to ensure their ongoing suitability, adequacy, and success in contributing to the following outcomes and impacts:

— identify, clarify and quantify learning and progress towards value realization;

— recognize what worked and what did not; what to keep, change, add, remove;

— apply that learning to future front-end innovation initiatives, enabling refinement and development to continually create value for the organization;

— align future front-end innovation efforts with the organization's strategy, ambitions and capabilities;

— develop the contribution from front end innovation initiatives towards key value creation objectives, such as ROI, growth, sustainability, finances, learning, capabilities, social benefits, and the culture and perception of the organization.

Front end innovation evaluation extends to validated innovation concepts only as part of potential value creation. When evaluating a comprehensive innovation management system, contributions to value realization can also be considered.

7.2 Inputs

Review and evaluation of front-end innovation initiatives should include consideration of:

— the organization's strategic intelligence;

— relevant elements from the organization's strategy and portfolio;

— external considerations such as best practices and other knowledge sources, performance and other benchmarks;

— experience and perspectives from interested parties;

— experiences and outputs from previous front end innovation efforts, from both successes and failures;

— experience and learnings from those involved in and impacted by front end innovation efforts;

— the organization's performance versus established performance indicators;

— achievements versus the organization's front-end innovation objectives.

7.3 Activities

The organization should consider the following to enable a useful and successful front-end innovation evaluation:

— planning: Involves criteria setting from the innovation intent, the defined scope and previous experience. Organizations should consider which activities link better or demonstrate relevant impact to the intent and scope. Organizations should also be guided by what is most relevant for a specific use case or organization rather than fully adopting a universal set. The "essential few" is a useful rule; pick a small number of activities of most relevance. This can simplify evaluation of actual progress versus the intended plan.

— input: Pressures for efficiency in the deployment of resources for front end innovation initiatives are common. Organizations should consider measurement of inputs. Inadequate inputs or failure to

deploy planned inputs can lead to problems with future performance and the sustainability of front-end innovation initiatives.

— assessment: Involves the documented analysis of users and their experience, outcomes, entities, and process(es). Organizations should monitor progress of activities against criteria to learn and evolve to other measures, as appropriate. They should be aware that if the monitoring and reporting requirements are too onerous, they can inhibit the front-end innovation process itself.

— review: Involves ensuring that front end innovation initiatives are meeting objectives with respect to learning and the ability to deliver on intended outcomes. Organizations should consider performance in terms of the process of how inputs contribute to outputs. This will determine the suitability, adequacy, efficiency, or effectiveness of the tools and methods that have been used to achieve objectives for users and interested parties.

7.4 Outputs

The organization should document and share the results of front-end innovation evaluation, identify opportunities for improvement and prioritize needs for change and development, e.g. in terms of tools, methods, capabilities, and strategic intent.

Evaluation serves to capture and advance the performance and capability to manage opportunities and ideas on a sustained, successful basis.

In closing, front end innovation is an iterative, cyclical effort for the organization. Different methods and tools guide progression through front end innovation activities. Addressing people and organization considerations helps to create the right environment for success. More practical guidance, such as for tools and methods is presented in Annexes A through C.

The organization should retain documented information as evidence of evaluations and reviews.

Annex A
(informative)

Preparing for managing opportunities and ideas

A.1 General

This annex provides examples, illustrations and background on a range of established methods for consideration when preparing to manage opportunities and ideas. These methods can be used alone or in combination to support progression towards validated innovation concepts.

A.2 Progression of opportunities and ideas

Progression is illustrated in Clause 4, with the focus on selection outcomes. Progression can also be viewed in terms of the interim steps as in Figure A.1:

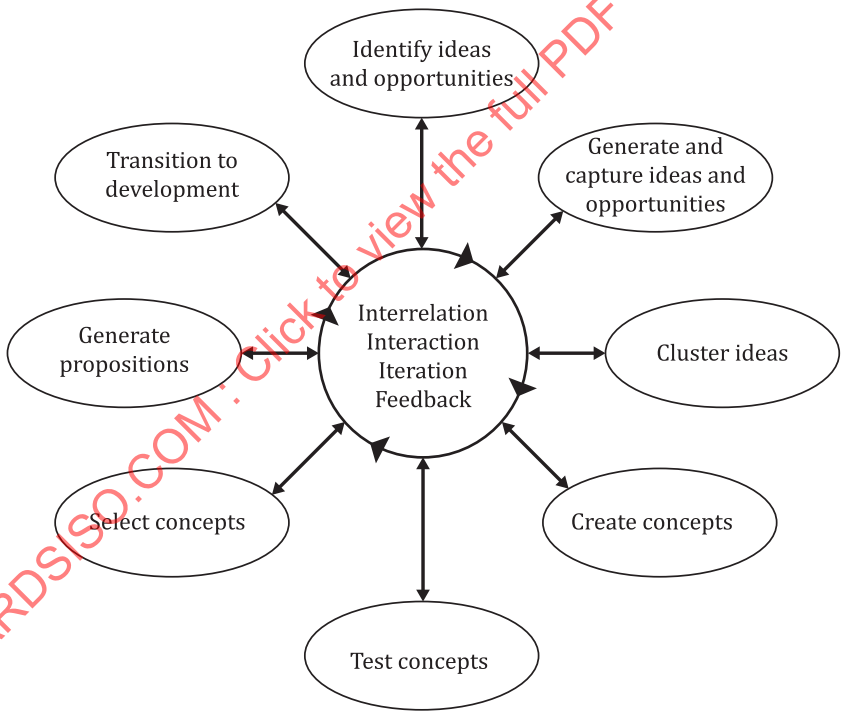


Figure A.1 — Opportunity and idea progression

A.3 Types of innovation

Below is a non-exhaustive list of types of innovation in alphabetical order.

— brand innovation;

— breakthrough innovation;

— business model innovation;

— channel/distribution innovation;

— customer service innovation;
— disruptive innovation;
— derivative innovation;
— extreme innovation;
— feature innovation;
— frugal innovation (cost-driven innovation);
— incremental/adjacent innovation;
— network innovation;
— performance innovation;
— process innovation;
— product innovation;
— profit model innovation;
— platform innovation;
— radical innovation;
— revenue/cost innovation;
— service innovation;
— sibling innovation (product system innovation);
— software innovation;
— supply chain innovation;
— sustainability/eco innovation;
— technology/manufacturer push;
— transformational innovation;
— user experience innovation (UX).

A.4 Methods suitability and benefits for different organizations

Table A.1 provides a brief description, potential benefits, and examples and guidance on those methods that can be more suited to one organization or user type versus another. See the Table A.1 key below for a description of types likely to use them.

Table A.1 — Description, potential benefits and examples of innovation management methods

Description and suitability by type	Benefits and examples
Linear Activities are partitioned into distinct phases with transitions from one phase to another governed by phased decision points. Type: a, b, d, e, g	Controlled and easily measured nature can reduce and mitigate risk related to ideas and innovation concepts. EXAMPLES: Waterfall, phase-gate.
Non-linear Opportunities and ideas evolve over time through repeated prototype/learning cycles. Type: a, b, c, d, e, g	Each iteration reduces uncertainty and obtains important feedback from users and other interested parties to incorporate into the subsequent prototype release. EXAMPLES: Spiral/iterative, agile innovation, Lean Start-up, IpOp.
Open/Closed Opportunities, ideas and knowledge are retained internally (closed) or ideas and knowledge are accepted from external entities (open). Type: a, c, d, e, f, g	Closed approach implies generating and refining ideas mainly on internal capability. It can be easier to protect these ideas. Open approach involves various interested parties and expands opportunities and ideas but securing the IP rights can be challenging. EXAMPLES: Open/User Innovation.
Funnel Large number of ideas are obtained at the outset, then systematically narrowed down resulting in only the best being implemented. Type: a, d, e, g	The narrowing down process can be linear or iterative in nature and can be open or closed in approach.
Online/Collaborative Enlisting the services of many people, often unpaid volunteers, employing the Internet as the communications medium. Typically, a goal is announced as a challenge to which innovators can respond. Type: a, c, d, e, f, g	Captures opportunities, ideas and knowledge from the most diverse set of problem solvers. Can also cost a fraction of the amount of internally developed solutions. EXAMPLES: Crowdsourcing, Idea challenge.
Scale and scope Methods with low degree of change, incremental or sustaining innovations, involve studying the current system in detail and analysing where improvements are needed. Methods with high degree of change, radical and breakthrough innovations, envision a future based on possibilities then back-cast from the future to the present to determine learning iterations to attain an envisioned future. Type: a, b, c, d, e, f, g	Low degree of change methods are nearer-term, systematic- and repeatable-consistent with development. EXAMPLE: ITRIZ. High degree of change methods reduce uncertainty over the longer-term. EXAMPLES: Discovery-Incubation-Acceleration (DIA), Directed evolution.
Key: Type a Established, large organizations (for profit and social value). Type b Small and Medium Enterprises (SMEs). Type c Start-ups/venture capitalists. Type d Non-profit organizations. Type e Non-governmental organizations (NGOs). Type f Individuals inside or outside of an organization. Type g Universities and research institutions.	

Table A.1 *(continued)*

Description and suitability by type	Benefits and examples
Bottom-Up/Top-Down Bottom-Up methods depend on ideas coming from all employees. Top-Down methods depend on opportunities and ideas coming from senior sponsors in the organization. Type: a, b, c, d, e	Bottom-Up Bottom-Up methods collect many ideas from employees at the grassroots that can be or not be strategically linked. EXAMPLES: Employee challenges, microMBA training, hackathons. Top-Down Top-Down methods are most often driven by an innovation objective or strategy. EXAMPLES: Strategic challenges, Strategic intent.
Organizational setup Internal or corporate venture method involves installation of innovation management and governance, alongside and in parallel with existing management structures. Embedded innovation management methods involve installing innovative thinking as a core competency throughout the organization. Type: a, c, d, e	Venturing methods, such as incubators and accelerators, allow the existing management structure to remain unchanged. Embedded methods change the existing management mindset and business processes.
Gamification Application of game-design elements to motivate and create excitement for problem-solving by users and other stakeholders. Type: a, c, d, e, f, g	Gaming elements can increase the involvement of others resulting in higher productivity and enhanced outcomes.
Key: Type a Established, large organizations (for profit and social value). Type b Small and Medium Enterprises (SMEs). Type c Start-ups/venture capitalists. Type d Non-profit organizations. Type e Non-governmental organizations (NGOs). Type f Individuals inside or outside of an organization. Type g Universities and research institutions.	

A.5 Innovation management methods and tools

Where opportunities and ideas come from and how they are refined depend on motivation, methods and tools. The following is a selection of the large number of methods and tools that have been developed:

- Agile Innovation Model [17]
- Alternatives Principles [12]
- Anticipatory Failure Determination [8, p.128]
- Back-of-the-Napkin Model [8, p.148]
- Balanced Scorecard [8, p.150]
- Benchmarking [15, p.141, 150-157] [8, p.158]
- Bottom-Up Model [15, p.683-684]
- Gamification [8, p.472]
- Grand Challenge Model [8, p.529]
- Group of Innovation Champions [15, p.30]
- Ideality-First [8, p.502]
- Innovation Funnel [8, p.161, 329, 943, 1128]
- IP Protection [14] [20]
- IpOp Model [20]

- Brainstorming [8, p.197]
- Closed Innovation [15, p.443]
- Clustering [8, p.243]
- Collaborative Sketching [8, p.247]
- Collaborative Teams [15, p. 0-31]
- Collaborative Innovation Networks (COIN) [13]
- Concept Development [8, p.257-264]
- Connect & Develop Model [16]
- Continuous Improvement Process [8, p.608]
- Creative Problem Solving [8, p.283]
- Cross-Functional Teams [15, p.364]
- Cross-Industry Innovation [8, p.289]
- Crowdsourcing [15, p.427] [8, p.293]
- Design Around [19]
- Design Thinking [15, p.219] [8, p.339]
- DIA Model [18]
- Directed Evolution [21]
- Directed Funding Model [8, p.529]
- Double Diamond [10]
- Elimination Principles [12]
- Forced Analogy [8, p.117, 1124]
- Functional Needs Analysis [15, p.385]
- Function Thinking [8, p. 458]
- Function Analysis [15, p.385]
- Futurecasting [8, p.637, 1026-1033]
- Jobs To Be Done Theory [9]
- Lateral thinking [15, p.211] [8, p.641]
- Lead User Method [15, p.312-317] [8, p.647]
- Lean Start-up [15, p.26, 60] [8, p.649]
- Nominal Group Technique [15, p.185-186]
- Open Innovation Ideas [15, p.443] [8, p.741]
- Opportunity/Risk Analysis [8, p.228]
- Osborne Checklist [8, p.750]
- Patent Fencing [14]
- Pivoting [8, p.775]
- Pre-mortem [8, p.793]
- Prototyping [15, p.523] [8, p.823]
- Scenario Planning [8, p.987]
- Separation Principles [8, p.900] [12]
- Six Sigma (DMAIC/DMADV) [15, p.162, 271-277]
- Social Network Innovation Models [8, p.664]
- Spiral Model [7] [11]
- Stage-Gate Model [8, p.943]
- SWOT Analysis [8, p.876]
- Systematic Innovative Thinking [8, p.985] [5]
- Ten Types [8, p. 1004]
- Thinking Hats Method [8, p.78]
- Top-Down Model [15, p.683-684]
- TRIZ Model [15, p.195-196, 379-402] [8, p.993]
- Value Analysis [8, p.460]

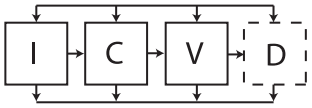
NOTE Numbers in brackets indicate references to the Bibliography.

A.6 Innovation management method description examples

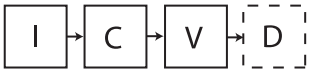
A.6.1 Linear methods

Some organizations prefer a linear process where the activities are partitioned into distinct phases with transitions from one phase to another governed by phase-gate decision points. Care should be given to identifying and preparing the people responsible for making the decisions and the criteria used for making the decisions at each phase. The controlled and easily measured nature of these methods

can reduce and mitigate risk related to ideas and innovation concepts. In these methods, ideas tend to come first and are vetted by meeting criteria set at each phase-gate with only the most promising surviving through to further development. Funnel-type methods are well suited for capturing many candidate ideas early (e.g. from a bottom-up process whereby anyone can make a suggestion) and are also well suited for collaboration with external interested parties throughout the process. Examples of these kinds of methods include Phase-Gate, Innovation Funnel, Open Innovation, and the Waterfall method (see Figure A.2).



a) Interactive/chain linked



b) Linear/waterfall

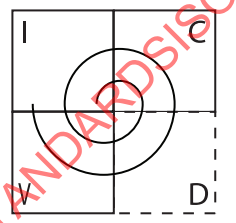
Key

I identification
C concept creation
V validation
D development (out of scope for this guidance)

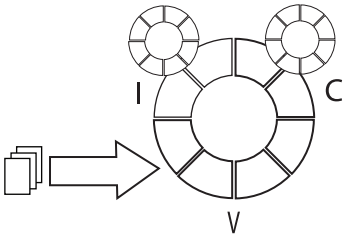
Figure A.2 — Examples of linear methods

A.6.2 Non-linear methods

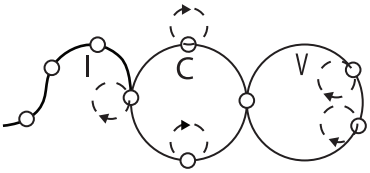
Many have found it difficult to manage and control creative activities such as opportunity and idea generation and innovation concept formation in a pre-set sequence, so they have adopted non-sequential methods. These methods recognize that a completed effort is not possible by one pass through a series of steps and therefore facilitate multiple iterations. In these methods, opportunities and ideas evolve over time through the efforts of many people by releasing prototypes and minimum viable products to gather feedback from users and interested parties. Refining opportunities and ideas in this way often increases the likelihood of a successful innovation. The iterative nature of these methods helps reduce uncertainty with each iteration. Examples of these kinds of methods include the Spiral Model, Agile Innovation, Lean Start-up, IpOp model, Extreme Innovation, and rapid prototyping methods (see Figure A.3).



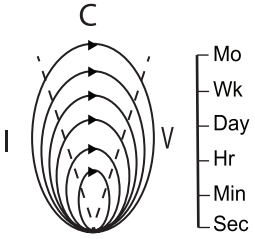
a) Iterative/spiral



b) Agile innovation



c) Lean start-up



d) Lean/lightweight/extreme innovation

Figure A.3 — Examples of non-linear methods

A.6.3 Funnel methods

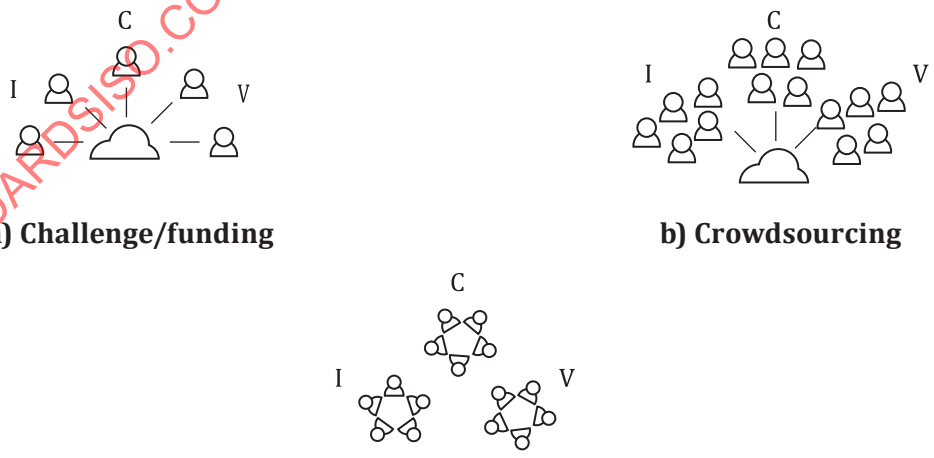
Funnel methods seek to collect a large number of ideas which are then narrowed down via a series of screening and selection steps. It is important to generate as many ideas as possible, then select only the best ideas for full development. For some, this is an internal method allowing no interaction with outside entities (Closed Innovation). For others, knowledge and information from outside entities are welcome and used to refine and select ideas (Open Innovation) (see Figure A.4).

a) Innovation funnel **b) Open innovation**

Figure A.4 — Examples of funnel methods

A.6.4 Online collaboration methods

With increasing use of the Internet and social media platforms, some have turned to collaborative opportunity and idea management methods. These involve enlisting the services of many people, even unpaid volunteers, employing the Internet as the communications medium. Typically, a goal is announced as a challenge to which innovators can respond. Sometimes the challenge is in the form of a Request for Proposal (RFP) and other times it is just a simple statement of need. Respondents conduct innovation activities in whatever manner they desire. Ideas are created by the masses in response to the overall directive often in isolation and in competition with each other. However, some forms of crowdsourcing encourage collaboration and partnership between the respondents that can lead to opportunities. Examples of these kinds of methods include Collaborative Innovation Networks (COINs), crowdsourcing, grand challenges, and government funding agencies (see Figure A.5).



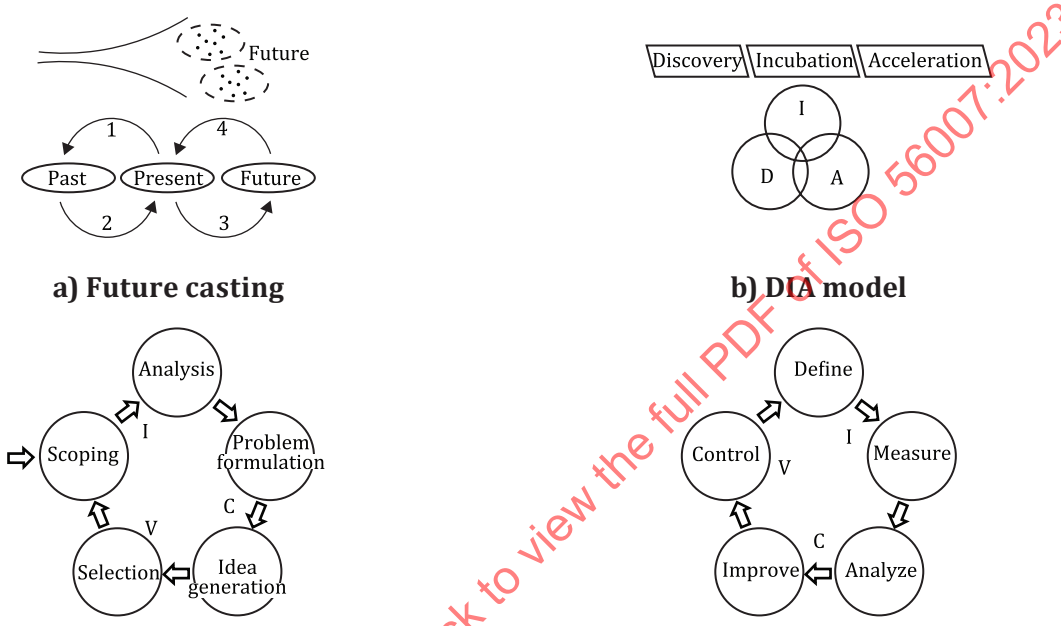
a) Challenge/funding **b) Crowdsourcing**

c) Collaborative innovation networks (COINs)

Figure A.5 — Examples of online collaboration methods

A.6.5 Scope and scale methods

Methods exist for creating different types of innovations. For example, cyclic or regularly repeated methods all strive to seek near-term, incremental or sustaining innovations. Other methods seek to envision and attain a more distant future. Ideas in the near-term methods result from detailed analysis and problem-solving phases done in either linear or iterative fashion. Opportunities in the long-term methods come from projecting the trajectory of existing trends into the future, back-casting from the future to the present, strategic envisioning, and systematic learning. Long-term methods are best suited to addressing high levels of uncertainty. Examples of these kinds of methods include incremental problem solving, future forecasting and Discovery-Incubation-Acceleration (DIA) model (see Figure A.6).



a) Future casting **b) DIA model**

c) Incremental problem-solving **d) Continual process improvement**

Figure A.6 — Examples of scope and scale methods

A.6.6 Bottom-up and top-down methods

Bottom-up methods depend on ideas coming from employees. Ideas can be either solicited or unsolicited where anyone can submit and champion an idea. These methods can be well suited for process improvement, where the front-line workers generate ideas for improving their portion of the process. Strong support is needed by senior leaders in any organization to allow the entry of any new ideas and to bring a new idea from vision to reality.

Top-down methods are management-driven, depending on a single leader, small group of leaders, or an external entity to lead and stimulate opportunity and idea management activities. A single leader can be the Chief Executive Officer/founder of a company, the Chief Technology Officer, or an Innovation Champion. A single group of leaders can be an Innovation Committee, Cross Functional Team, Project Managers, or Unit Heads. External entities can be Government funding agencies, standards setting and policy organizations, such as ISO, American National Standards Institute (ANSI), United States Center for Disease Control (CDC), World Health Organization (WHO) or other profit/non-profit organizations.

Other top-down methods involve new business creation or new business development. These are typically integrated within the organization as part of an innovation strategy and orchestrated within a management system. These are designed to achieve growth and renewal of the organization through a strategic ambition or intent. Going beyond most strategy planning horizons, these often result in radical/breakthrough, business model, growth platform or capability types of innovations. These

opportunities are characterized by higher uncertainty and can be sponsored by a business unit or a central function, depending on how much these opportunities stretch the organization.

A.6.7 Organizational set-up methods

Different organizational structures can be used to achieve different objectives. Internal or corporate venture methods involve installation of governance for front end innovation activities, alongside and in parallel with existing management structures. The existing management structure remains unchanged. Many entities use venturing approaches, such as incubators and accelerators, because they require the least time, money, and effort to implement. However, confusion, friction, and unrest can occur when interaction with the existing structure is required because the innovation initiative can become an intrusion and interruption to established business practices. As a result, new opportunities and ideas can be perceived as being a threat to the core business and potentially undermining the likelihood of success.

Embedded organizational structure methods involve installing innovative thinking as a core competency throughout the organization. These methods seek to change the existing management mindset and business processes. Entities having embedded and aligned organizational models often incorporate change more easily and are prepared to accept the upfront cost and effort to change the status quo, often involving a culture change. Here, new opportunities and ideas are expected and even anticipated rather than being a threat.

Sometimes, more creativity and effectiveness are achieved if front end innovation initiatives are done in isolation (i.e. skunkworks fashion) and kept away from existing management, structures and processes, which can limit thinking. Isolation of these initiatives can result in interesting innovations without changing the company's culture or operating model. This approach requires the allocation of specific resources as well as focused teams of dedicated people and extraordinary support from the executive team. Also, a mechanism is needed for "spinning off" entities that might not be aligned with an organization's strategic intent.

A.6.8 Gamification methods

Gamification methods are about the application of game-design elements to motivate and create excitement for problem-solving by users and other stakeholders. Gamification of innovation is becoming popular, either in software or physical on-site approaches. These methods can show clear advantages on processes (more structured and organized) and teams (more engaged and aligned). Gamification is the process of making activities more game-like in non-game contexts, to encourage users' motivation and engagement in a particular task. By providing gamified experiences, such as having fun and gaining a feeling of mastery, organizations are making desired behaviours more engaging even in routine tasks and contexts. Gamification has the power to trigger people's curiosity about innovation, keeps people intrinsically motivated to engage continuously, enhances internal collaboration, promotes fun and commitment among employees, increases motivation to learn and grow, provides insights for future areas of product/service applications, increases the willingness to take risks, educates on how to accept failure, promotes openness to new opportunities and ideas, among many other behaviours.

Annex B
(informative)

Managing uncertainty for opportunities and ideas

B.1 General

This annex provides examples of specific methods and tools to identify and reduce uncertainty based on categories and independent of them.

There are two approaches for identifying uncertainties:

— one that relies on categorized checklists from the practical experiences of innovators and a learning plan to systematically guide learning (see B.2, B.3 and B.4 below);

— one that prompts innovators to identify uncertainties independently of categories and calibrate the effort to reduce them (see B.5 and B.6 below).

These two approaches complement each other and can also be combined.

The following descriptions and tools are presented below:

For the first approach (with categorization):

— B.2 Categorizing of uncertainties by category and level;

— B.3 Tool for how to screen for level of uncertainty;

— B.4 Tools for how to identify and reduce uncertainties by category.

For the second approach (without categorization)

— B.5 Identifying uncertainties independently of categories;

— B.6 Tool for how to calibrate the effort to reduce them.

The first approach (with categorization) can be used for an early general assessment of the level of uncertainty of an opportunity or an idea. It can also be used as a checklist to identify uncertainties and verify down-the-road that the most critical uncertainties have been considered that would otherwise get in the way of success of a maturing innovation concept. It is supported by a learning plan to guide uncertainty reduction across categories.

The second approach (without categorization) can be used by innovators willing to refine their opportunity or idea with a roadmap to guide them in how to make their opportunity, idea, or innovation concept as well as the related uncertainties explicit. This requirement to be explicit leads innovators to identify at a more detailed level the uncertainties of their opportunity or idea and the effort required to reduce them.

B.2 Categorizing of uncertainties by category and level

To identify and reduce uncertainties, models like the DIA model[22], use categories and levels. Uncertainty can be categorized into five or more categories. The list below provides examples of these categories and the questions to ask:

— Organization: Where does the idea or opportunity fit? Is there a logical home? Who will champion the innovation concept? How are decisions made when operating under conditions of uncertainty? Is missing information available elsewhere?

— Technical (or Implementation): Is the innovation concept feasible? Will it be economically feasible to develop? Can the solution be scalable?

— Resource: Is there funding available for the idea or opportunity? Can it be resourced with the right people and capabilities, internally or externally? Can we find the right partners?

— Market (or Mission): Is there a need or compelling vision for the business/mission? Are there multiple potential applications and/or business models? Is there a viable innovation concept? Will it create sufficient value? Are there market, regulatory, political, environmental and/or societal considerations that will help or hinder innovation concept viability?

— Interested parties: How will the innovation concept impact diverse interested parties? Which interested parties will support the innovation concept? What types of resistance can prevent them from supporting the innovation concept? Can these types of resistance be reduced?

Uncertainties can also be categorized across three levels: low, medium, and high uncertainty. Timing varies across industries and organizational contexts.

The three levels can be aligned to likely innovation types and uncertainty reduction requirements as follows:

a) Low uncertainty; shorter term (typically), incremental innovation

   1) significant information, understanding or knowledge is available for an individual or team;

   2) ideas can be directed to phase gated or other serial methods for prioritization and development.

b) Medium uncertainty; mid-term, adjacent or step change innovation

   1) some information, understanding or knowledge is available for an individual or team;

   2) ideas and opportunities can go through customized phase gates or exploration and experimentation iterative learning processes to reduce levels of uncertainty prior to prioritization and development.

c) High uncertainty; longer term, breakthrough or radical innovation

   1) limited or no information, understanding or knowledge is available for an individual or team;

   2) ideas and opportunities can go through strategic visioning of future scenarios or strategic learning exploration and experimentation methods to reduce levels of uncertainty prior to prioritization, development and/or business build up.

B.3 Tool for how to screen for level of uncertainty

The purpose of this tool is to provide guidance for how to screen for level of opportunity or idea uncertainty by category.

— For low uncertainty, the requirements can be defined based on statements of what is known or mostly known.

— As the levels of uncertainty increase, asking questions is required to fill gaps in information, understanding or knowledge through learning based on what is not known yet.

Instructions for using this screening tool for levels of uncertainty are as follows:

a) Consider the requirement statements on the left-hand side and uncertainty questions on the right-hand side.

b) Place an 'X' in the box for each of the five categories of uncertainty to indicate level of uncertainty.

   1) Low: If requirements are in place and all or most of the uncertainty questions can be answered.

   2) Medium: If some of the questions can be answered.

   3) High: If most of the questions cannot be answered.

c) Next, look across the five categories of uncertainty.

   1) If all are low, then the opportunity or idea can be mature enough to be ready for development. This would suggest that requirements can be defined and there are very few, if any, questions to address.

   2) If there is a mix of low, medium, and high, this would also require reducing opportunity or idea uncertainty prior to development.

   3) If all are at medium to high levels of uncertainty, then the opportunity or idea clearly requires reducing uncertainty by applying different methods for learning to answer questions prior to development.

Table B.1 below is an example of an opportunity with a high level of uncertainty whereby many questions need to be answered.

Table B.1 — Example of screening for opportunity with high level of uncertainty

Knowns or certainties	Low	Medium	High	Unknowns or uncertainties
Organization requirements Projects have a home or sponsor. Commitment comes from a clear strategy and metrics.			X	Organization questions Where does the opportunity or idea fit? Is there a logical home? Who will champion the innovation concept? How are decisions made when operating under conditions of uncertainty?
Technical (or implementation) requirements Technology or infrastructure exists. Specifications are defined to develop a solution.			X	Technical (or implementation) questions Is the innovation concept feasible? What technology could we leverage or develop? How could this change the world, improve performance or reduce costs? Will it be economically feasible? Can the solution be scalable?
Resource requirements People and money are assigned. Projects are prioritized through a portfolio process.			X	Resource questions Is there funding available for the opportunity or idea? How do we fill our knowledge gaps? Can it be resourced with the right people and capabilities, internally or externally? Can we find the right partners?
NOTE Adapted from Leifer et al [23].				

Table B.1 *(continued)*

Knowns or certainties	Low	Medium	High	Unknowns or uncertainties
Market (or mission) requirements Market or mission is familiar, already exists. Data is available to support the business or innovation concept case. Regulatory, political, environmental or societal guidelines are clear and already exist.		X		Market (or mission) questions Is there a need or compelling vision for the opportunity or idea? Are there multiple potential applications and/or business models? Is there a viable innovation concept? Will it create sufficient value? Are there market, regulatory, political, environmental, or societal considerations that will help or hinder innovation concept viability?
Interested party requirements Interested parties are known, networks exist. Organizations are viewed as credible.			X	Interested party questions How will the innovation concept impact diverse interested parties? Which interested parties will support the innovation concept? What resistances can prevent them from supporting the innovation concept? Can these resistances be reduced?
Low to Medium Levels of Uncertainty				Medium to High Levels of Uncertainty

NOTE Adapted from Leifer et al [23].

B.4 Tools for how to identify and reduce uncertainties by category

B.4.1 Tool for creating a learning plan to identify and reduce uncertainties across categories

The purpose of this tool is to provide guidance for how to identify uncertainties by category. It requires being clear on what is known (not what we think we know) and identifying what is unknown that needs to be learned through a systematic approach to uncertainty reduction. It applies to a specific opportunity, idea, or innovation concept.

Complete the Learning Plan template by following the steps below (see Table B.2).

a) List what is known across Organization (O); T = Technical (or Implementation); R = Resource; M = Market (or Mission); P = Interested parties (OTRMP).

   1) Write statements of what is known, supported by evidence.

   2) If there is no evidence, then it is an assumption of what we think we know.

b) List what is unknown or uncertain across Organization (O); T = Technical (or Implementation); R = Resource; M = Market (or Mission); P = Interested Parties.

   1) Phrase as questions to be answered.

   2) Look for latent/hidden unknowns and uncertainties that can impede success.

c) Identify the most critical unknowns or uncertainties that can become showstoppers.

   1) Showstoppers are ones that would get in the way of success.

2) To determine if most critical, ask that if the unknown or uncertainty is not addressed would it impede success.

d) Identify assumptions that can be tested based on most critical unknowns or uncertainties.

1) No more than three to five assumptions should be tested across categories of uncertainty to focus on learning about what is most critical. It does not require covering all categories as organization and resource can be most critical before addressing any technical or market ones.

2) Primary assumptions can be tested, not derivative ones.

i. Primary assumptions are those, such as, performance improvements, cost savings or senior leadership support (or not) for a new business or operating model.

ii. Derivative assumptions are those that are the financial or market consequences of a primary assumption, such as, attaining 25 % market share or a 10 % ROI.

NOTE This is a learning plan to reduce the most critical unknowns or uncertainties, not a task or project management plan.

e) Test most critical assumptions by identifying tasks or actions required to reduce uncertainty.

1) Select most effective tests as a function of learning per money spent and unit of time invested. Objective is inexpensive tests to maximize learning and minimize spending.

2) Create action plan of tasks, timetable, and criteria for tests:

i. What to do? Who is responsible?

ii. By when? At what cost?

iii. What type of organizational support is required?

iv. What are the objectives/evaluative criteria for the tests to know if tests are successful or not?

f) Review learning outcomes for next steps:

1) Convert assumptions into knowledge: List new knowns and impact.

2) Consider impact across OTRMP categories.

3) Consider impact on overall opportunity/project progress and risks.

4) Determine influence on next steps to repeat cycle of learning through systematic approach.

Table B.2 — Tool to systematically identify uncertainties by categories

Learning plan template	**O**	**T**	**R**	**M**	**P**
Follow systematic learning approach:					
1. List knowns written as statements (supported by evidence).					
2. List unknowns/uncertainties phrased as questions.					
3. Identify the most critical unknowns or uncertainties.					
4. Identify assumptions based on most critical unknowns or uncertainties (no more than 3 to 5).					
Key: O = Organization; T = Technical (or implementation); R = Resource; M = Market (or mission); P = Interested parties.					

Table B.2 *(continued)*

Learning plan template	O	T	R	M	P
5. Test most critical assumptions. Identify tasks, timetable, and criteria for tests.					
6. Review learning outcomes for next steps:					
Convert assumptions into knowledge: List new knowns and impact.					
Consider impact across OTRMP.					
Consider impact on overall opportunity/project progress and risks.					
Determine influence on next steps.					
Key: O = Organization; T = Technical (or implementation); R = Resource; M = Market (or mission); P = Interested parties.					

NOTE Sources: [24], [25].

B.4.2 List of detailed questions to reduce uncertainties by category

The purpose of the list of detailed questions is to provide additional guidance across the five uncertainty categories of questions to ask to help reduce levels of uncertainty as indicated in Table B.3 below. While some questions are covered in the tool to screen for level of uncertainty in Table B.1, they are provided as examples only and this is a more complete list.

Table B.3 — More detailed questions by categories of uncertainty

Category of uncertainty	Questions to consider
Organization	— Where does the opportunity or idea fit? Is there a logical home? Who will champion the innovation concept? — Does the idea fit with our strategic intent? Do we have the capacity to pursue it? — How are decisions made when operating under conditions of uncertainty? — Can the action plan realistically deliver to the definition of success, or the minimum required? — Are the organizational risks for any remaining critical uncertainties acceptable? — Does the proposed solution fit into our DNA/capabilities as of today? Can our organization develop a solution to meet this need? — Can we provide the rationale for why it makes sense for our organization to pursue this opportunity, idea or innovation concept?

Table B.3 *(continued)*

Category of uncertainty	Questions to consider
Technical (or implementation)	— Is the innovation concept feasible? Have we demonstrated technical, business model and/or organizational feasibility? — Is there the potential for significant improvements and/or cost reductions in what already exists or the creation of something new to the world or market? — Do we have confidence that there is room to operate within the IP landscape? — Do we have confidence that technology, process, or other technical challenges can be overcome? — Can we develop a prototype for market learning? — Will the innovation concept be economically feasible? Can the solution be scalable? — Do we know how to develop this product, service or solution?
Resource	— Is there funding available for the opportunity or idea to reduce uncertainty prior to development? — Do we have internal foundational competencies we can leverage to pursue this opportunity or idea? — Is the team capable and motivated enough to successfully deliver the definition of success? — Can this opportunity, idea or innovation concept be resourced with the right people and capabilities, internally or externally? — Can we find the right partners? Which competency gaps could be filled externally via strategic partnerships and competency-based acquisitions?
Market (or mission)	— Is there a need or compelling vision for the opportunity or idea? — Are there multiple potential applications and/or business models? — Is it a viable innovation concept? Will it create sufficient value? — Are there stated or unstated pain/need/desire(s) for clearly identified customers? — Is the proposed solution compelling? Is the market entry strategy clear? — Will the target customer prefer this solution over the alternatives available to it and why? — Do we have a sense of the potential for the market or mission and the window of opportunity? — Are there market, regulatory, political, environmental, or societal considerations that will help or hinder innovation concept viability?

Table B.3 *(continued)*

Category of uncertainty	Questions to consider
Interested parties	— How will the innovation concept impact diverse interested parties from policy makers to industry? — Which interested parties will support the innovation concept? — What resistances could prevent interested parties from supporting the innovation concept? Can these resistances be reduced? — Are the targeted customer segments willing to pay for help in meeting their needs? — Can we provide a clear value proposition (or hypothesis) for interested parties with different objectives? — Are the targeted customer segments or interested parties willing to pay our organization to help them meet their needs? Are we credible enough to provide this solution? — Does this project fit the investor's strategy + brand/image or is it essential for market positioning?

B.5 Identifying uncertainties independently of categories

Another approach for helping innovators identify what they do not know is one that leads innovators to consider many parameters of their opportunities or ideas. For considering as many parameters as possible, innovators are encouraged to do a holistic analysis very early, even before significant time and/or money have been used to collect the missing information (testing).

This approach can be complementary to categorization. The objective is to identify uncertainties as early as possible and ask innovators to provide a detailed clarification of their opportunities or ideas to make what they do not know as explicit as possible.

To achieve this analysis that is independent of categories, models like the IpOp Model use a guided iterative roadmap that requires innovators to:

a) Write down a detailed clarification for their opportunity or innovation concept addressing all the components of the roadmap, with the understanding that:

   1) They should provide only factual information supported by evidence.

   2) If information is unreliable or not factual, they should treat them as unknowns or uncertainties.

   For example, innovators can be asked to reliably list all the decision criteria that the target customer or user considers for selecting the offering to best address the pain/need/desire(s) to be satisfied. If part of this information and/or knowledge is missing, it prompts innovators to add this uncertainty or unknown to their inventory of uncertainties.

b) Make an inventory of all the uncertainties. A form like Table B.4 below is an example of the way to make such inventory.

c) Rank the uncertainties according to their impact on the ability to deliver the definition of success, with the understanding that:

   1) Not all unknowns or uncertainties have the same level of importance.

   2) No-go criteria should be flagged in advance.

   3) Some uncertainties can be showstoppers.

4) The extent to which each critical uncertainty should be reduced depends on the level of tolerance of decision-makers.

d) Choose the most important critical unknowns or uncertainties to be reduced and those that can remain without the missing information or knowledge. This becomes the inventory of uncertainties.

e) Write an opportunity case that outlines for decision-makers the essential information they need to decide what to do with the innovation concept. Since all information and knowledge collected during the iterative analysis is not necessarily relevant for decision-makers, this opportunity case only contains selected content of the analysis that is relevant for them (see C.5). One of the essential components of the opportunity case is the list of critical uncertainties with the resources needed to obtain the missing information or knowledge.

This early analysis should not take more than a couple of days to identify the most identifiable uncertainties or unknowns. Once the analysis has been done, writing the opportunity case can be done quickly.

Once the opportunity case has been developed cataloguing unknowns or uncertainties for uncertainty reduction, including a cost and timeline, the sequence for managing uncertainties is as follows:

Assuming the opportunity case is convincing enough, an allocation of resources is made for reducing the critical unknowns.

Once these unknowns are reduced, the opportunity case is updated and the decision is made if the innovation concept should proceed to development, be archived or, if needed, go back for further analysis. Reducing uncertainties implies a dynamic process that translates into an iterative analysis.

If the decision is made to proceed to development, additional resources are allocated for this next phase.

B.6 Tool for how to calibrate the effort to reduce them

The purpose of the tool shown in Table B.4 is to provide guidance for calibrating the effort required to reduce critical uncertainties. It applies to a specific opportunity, idea, or innovation concept.

This tool is designed for cataloguing the most critical uncertainties or unknowns and calibrating the effort required to reduce them. It can be used as follows:

a) Create the list of critical uncertainties that maps those that should be reduced.

b) Define the most effective sequence for reducing no-go uncertainties, while minimizing the use of resources.

   1) Such sequence provides a customized phase-gate approach for each opportunity, idea or innovation concept.

   2) This contrasts with traditional phase-gate approaches that typically use a standard sequence for all projects.

c) Determine for each uncertainty which testing method is appropriate for obtaining missing information or knowledge, with the understanding that:

   1) Each testing method requires either time or money, or both.

   2) A list with a total provides a calibration of effort required to reduce uncertainties.

   3) Early-stage calibration enables decision-makers to assess total resources required.

d) Decide if the innovation concept is attractive enough to warrant allocation of resources. This requires to:

   1) Agree upon which critical uncertainties to test based on resource availability.

2) Consider the need for resources according to resources available (e.g. time, money, skills) and tolerance for uncertainty.

e) Allocate and use resources to reduce critical uncertainties.

f) Iteratively update initial opportunity case with information obtained through the reduction of uncertainties.

1) Be certain to include the inventory of all your uncertainties or unknowns in the opportunity case (see C.5).

Use the updated opportunity case for the selection process (see 6.4.3.6).

If new unidentified critical uncertainties are identified during the uncertainty reduction process, activities 1 to 6 should be repeated.

Table B.4 — List for calibrating the effort required to reduce critical uncertainties/unknowns

Ref	Critical unknowns	Impact	Tactical move to reduce the unknown	Out-of-pocket expenses	Person days	Due date	Opportunity killer
			Total resources	0	0		

Annex C
(informative)

Front end innovation processes and activities

C.1 General

This annex provides additional detail on the following: where to look for opportunities and ideas, typical validation selection criteria, an example decision-tree based on these criteria and how to write a proposition.

C.2 Inspiration for opportunities and ideas

C.2.1 General

Opportunities and ideas come from many different areas and there are a variety of approaches to inspire their conceptualization. Details in support of Figure 5 in 6.2.3 are as follows.

C.2.2 Customer/User-focused

One way of recognizing needs is by observing and analysing customer/user motivation, behaviour, and desires. There are many methods for analysing customers/users. Understanding customer/user emotion and motivation when selecting a solution is important in generating great opportunities and ideas. Some customers/users are drawn to new solutions because they perform better than existing models. Other customers/users are motivated only by cost and will opt for the less expensive version of a solution. Customers/users who already use a certain product or service will likely be motivated to adopt a solution complementing that product or service. Many customers/users are won over by the way a solution makes them feel.

EXAMPLES

— In design thinking, one empathizes with the customer/user to better understand how they use and interact with the innovation concept.

— In the jobs-to-be-done theory, the focus is on the reasons a customer/user invites the solution into their lives. Understanding customer/user motivation leads to new options for a solution.

— In lead user analysis, a subset of potential customers/users is studied of those ahead of the rest of the market.

— UX focuses on the feeling a customer/user gets by interacting with the innovation concept.

— In focus groups, the behaviour and reactions of a small diverse group of potential customers/users are observed through a series of interactive discussions. Information obtained is used to create new opportunities or ideas, to refine evolving ones or could even lead to new innovation concepts.

— Crowdsourcing is used to gather opportunities, ideas, or innovation concepts from the public at large.

C.2.3 Market-focused

Another way to identify opportunities and ideas is to analyse market forces and trends to predict the future and explain the past. One can endeavour to predict customer and market behaviour in the near-term (typically months ahead) or in the long-term (years or decades).

EXAMPLES