Università di Roma Tor Vergata

Laurea / B.A. in Global Governance

Management of Innovation

Topic 4
Moving innovation forward

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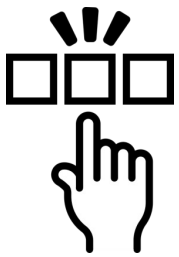
Slides are taken/adapted from:
J. Tidd, J. Bessant and K. Pavitt, *Managing Innovation. Integrating Technological, Market and Organizational Change*
John Wiley & Sons Ltd, 2018

Why is selection important?

- Plenty of things we could do but we have limited resources.
- Random choice is gambling.
- Innovation involves uncertainty and risk so we need ways of choosing projects to balance risk and reward.
- Building a balanced portfolio.



The funnel of uncertainty

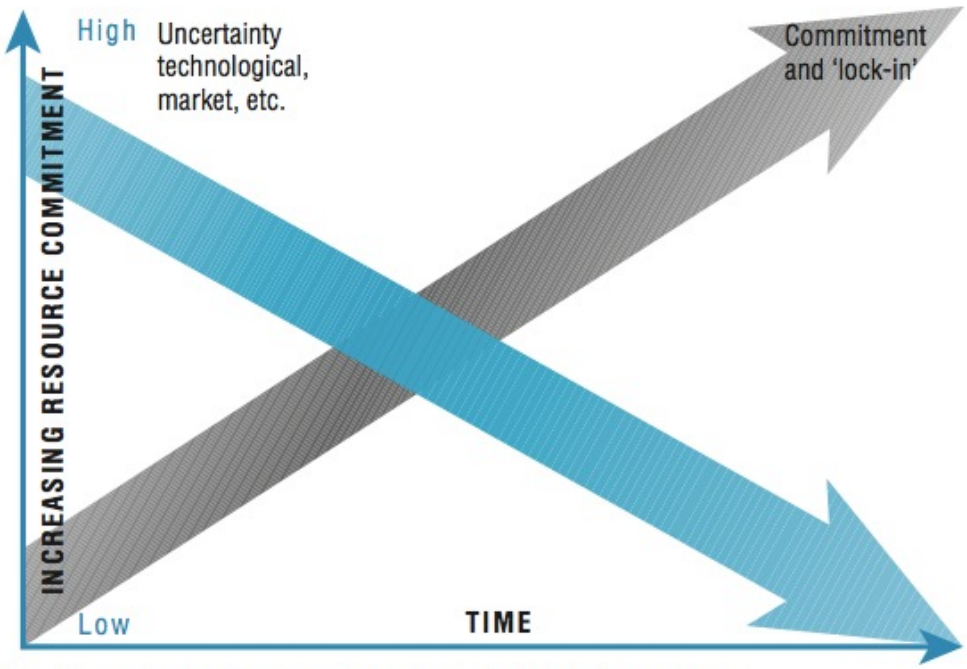


Figure 7.1 Uncertainty and resource commitment in innovation projects

The innovation funnel

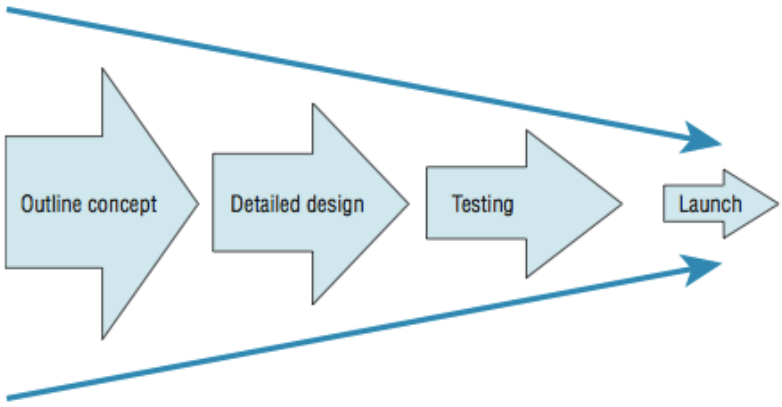


Figure 7.2 The innovation funnel

Uncertainty in project planning

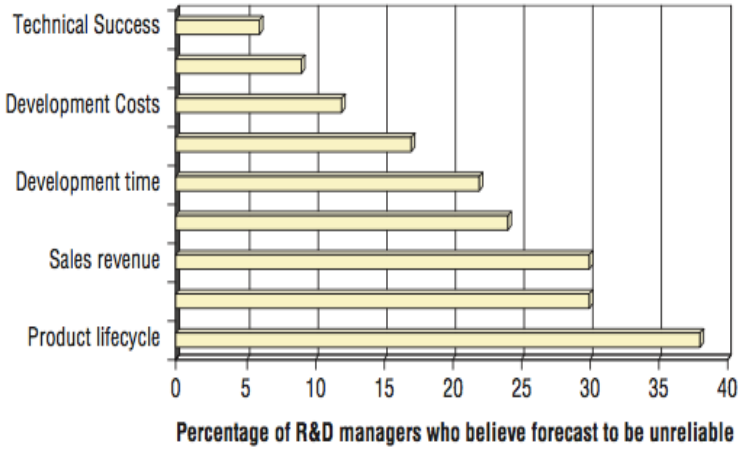
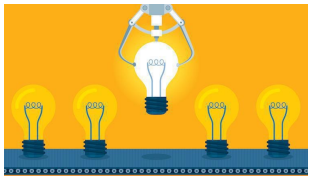


FIGURE 9.3 Uncertainty in project planning

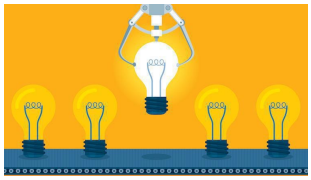
Source: Derived from Freeman, C. and L. Soete (1997) *The Economics of Innovation*. Cambridge, MA: MIT Press.

Approaches to project selection



Selection approach	Advantages	Disadvantages
Simple 'gut feel', intuition	Fast	Lacks evidence and analysis, may be wrong
Simple qualitative techniques – for example checklists and decision matrix	Fast and easy to share – provides a useful focus for initial discussions	Lacks factual information and little or no quantitative dimension
Financial measures – for example, return on investment or payback time	Fast and uses some simple measurement	Doesn't take account of other benefits which might come from the innovation – learning about new technologies, markets, etc.

Approaches to project selection (continued)



Selection approach	Advantages	Disadvantages
Complex financial measures – for example 'real options' approach	Takes account of learning dimension – the benefits from projects may lie in improved knowledge which we can use elsewhere as well as in direct profits	More complex and time-consuming. Difficult to predict the benefits which might arise from taking options on the future
Multi-dimensional measures – for example, decision matrix	Compares on several dimensions to build an overall 'score' for attractiveness	Allows consideration of different kinds of benefits but level of analysis may be limited
Portfolio methods and business cases	Compares between projects on several dimensions and provides detailed evidence around core themes	Takes a long time to prepare and present

Simple checklist

A list of factors which are considered important in making a decision in a specific case. Criteria include technical and commercial details, legal and financial factors, company targets and company strategy. The technique can be strengthened by:

- including some quantitative factors among the whole list of factors;
- assigning different weights to different factors;
- developing a systematic way of arriving at an overall opinion on the project, such as a score or index.

Example of a checklist

Factors	Score (1-5)	Weight (%)	S × W
Corporate objectives			
Fits into the overall objectives and strategy Corporate image			
Marketing and distribution			
Size of potential market Capability to market product Market trend and growth Customer acceptance Relationship with existing markets Market share Market risk during development period Pricing trend, proprietary problem, etc. Complete product line Quality improvement Timing of introduction of new product Expected product sales life			

Example of a checklist (continued)

Factors	Score (1-5)	Weight (%)	S × W
Manufacturing			
Cost savings Capability of manufacturing product Facility and equipment requirements Availability of raw material Manufacturing safety			
Research and development			
Likelihood of technical success Cost Development time Capability of available skills Availability of R&D resources Availability of R&D facilities Patent status Compatibility with other projects			

Example of a checklist (continued)

Factors	Score (1-5)	Weight (%)	S × W
Regulatory and legal factors			
Potential product liability Regulatory clearance			
Financial			
Profitability Capital investment required Annual (or unit) cost Rate of return on investment Unit price Payout period Utilization of assets, cost reduction and cash-flow			

Business case

Business case – the story behind a proposed project should contain:

- details of the product or service;
- assessment of the market opportunity;
- identification of target customers;
- barriers to entry and competitor analysis;
- experience, expertise and commitment of the management team;
- strategy for pricing, distribution and sales;
- identification and planning for key risks;
- cash-flow calculation, including breakeven points and sensitivity;
- financial and other resource requirements of the business.

The problem of multiple projects

The problem of multiple projects:

- Business case OK for single project.
- How to assess competing projects?
- Need to balance risk and reward.
- Need for portfolio management.

Problems due to lack of portfolio management

TABLE 7.1 Problems arising from poor portfolio management

Without portfolio management there may be	Impacts
No limit to projects taken on	Resources spread too thinly
Reluctance to kill-off or 'de-select' projects	Resource starvation and impacts on time and cost – overruns
Lack of strategic focus in project mix	High failure rates, or success of unimportant projects and opportunity cost against more important projects
Weak or ambiguous selection criteria	Projects find their way into the mix because of politics or emotion or other factors – downstream failure rates high and resource diversion from other projects
Weak decision criteria	Too many 'average' projects selected, little impact downstream in market

Source: Based on Cooper, R. (1988). The new product process: a decision guide for management. *Journal of Marketing Management*, **3** (3), 238–55.

Innovations portfolio

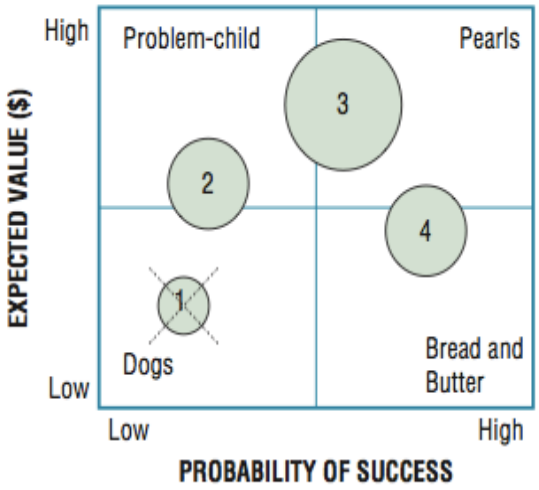


FIGURE 9.4 An example matrix-based portfolio

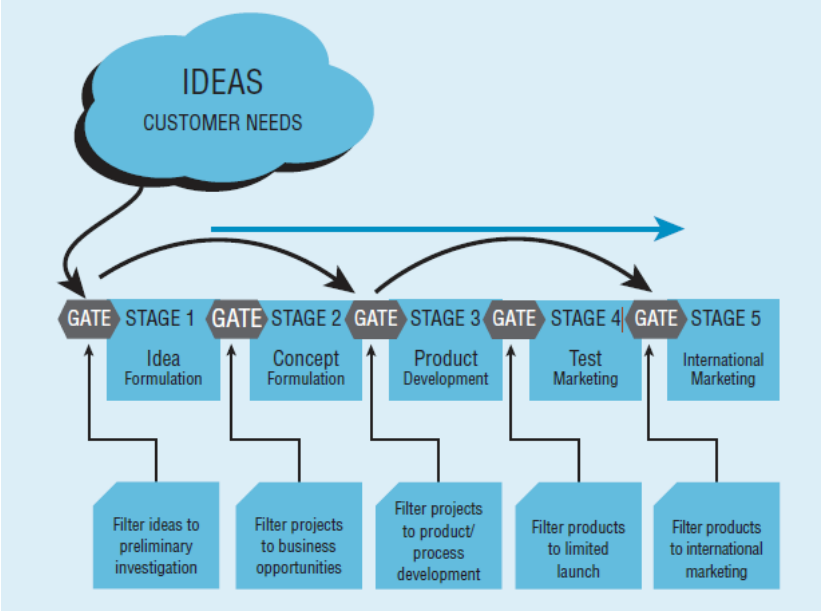
The A D Little matrix

• A D Little matrix groups technological knowledge into four key groups: base, key, emerging and pacing.

• Making this distinction helps: identify a strategy for acquisition based on the degree of potential impact; the importance to the enterprise; the protectability of the knowledge.

• Models of this can be refined, for example, by adding to the matrix information about different markets and their rate of growth or decline

Managing risk over time the Stage Gate approach



Dealing with radical innovation

• Problem is such high uncertainty that it becomes hard to evaluate.

• Risk is that organization rejects these options.

• Need some way of handling and evaluating these projects.

Typical reactions to 'wild' ideas

Argument	Underlying perceptions from within the established mental model
'It's not our business'	Recognition of an interesting new business idea but rejection because it lies far from the core competence of the firm
'It's not a business'	Evaluation suggests the business plan is flawed along some key dimension – often underestimating potential for market development and growth
'It's not big enough for us'	Emergent market size is too small to meet growth targets of large established firm
'Not invented here'	Recognition of interesting idea with potential but reject it – often by finding flaws or mismatch to current internal trajectories
'Invented here'	Recognition of interesting idea but rejection because internally generated version is perceived to be superior
'We're not cannibals'	Recognition of potential for impact on current markets and reluctance to adopt potential competing idea

Typical reactions to 'wild' ideas (continued)

Argument	Underlying perceptions from within the established mental model
'Nice idea but doesn't fit'	Recognition of interesting idea generated from within but whose application lies outside current business areas – often leads to inventions being shelved or put in a cupboard
'It ain't broke so why fix it'	No perceived relative advantage in adopting new idea
'Great minds think alike'	'Groupthink' at strategic decision making level - - new idea lies outside the collective frame of reference
'(existing) customers won't /don't want it'	New idea offers little to interest or attract current customers – essentially a different value proposition
'We've never done it before'	Perception that risks involved are too high along market and technical dimensions
'We're doing OK as we are '	The success trap – lack of motivation or organizational slack to allow exploration outside of current lines
'Let's set up a pilot'	Recognition of potential in new idea but limited and insufficient commitment to exploring and developing it - lukewarm support

What's in a business plan?

First of all a BP includes the details of the product or service;
… plus it includes:

- assessment of the market opportunity;
- identification of target customers;
- barriers to entry and competitor analysis;
- experience, expertise and commitment of the management team;
- strategy for pricing, distribution and sales;
- identification and planning for key risks;
- cash-flow calculation, including breakeven points and sensitivity;
- financial and other resource requirements of the business.

Criteria for judging plans

TABLE 8.1 Criteria used by venture capitalists to assess proposals

Criteria	European (n = 195)	American (n = 100)	Asian (n = 53)
Entrepreneur able to evaluate and react to risk	3.6	3.3	3.5
Entrepreneur capable of sustained effort	3.6	3.6	3.7
Entrepreneur familiar with the market	3.5	3.6	3.6
Entrepreneur demonstrated leadership ability*	3.2	3.4	3.0
Entrepreneur has relevant track record*	3.0	3.2	2.9
Product prototype exists and functions*	3.0	2.4	2.9
Product demonstrated market acceptance*	2.9	2.5	2.8
Product proprietary or can be protected*	2.7	3.1	2.6
Product is 'high technology'*	1.5	2.3	1.4
Target market has high growth rate*	3.0	3.3	3.2
Venture will stimulate an existing market	2.4	2.4	2.5
Little threat of competition within three years	2.2	2.4	2.4
Venture will create a new market*	1.8	1.8	2.2
Financial return > 10 times within 10 years*	2.9	3.4	2.9
Investment is easily made liquid* (e.g. made public or acquired)	2.7	3.2	2.7
Financial return > 10 times within 5 years*	2.1	2.3	2.1

1 = irrelevant, 2 = desirable, 3 = important, 4 = essential. * Denotes significant at the 0.05 level.

Forecasting innovation

Choice of method depends on:

- what we are trying to forecast
- rate of technological and market change
- availability and accuracy of information
- the company's planning horizon
- the resources available for forecasting.

Types of forecasting

Method	Uses	Limitations
Trend extrapolation	Short-term, stable environment	Relies on past data & assumes past patterns
Product and technology roadmapping	Medium-term, stable platform & clear trajectory	Incremental, fails to identify future uncertainties
Regression, econometric models and simulation	Medium-term, where relationship between independent & dependent variables understood	Identification & behaviour of independent variables limited
Method	**Uses**	**Limitations**

Types of forecasting (continued)

Customer and marketing methods	Medium-term, product attributes & market segments understood	Sophistication of users, limitation of tools to distinguish noise & information
Benchmarking	Medium-term, product & process improvement	Identifying relevant benchmarking candidates
Delphi and experts	Long-term, consensus-building	Expensive, experts disagree or consensus wrong
Scenarios	Long-term, high uncertainty	Time-consuming, unpalatable outcomes

Use of forecasting

	High novelty/radical project		Low novelty/ incremental projects	
Forecasting Method	Usage (%)	Usefulness	Usage (%)	Usefulness
Segmentation*	89	3.42	42	4.50
Delphi/Industry Experts	63	3.83	37	3.71
Surveys/Focus groups*	52	4.50	37	4.00
User-practice Observation	47	3.67	42	3.50
Scenario Development	21	3.75	26	2.80

Usefulness Scale: 1-5, 5=critical, based on manager assessments of 50 development projects in 25 firms. * denotes difference in usefulness rating is statistically significant at 5% level

Source: Adapted from Tidd, J. and Bodley, K. (2002) 'The affect of project novelty on the new product development process', *R&D Management,* 32(2), 127-138.

The most common forecasting methods

- customer or market surveys;
- internal analysis (e.g. brainstorming);
- external analysis (e.g. benchmarking);
- external analysis (e.g. Delphi or expert opinion);
- scenario development.

Internal search – brainstorming principles

- Keep a relaxed atmosphere. Meetings should be disciplined but informal. If possible, choose an informal venue.
- Get the right size of team. The technique seems to work best with groups of five to seven people.
- Choose a neutral (ideally external) chairperson. The chair checks that everyone understands what is going on and why. Avoid senior managers, as this can restrict the flow of ideas.

Internal search – brainstorming principles

- Define the problem or objectives clearly.
- Generate as many ideas as possible.
- Do not allow any evaluation or discussion.
- Give everyone an equal opportunity to contribute.
- Write down every idea – clearly and where everyone can see them.

Internal search – brainstorming principles

When all the ideas are listed, review them for clarification, making sure everyone understands each item. At this point you can eliminate duplications and remove ideas the group feels are no longer appropriate.

Allow ideas to incubate. Brainstorming sessions with perhaps a few days in between. This gives time for the team members to let the ideas turn over in their mind, which often results in new ideas at a later session.

Benchmarking

Benchmarking is simply the systematic comparison of something against something else. The 'something' can be a process, product, service or measure of performance.

Benefits of benchmarking

- Establishes realistic goals. Benchmarking helps to identify the most urgent and important areas for improvement, and reduces the likelihood of a focus on internal needs.

- Improves performance. Benchmarking identifies real problems, rather than pet projects or easy targets.

Benefits of benchmarking (continued)

- Achieves better practice. Benchmarking the processes of other organizations with superior performance provides information on proven good practice, and reduces the risk of following anecdotal management fashion or inappropriate consultancy prescriptions.

- Aids implementation and change. Benchmarking provides detailed and persuasive data on others' superior performance or practice, which helps to motivate and focus managers and staff. It can act as a catalyst.

Different definitions of scenarios

- An internally consistent view of what the future may turn out to be. Not a forecast, but one possible future outcome.

- A disciplined methodology for imagining possible futures in which organizational decisions may be played out.

- That part of strategic planning which relates to the tools and technologies for managing the uncertainties of the future.

Project appraisal aims to...

- Profile and gain an overall understanding of potential projects.
- Prioritize a given set of projects, and where necessary reject projects.
- Monitor projects, e.g. by following up the criteria chosen when the project was selected.
- Where necessary, terminate a project.
- Evaluate the results of completed projects.
- Review successful and unsuccessful projects to gain insights and improve future project management, i.e. learning.

Project evaluation involves...

- *Inputs* into the assessment include likely costs and benefits in financial terms, probability of technical and market success, market attractiveness and the strategic importance to the organization.
- *Weighting*: as certain data may be given more relevance than others (e.g. of market inputs compared with technical factors), in order to reflect the company's strategy or the company's particular views. The data are then processed to arrive at the outcomes.
- *Balancing* a range of projects, as the relative value of a project with respect to other projects, is an important factor in situations of competition for limited resources. Portfolio management techniques are specifically devoted to deal with this factor.

Problems of limited cognition

- *Reasoning by analogy*, which oversimplifies complex problems.
- *Adopting a single, prior hypothesis bias*, even where information and trails suggest this is wrong.
- *Limited problem set*, the repeated use of a narrow problem-solving strategy.
- *Single outcome calculation*, which focuses on a simple single goal and a course of action to achieve it, while denying value trade-offs.
- *Illusion of control and predictability*, based on an overconfidence in the chosen strategy, a partial understanding of the problem and limited appreciation of the uncertainty of the environment.
- *Devaluation of alternatives*, emphasizing the negative aspects of alternatives.

Characteristics of innovation investments

- *They are uncertain*, so that success cannot be assured.
- *They involve different stages* that have different outputs that require different methods of evaluation.
- *Many of the variables in an evaluation cannot be reduced to a reliable set of figures* to be plugged into a formula, but depend on expert judgements.

Diffusion of innovations

- Diffusion is the means by which innovations are translated into social and economic benefits.
- We know that the impact of the *use* of innovations is around four times that of their generation
- However, the benefits of innovations can take 10–15 years to be fully effected, and in practice most innovations fail to be adopted widely, and so have limited social or economic impact.

Rogers' definition

Rogers' definition of diffusion is used widely:

'the process by which an innovation is communicated through certain channels over time among members of a social system. It is a special type of communication, in that the messages are concerned with new ideas'

Rogers' 3 types of innovation decision

- *Individual*, in which the individual is the main decision-maker, independent of peers. Decisions may still be influenced by social norms and interpersonal relationships, but the individual makes the ultimate choice. For example, the purchase of a consumer durable such as a mobile phone.
Collective, where choices are made jointly with others in the social system, and there is significant peer pressure or formal requirement to conform. For example, the sorting and recycling of domestic waste.

- *Authoritative*, where decisions to adopt are taken by a few individuals within a social system, owing to their power, status or expertise (e.g. adoption of ERP systems by businesses, or MRI systems by hospitals).

Models of diffusion

In practice the precise pattern of adoption of an innovation will depend on the interaction of demand-side and supply-side factors:

- *Demand-side factors* – direct contact with or imitation of prior adopters, adopters with different perceptions of benefits and risk.

- *Supply-side factors* – relative advantage of an innovation, availability of information, barriers to adoption, feedback between developers and users.

The S-curve

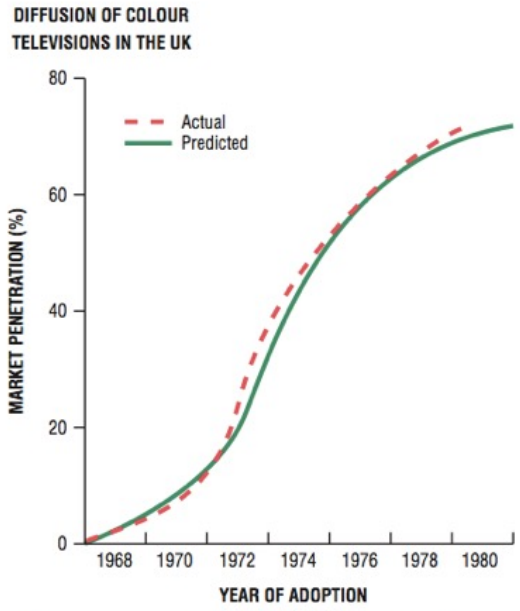


FIGURE 12.1 Typical diffusion S-curve for the adoption of an innovation

Source: Meade, N. and T. Islam (2006) Modeling and forecasting the diffusion of innovation: A 25-year review. *International Journal of Forecasting*, **22** (3): 519–545.

Barriers to adoption

- *economic* – personal costs versus social benefits, access to information, insufficient incentives

- *behavioural* – priorities, motivations, rationality, inertia, propensity for change or risk

- *organizational* – goals, routines, power and influence, culture and stakeholders

- *structural* – infrastructure, sunk costs, governance.

Attributes of innovation

- Primary attributes, such as size and cost, are invariant and inherent to a specific innovation irrespective of the adopter.

- Secondary attributes, such as relative advantage and compatibility, may vary from adopter to adopter, being contingent upon the perceptions and context of adopters.

Factors affecting diffusion

In predicting the rate of adoption of an innovation, five factors explain up to almost 90% of the variance:

- relative advantage
- compatibility
- complexity
- trialability
- observability.

Relative advantage

- Relative advantage is the degree to which an innovation is perceived as better than the product it supersedes, or competing products.

- Typically measured in narrow economic terms, for example cost or financial payback

- Non-economic factors such as convenience, satisfaction and social prestige may be equally important.

Checklist: Relative advantage

- How well does my plan show how much better off people will be when they adopt it?
- Why is this plan better than what has been done before?
- What advantages or benefits may there be to accepting the plan?
- Who will gain from the implementation of the plan?
- How will I (or others) be rewarded by adopting the plan?
- How can I emphasize the plan's benefits to all?

Compatibility

- Compatibility is the degree to which an innovation is perceived to be consistent with the existing values, experience and needs of potential adopters.

- Two distinct aspects of compatibility:

  - existing skills and practices,
  - and values and norms.

- Few innovations initially fit the user environment into which they are introduced. Significant misalignments between the innovation and the adopting organization will require changes in the innovation or organization, or, in the most successful cases of implementation, mutual adaptation of both.

Checklist: Compatibility

- How well does my plan demonstrate that it is compatible with current values, past experiences and needs?
- Is the plan consistent with current practice?
- Does the plan meet the needs of a particular group?
- Does it offer better ways to reach our common goals?
- Who will naturally support and agree with the plan?
- Can it be favourably named, packaged or presented?

Complexity

- Complexity is the degree to which an innovation is perceived as being difficult to understand or use.

- In general, innovations which are simpler for potential users to understand will be adopted more rapidly than those which require the adopter to develop new skills and knowledge.

Checklist: Complexity

- How well does my plan provide for easy communication, comprehension and use?
- Is the plan easy for others to understand?
- Can it be explained clearly to many different people?
- Will the plan be easily communicated?
- How can the plan be made more simple or easy to understand?
- Is the plan easy to use or follow?

Trialability

- Trialability is the degree to which an innovation can be experimented with on a limited basis.

- An innovation that is trialable represents less uncertainty to potential adopters, and allows learning by doing. Innovations which can be trialled will generally be adopted more quickly than those which cannot.

- Sometimes called ‘divisibility’ – how far can the risk of adoption be broken down into small steps rather than requiring a full commitment at the outset

Checklist: Trialability

- How well does my plan allow for trialability?
- Can the plan be tried out or tested?
- Can uncertainty be reduced?
- Can we begin with a few parts of the plan?
- How can others be encouraged to try out the plan?
- Can the plan be modified by you or others?

Observability

- Observability is the degree to which the results of an innovation are visible to others.
- The easier it is for others to see the benefits of an innovation, the more likely it will be adopted.
- The simple epidemic model of diffusion assumes that innovations spread as potential adopters come into contact with existing users of an innovation.

Checklist: Observability

- How well does my plan provide results that are easily observed and visible to others?
- Is the plan easy for others to find or obtain?
- Can the plan be made more visible to others?
- How can I make the plan easier for others to see?
- Will others be able to see the effects of the plan?
- Are there good reasons for not making the entire plan visible?

Checklist: Other factors

- What other resources will I need; how can I get them?
- What obstacles exist; how can we prevent or overcome them?
- What new challenges will be created; and dealt with?
- How can I encourage commitment to the plan?
- What feedback about the plan is needed?

Summary

- The process of innovation is much more complex than technology responding to market signals. Effective business planning under conditions of uncertainty demands a thorough understanding and management of the dynamics of innovation, including conception, development, adoption and diffusion.
- Forecasting the development and adoption of innovations is difficult, but participative methods such as Delphi and scenario planning are highly relevant to innovation and sustainability. In such cases the process of forecasting, including consultation and debate, is probably more important than the precise outcomes of the exercise.
- The adoption and diffusion of an innovation depend on the characteristics of the innovation, the nature of potential adopters and the process of communication. The relative advantage, compatibility, complexity, trialability and observability of an innovation all affect the rate of diffusion.