

## Schumpeter's Model of the Innovation Process

Schumpeter developed two different models

**(1) Model of entrepreneurial innovation (1912):**

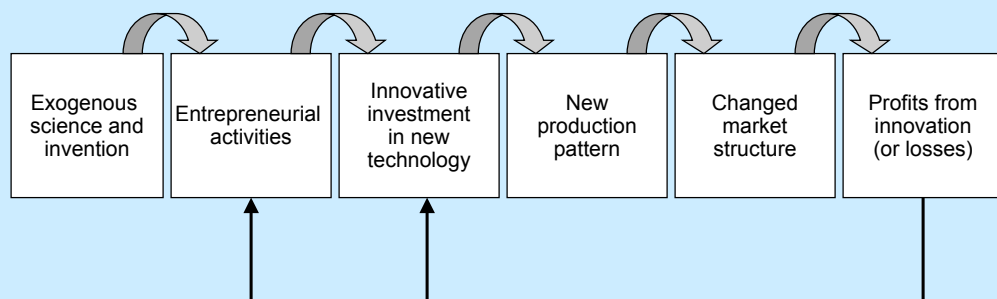
- the entrepreneur has the key function for the whole process and realises the potential of inventions
- science, technology and inventions are seen as exogenous to the firm
- profits from innovation are the incentive to invest further in innovation
- linear model with successive stages

**(2) Model of innovation managed in large firms (1942):**

- the management of large firms has taken the part of the entrepreneur
- R&D is mainly performed in-house in large companies, however, external science and technology still exists
- profits from innovation are the incentive to invest again in innovation
- linear model with successive stages

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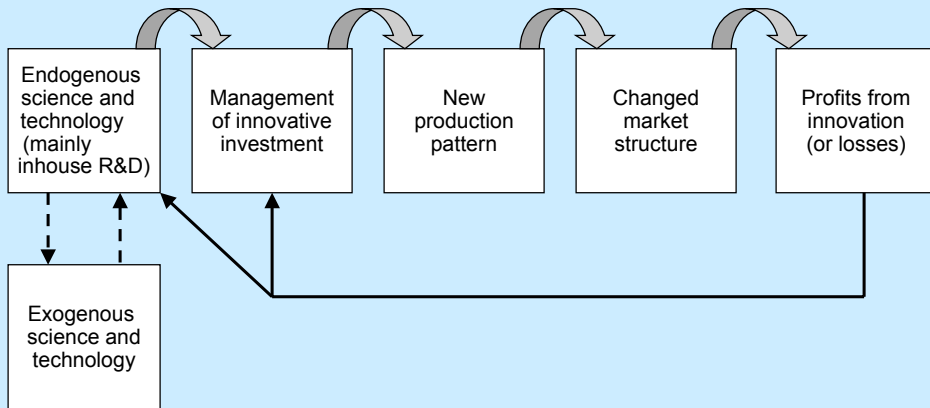
## Schumpeter's Model of Entrepreneurial Innovation



Source: Freeman (1982, 212)

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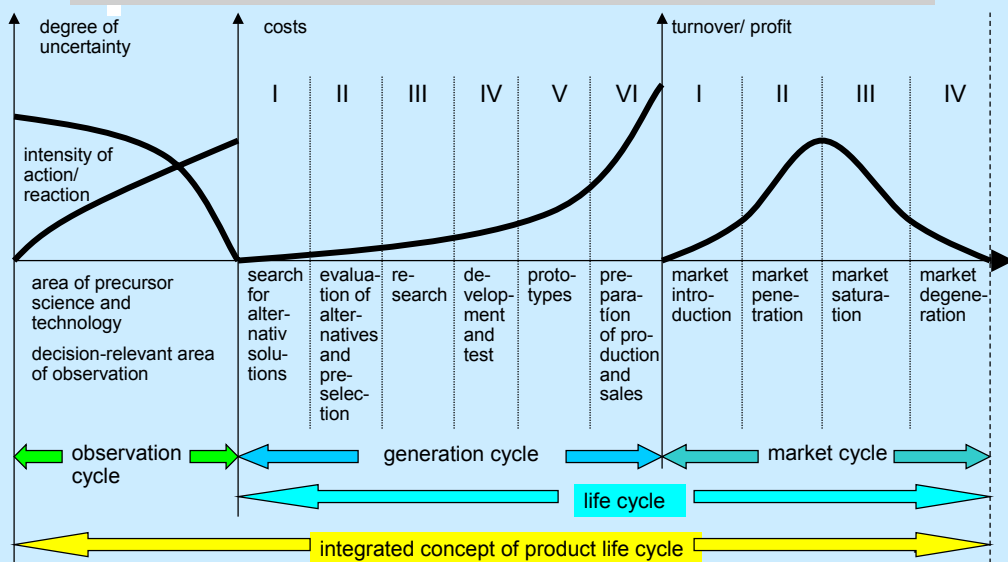
## Schumpeter's Model of Large Firm Managed Innovation



Source: Freeman (1982, 212)

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## The Integrated Product Life Cycle Concept of the Innovation acc. to Pfeiffer and Bischof



Source: Pfeiffer/Bischof (1982, 136)

## Internal and External Sources of Innovation

Internal Sources	External Sources
<ul style="list-style-type: none"> <li>• Research and Development</li> <li>• Patent department</li> <li>• Production</li> <li>• Marketing/ market research/ sales</li> <li>• Technical services</li> <li>• Assembly</li> <li>• Employees</li> <li>• 'Betriebliches Vorschlagswesen'</li> </ul>	<ul style="list-style-type: none"> <li>• Customers</li> <li>• Trader, trading organisation</li> <li>• Inventor</li> <li>• Universities, public R&amp;D institutes</li> <li>• Suppliers</li> <li>• Competitors</li> <li>• (New) products in other markets/ sectors</li> <li>• Consultant</li> <li>• Market research institutes</li> <li>• Professional associations</li> <li>• Ministries; public institutions</li> </ul>

Quellen von Neuproduktideen (in Anlehnung an Meffert, 1991)

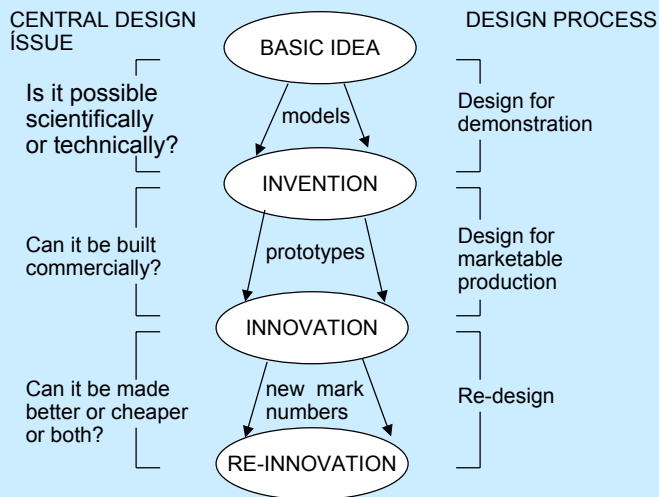
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## Rothwell and Gardiner Model of Innovation

- Basic ideas lead to invention and then to innovation
- However: since only about 10% of all innovations can be characterised as radical innovations (90% incremental innovations) a new element has to be introduced: the phase of re-design with the result of re-innovation
- Conclusion: focus of the management on re-design/ re-innovation and the interaction between producers and users is needed ('technology/ market coupling')
- Attempt to bridge linear with complex models

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## Rothwell and Gardiner Model of Innovation



Source: Rothwell/Gardiner (1988, 374)

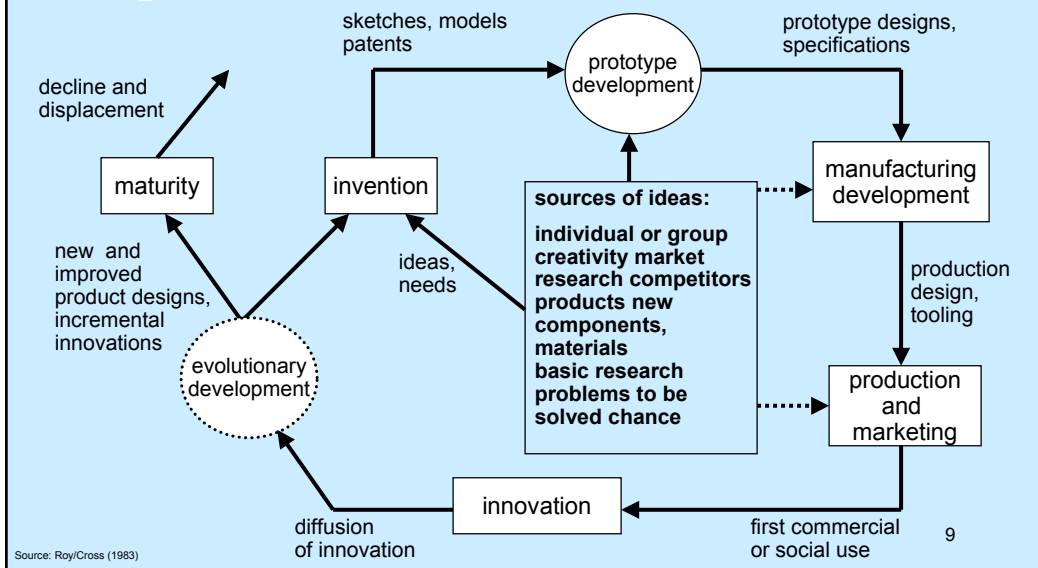
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## Model of the Evolution of Innovation acc. to Roy/ Cross

- Innovation is a cyclic process and at the core are different sources of innovation
- Sources for innovation are not only research but markets/ customers, competitors, creativity, etc.
- Knowledge generation is directly linked to other stages (e.g. prototyping, manufacturing development, production, marketing)
- 'Learning from markets' aspect
- The sequential mode is broken up towards various interactions and feedback loops
- Link of the model to the product life cycle concept
- Question: No linkages from different stages to knowledge generation?

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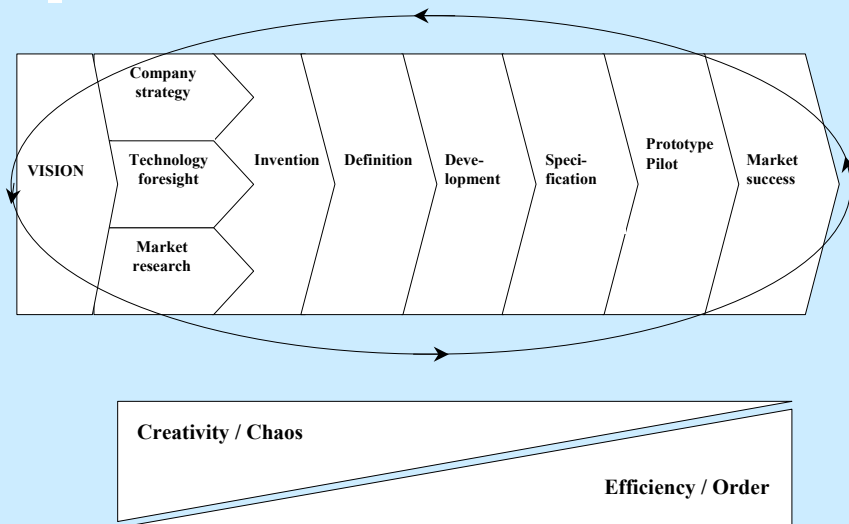
## Model of the Evolution of Innovation acc. to Roy/ Cross



## Dynamic Characteristics of the Innovation Process (I)

- **View on the differences between the early and the later phases of the innovation process**
- **Early phases deal with creativity, idea finding, intangible assets and concepts**
- **Later phases deal with development, construction, tangible assets, efficiency**

## Dynamic Characteristics of the Innovation Process (II)



Source: adapted from Ebner and Walti 1996, 20

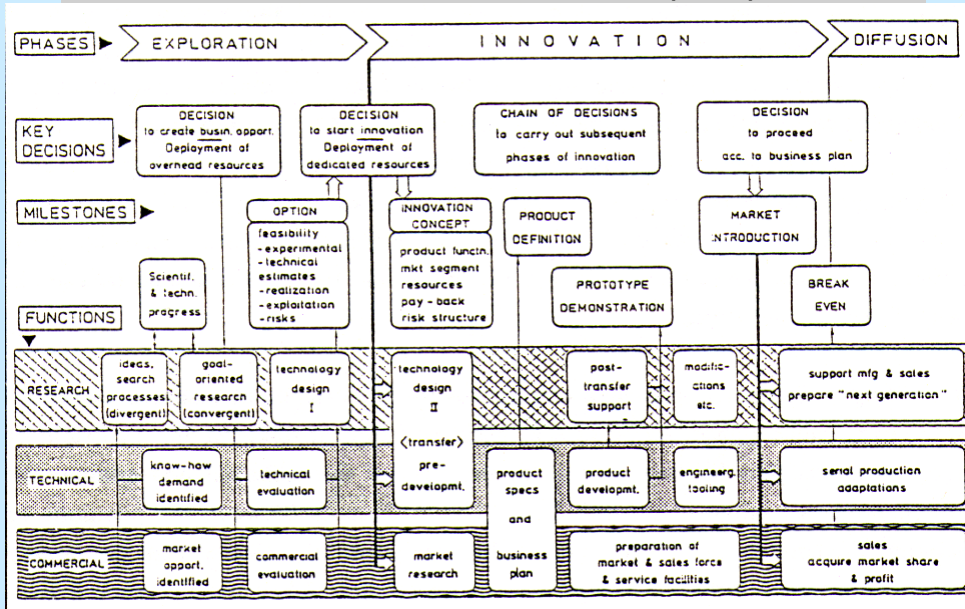
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## Two-dimensional Model of an Industrial Product Innovation acc. to Schmidt-Tiedemann

- Model represents innovation processes in large firms (electronics industry)
- Approach: combining the phases of the innovation (exploration, innovation, diffusion) with three functions (research, technical, commercial);
- Additional elements are key decisions and milestones
- Parallel activities and linkages of the functions to the time sequences of the innovation process (e.g. research can influence the innovation even in later stages)

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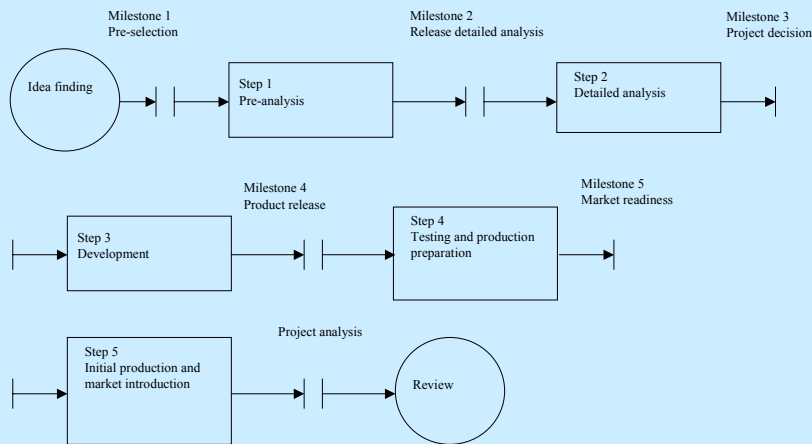
## Two-dimensional Model of an Industrial Product Innovation acc. to Schmidt-Tiedemann (1982)



## Conclusions: Models of the Innovation Process

- **Core stages of the innovation process are:**
  - Searching and recognising technological and market opportunities
  - Evaluating and selecting alternatives
  - Formulating ideas and problem solving
  - Testing, prototyping, demonstrators
  - Production
  - Market introduction
  - Learning
- In practice, in many cases the different stages are not linear or sequential
- Linkages and relationship between the different functions and actors are extremely important
- Models can be used to 'standardise' the new product development process

## Model of a Standardised New Product Development Process (I)



Source: adapted from Kleinschmidt, Geschka and Cooper 1996, 52

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## Model of a Standardised New Product Development Process (II)

### Idea finding

### Milestone 1: pre-selection:

- Must and should criteria

### Step 1: pre-analysis (quick, low cost, qualitative):

- Market
- Technique / Technology
- Cost

### Milestone 2: release detailed analysis:

- Must and should criteria from milestone 1
- Rough economical calculation

### Step 2: detailed analysis:

- Detailed market analysis
- Legal judgment
- Detailed technical analysis
- Project establishment
- Product definition
- Project plan
- Rough Business Plan

### Milestone 3: project decision:

- Quality check of preceding activities
- Refined must and should criteria
- Release product definition
- Release action plan for the next step

### Step 3: development:

- Product development
- Test plan and marketing plan
- Cost analysis
- Market analysis and customer feedback

Source: adapted from Kleinschmidt, Geschka and Cooper 1996, 52

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## Model of a Standardised New Product Development Process (III)

### Milestone 4: product release

- Quality check of preceding activities
- Cost and economical analysis
- Release action plan for the next step

### Step 4: testing and production preparation

- Complete cost, economical and financial analysis
- Internal usage test
- Customer test
- Pilot production
- Selling test
- Implement the systems for production control and logistic
- Business Plan

### Milestone 5: market readiness

- Quality check of preceding activities
- Detailed economical and financial criteria
- Release action plan for the next step

### Step 5: initial production & market introduction

- Execution of the plan
- Start routine production
- Storage in the logistic system
- First selling

### Project analysis:

- Planned/actual comparison
- Critical examination of overall project

### Review

Source: adapted from Kleinschmidt, Geschka and Cooper 1996, 52

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