

*OECD Workshop, June 30 - July 1, 1997*

---

## **Modelling innovation and learning in SMEs**

**David Brown\***

**Arthur D. Little, Cambridge, UK**

**Jan Cobbenhagen**

**MERIT, Maastricht, NL**

*\*Formerly: WRI/CSME, Warwick Business School, UK*

# Policy aims




---

- ◆ Promotion of innovation, especially in SMEs, for diverse economic and social reasons
- ◆ Hence
  - attempts to identify target groups of firms
  - instruments to grow the market for consultancy / advice to SMEs
  - development of tools and programmes at national, EU, regional, sectoral, private levels
  - reviews of previous efforts
- ◆ But limited success - **why?**
  -

–

# Innovation in SMEs: Difficulties

---

- ◆ Information
- ◆ Reluctance to engage outside help
- ◆ Financing
- ◆ Short timescales
- ◆ Risk
- ◆ “Tomorrow as well as today”
- ◆ Understanding
  - Large firms:  High tech SMEs:  Most SMEs: 
- ◆
- ◆
- ◆

# Why is it important to understand innovation processes in SMEs?

---

- ◆ See where and how specific IMTs have their effect
- ◆ Identify gaps in provision
- ◆ Design new / better IMTs
- ◆ Target the right firms with the right support
  - achieve ‘best fit’ between tool / advisor / firm
- ◆ Improve advisor / consultant capability
- ◆ Deploy public resources in alignment with policy aims
- ◆ Understand the key role of the entrepreneur / innovation champion

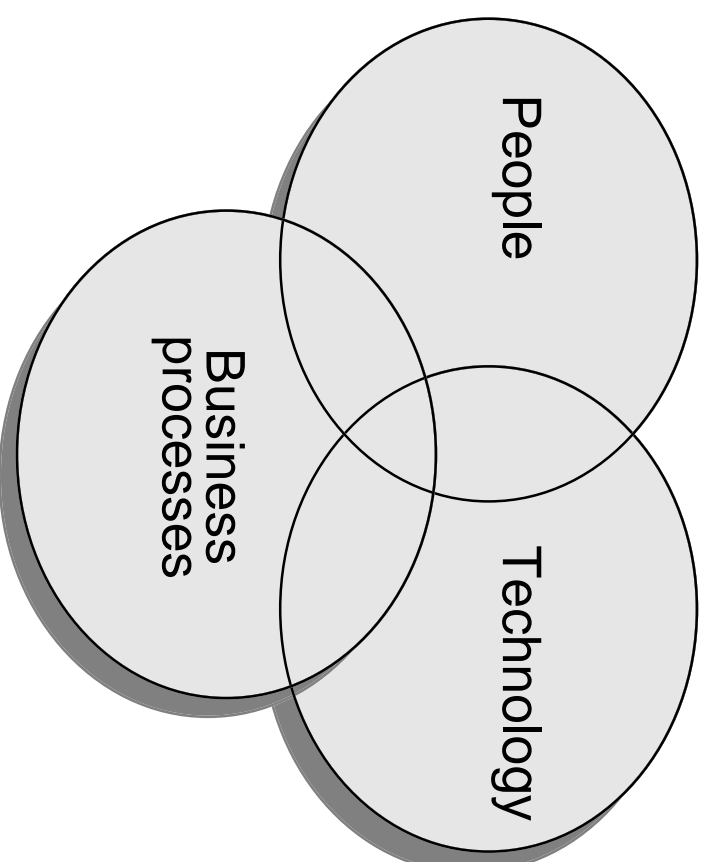
# Innovation in SMEs

---

*Innovation is not, primarily, about technology. It is about people, culture, and communication.*

# An integrated approach

---



## Fields to draw from....

---

- ◆ The business process paradigm
- ◆ Product and process innovation research
  - especially in manufacturing
- ◆ Learning research
- ◆ ‘Routines’ concepts
- ◆ Past experience
  - e.g. MINT programme, national schemes
- ◆ Case studies to test the model

# Innovation in smaller firms

---

- ◆
- ◆ Doing new things
- ◆
- ◆ Doing things in new ways
- ◆
- ◆ What are we doing it for?

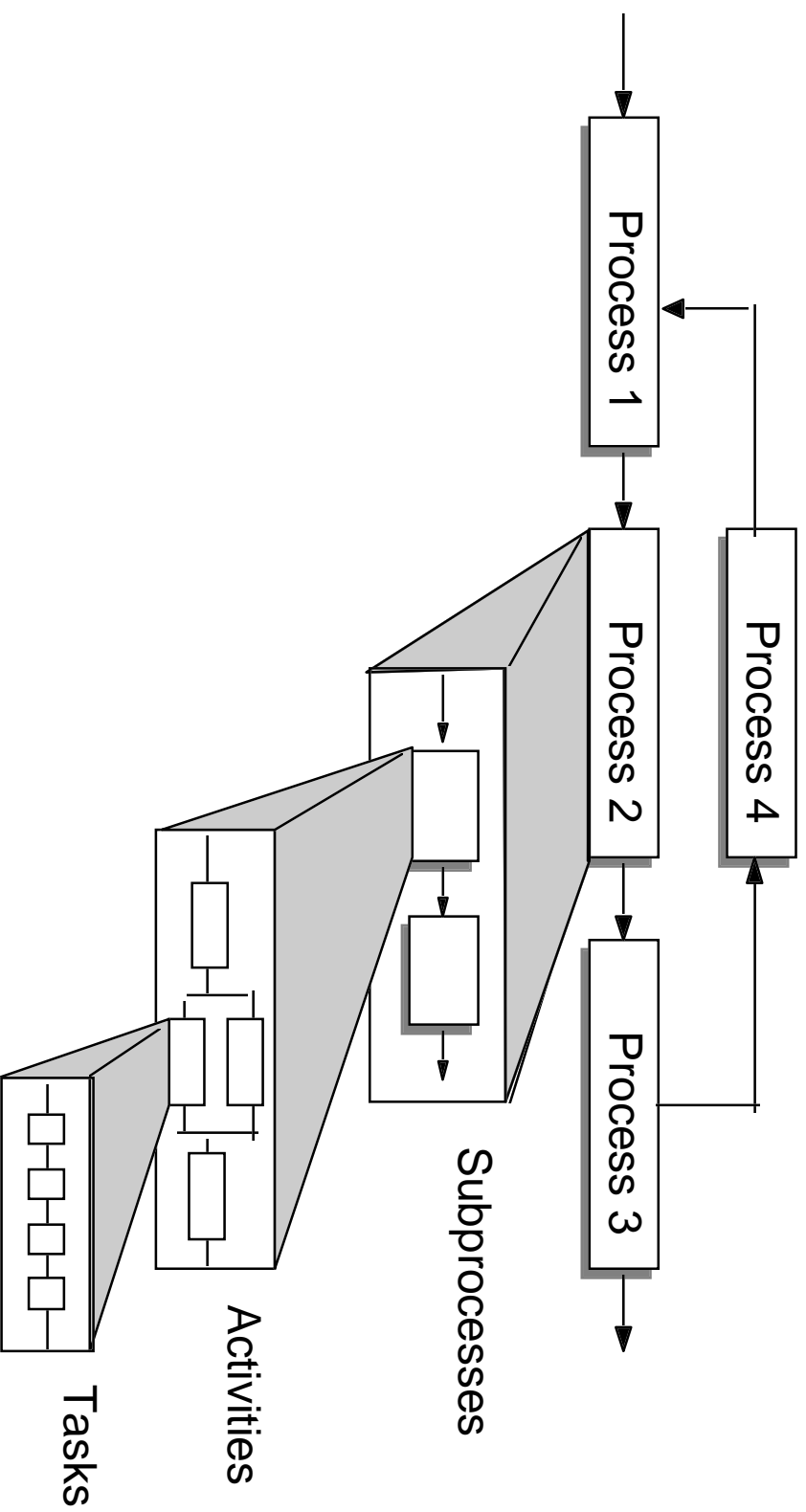
# Doing new things

---

- ◆ Identify and scope new market opportunities
- ◆ Conceive new products / services
- ◆ Apply R&D
- ◆ Design
- ◆ Product development
- ◆ Process development
- ◆ Prototyping, testing, trial marketing
- ◆ ‘Productionise’

# The business process hierarchy

---



(after Harrington, 1991)

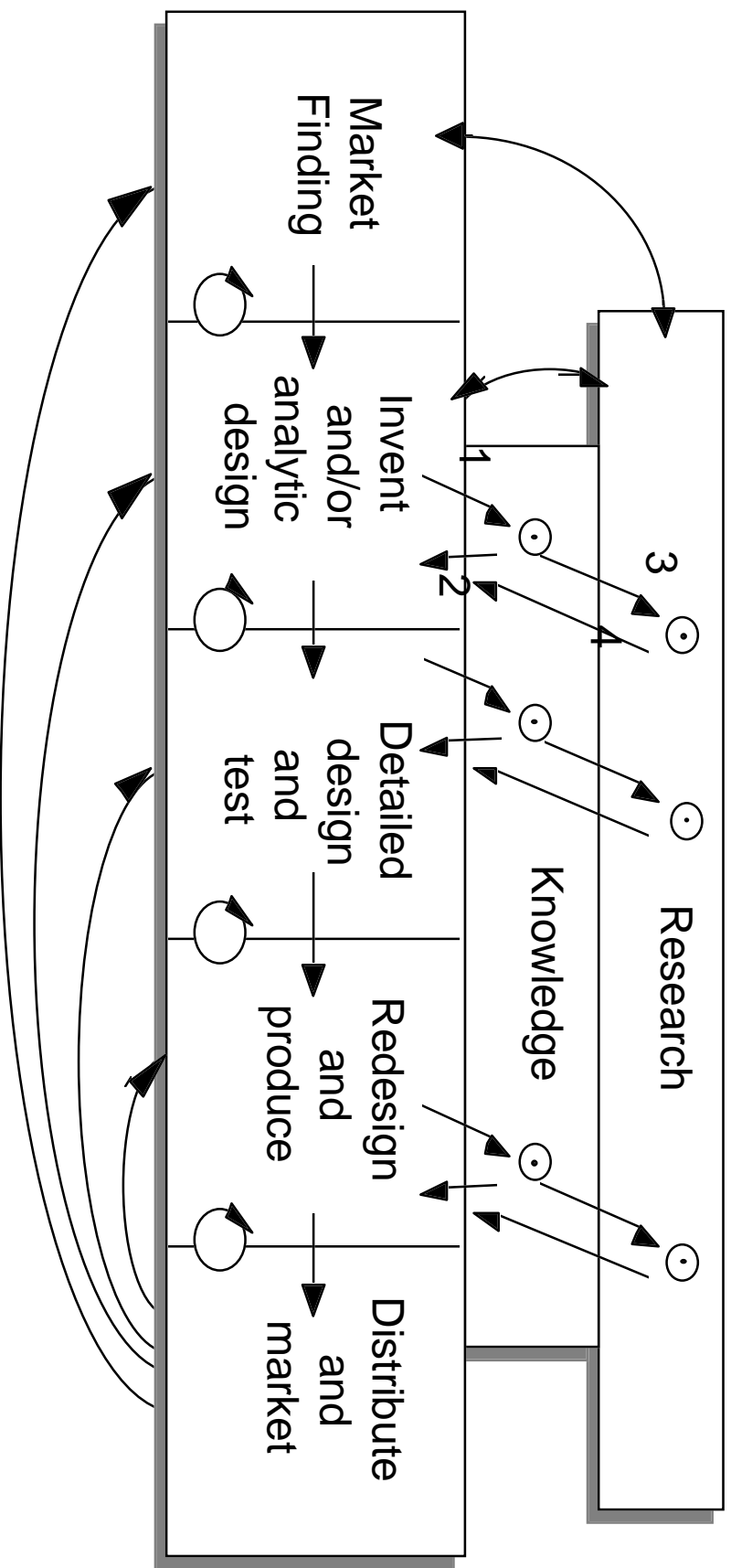
# Chiesa et al: technical innovation in manufacturing firms

---

- ◆ Audit based on a process model of technical innovation
- ◆ Core processes:
  - concept generation
  - product development
  - process innovation
  - technology acquisition
- ◆ Enabling processes
  - resources
  - systems and tools
  - leadership

# The Chain-linked model of Innovation

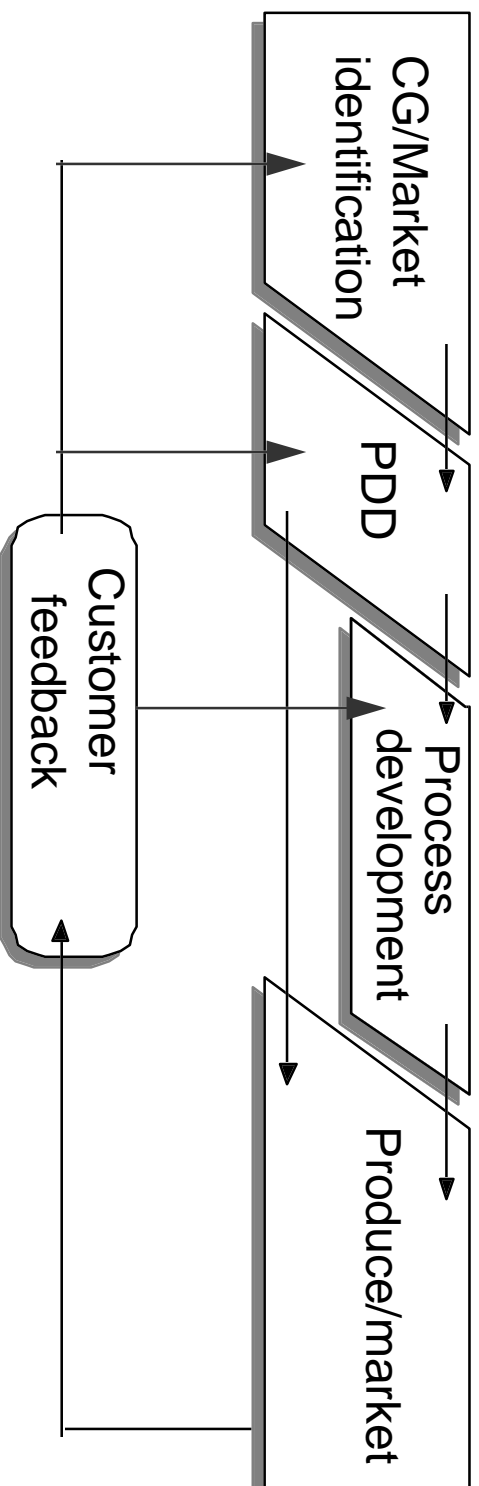
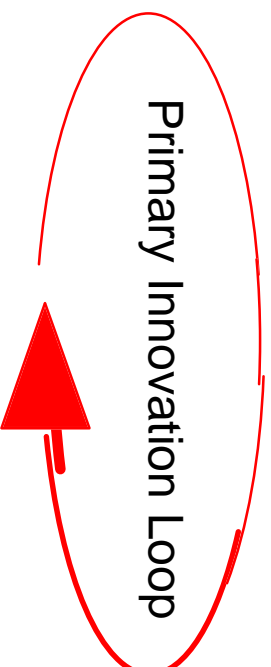
---



(Source: Kline, 1985)

# The primary innovation loop

---



CG = concept generation    PDD = product design & development

# Innovation in smaller firms

---

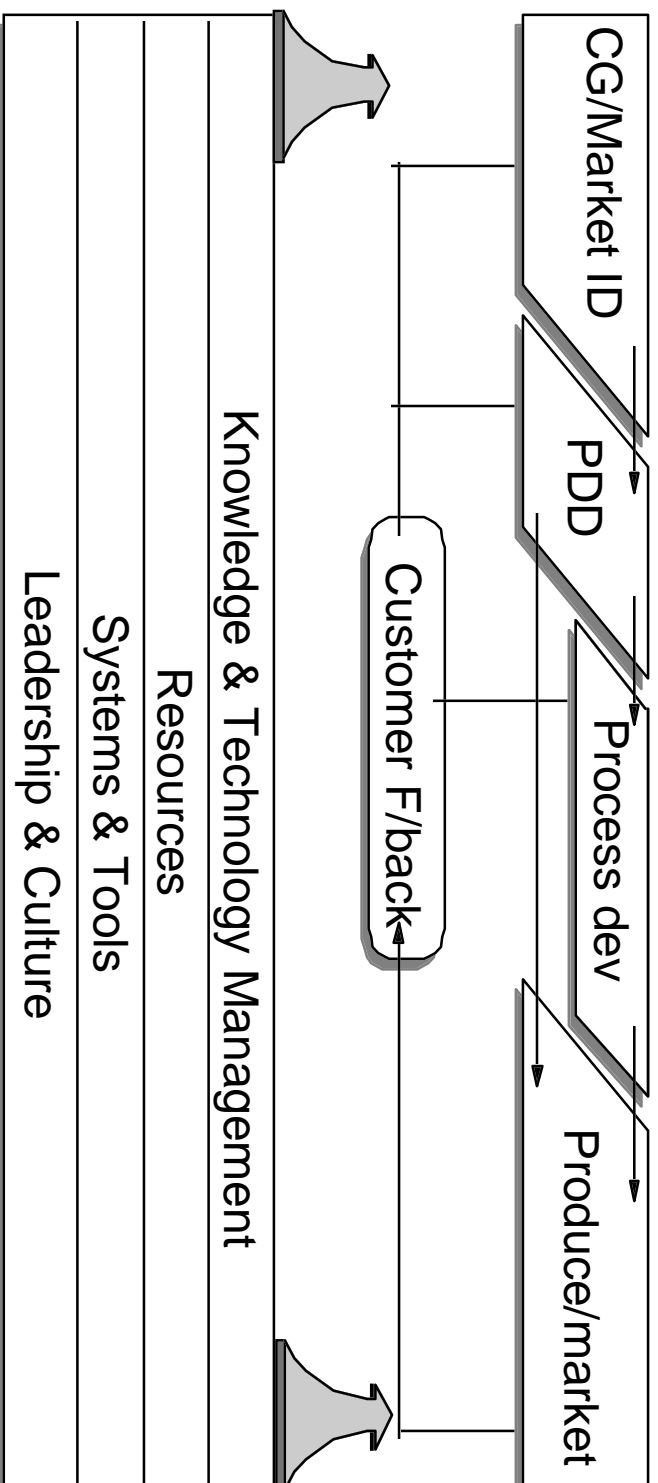
- ◆
- ◆ Doing new things
- ◆
- ◆ *Doing things in new ways*
- ◆
- ◆ What are we doing it for?

# Doing new things: the primary innovation loop

- ◆ Describes processes of product / process conception, development and marketing
- ◆ Enabled by:
  - knowledge and technology management (searching for, accessing, screening, internalising knowledge from outside, or identifying/developing it internally)
  - human and financial resources
  - systems and tools
  - leadership, direction and climate
- ◆ Doing the same sort of thing - but better, faster, more efficiently, more effectively

# The primary innovation loop

---



CG = concept generation    PDD = product design & development

## Doing things in new ways: the learning loop

- ◆ Need to do more than cycle round the primary loop faster and faster
- ◆ Routines as the 'genes' of an organisation
  - 1 - short term behaviour (operating characteristics)
  - 2 - augmentation of firm's capability over time
  - 3 - modifiers - allowing other routines to change
- ◆ Routines must be matched to the changing external environment
- ◆ SMEs are often focused on class 1 routines and need to initiate / enhance a learning process
  - 'changing the rules of the game'
- ◆
- ◆
- ◆

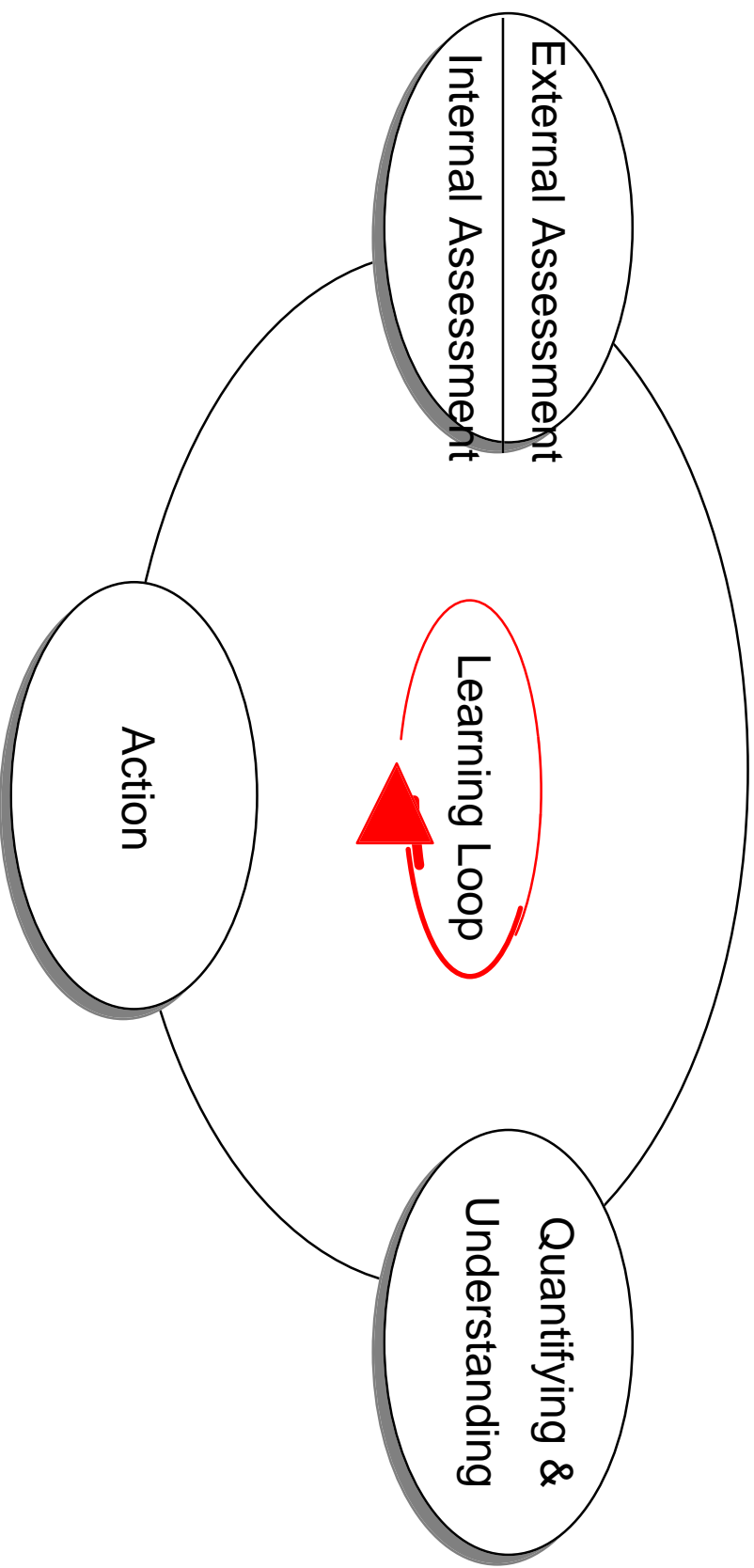
# A learning process

---

- ◆ **External position assessment**
  - benchmarking against external comparators, ‘best practice’, technology impact, business environment
- ◆ **Internal position assessment**
  - strengths & weaknesses, competences, skills, knowledge, technologies, resources, aspirations
- ◆ **Quantify and understand**
  - e.g. business process maps, risk analysis, route mapping, financial analysis
- ◆ **The primary innovation process can be seen as the ‘action’ step in a larger loop**

# The learning loop

---



# Innovation in smaller firms

---

- ◆
- ◆ Doing new things
- ◆
- ◆ Doing things in new ways
- ◆
- ◆ *What are we doing it for?*

# Redefining the mission: the strategic loop

- ◆ Goals of the firm



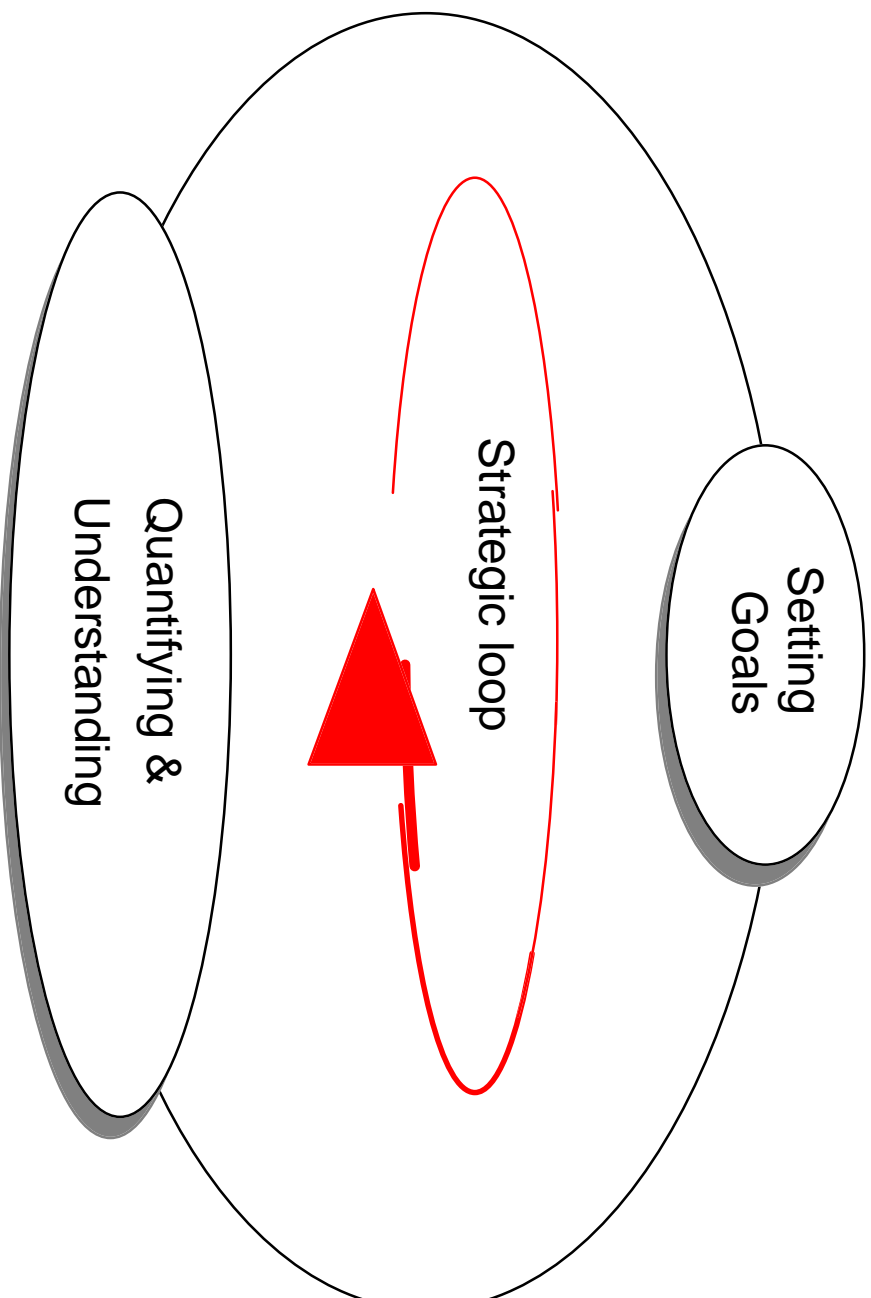
aspirations of the entrepreneur / owner

- ◆ Mission
- ◆ Strategy
- ◆ Strategic loop as the initiator for culture change
- ◆

*Then translate goals into clearly understood, quantifiable objectives*

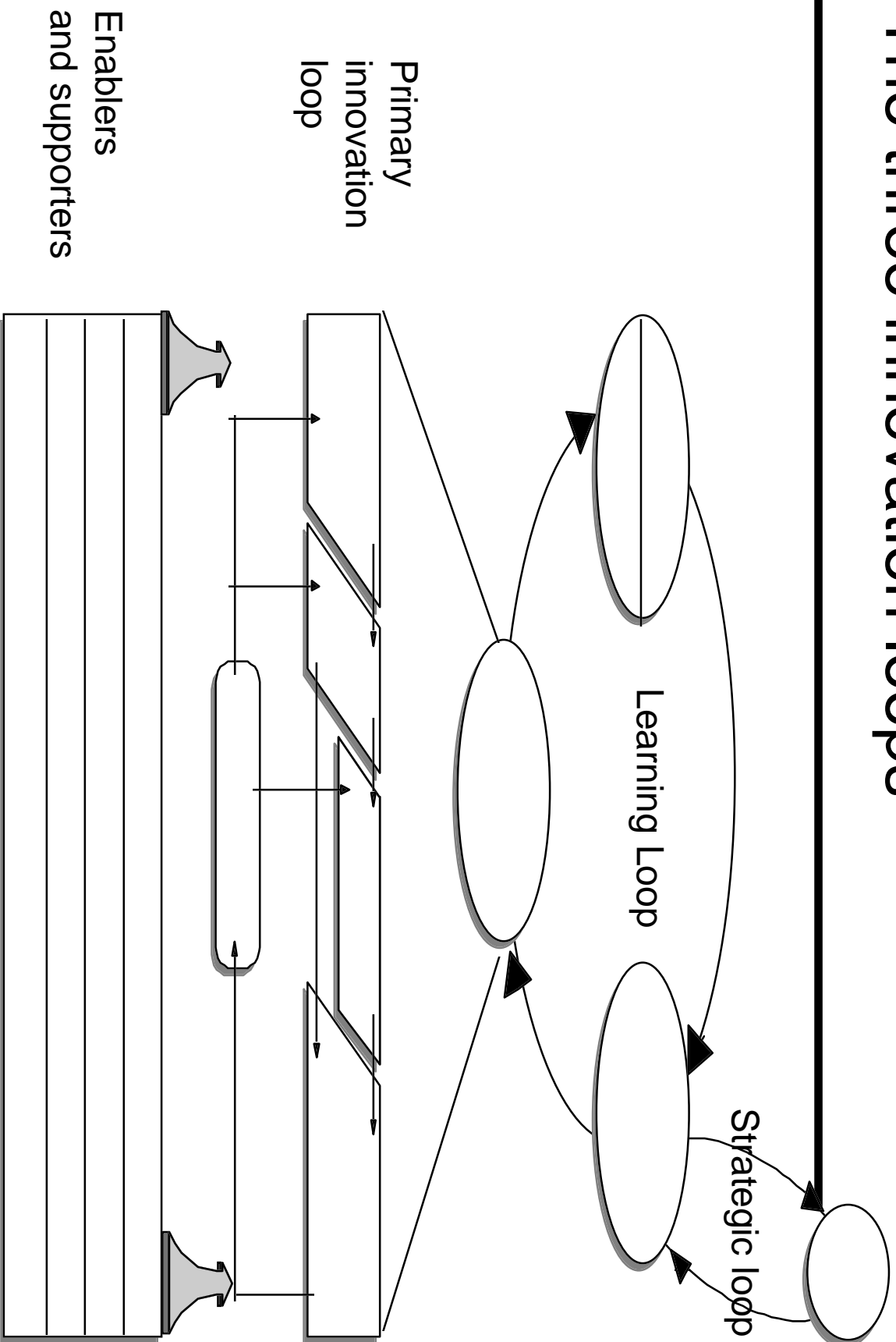
# The strategic loop

---



# The three innovation loops

---



## What can we do with the model?

---

- ◆ See where particular IMTs impact on innovation processes
- ◆ See where programmes such as MINT fit in - and why they inexorably move to a holistic view
- ◆ Link innovation climate and the Quality ethos
- ◆ Help develop a holistic understanding of company needs
- ◆ ... but understand priorities
- ◆ See what's different about a small firm

# Some IMTs in relation to the model

---

Methodology	SL	LL	CG	PD	PI	PM	EN
general diagnostic audits	X	X	X	X	X	X	X
benchmarking	X	X					
creativity methods	X		X				
focus groups	X	X	X				
customer surveys			X				
brainstorming	X	X	X	X			
market research tools			X				
SWOT analysis	X		X				
Quality audits		X				X	X
Quality system implementation				X	X	X	X
risk analysis		X		X	X		X
project selection tools				X	X		
project/programme management tools				X	X	X	X
critical path analysis				X	X	X	
computer aided design / manufacture (CAD / CAM)				X		X	X
computer-integrated manufacturing (CIM)						X	
Just-in-time manufacturing (JIT)						X	
statistical design & control methods							X
investm ent / financial analysis	X	X		X	X		
core competence analysis		X	X				
joint ventures / strategic alliances				X	X	X	
business / quality clubs		X	X	X	X	X	
business process reengineering		X	X	X	X	X	

## How small firms differ from big ones

---

- ◆ *Strategic loop*: Goals are complex - often dependent on personal aspirations of the entrepreneur
- ◆ Need for external help at potentially all stages of the *learning loop*
- ◆ Cycling round the *primary loop* is discrete, not continuous
- ◆ Issues:
  - Limited resources / people / money / skills / knowledge / time
  - Short termism
  - Risk aversion
  - Some information channels more accessible/useful than others
- ◆ Hence, tools must cater for SMEs' specific situations

## What information channels are useful?

---

- ◆ Supply chain sources: customers, suppliers, competitors
- ◆ Trade media and exhibitions
- ◆ Learning from peers
- ◆ Less importance attached to consultants, public sector, universities
- ◆ IMTs should help firms key into information channels based on supply chains, local networks, industry sectors, etc
- ◆ But: are firms learning sufficiently from other sectors?

# Risk: a key issue in SME innovation

---

- ◆ Risks greater for smaller firms
  - partly due to limited access to information; finance; management / technology skills
- ◆ Stakes are high & consequences severe
  - only one chance: failure may prejudice survival
  - personal assets at stake
- ◆ Result - high risk aversion
- ◆ Exacerbated by supply chain pressures
- ◆ Reducing the risk
  - early tangible results give confidence for larger changes
  - incremental, not just radical, change
  - new product process in a small firm
  - 'intelligent friend of the business'
  - mentoring

# The four growth strategies

---

	Existing products	New products
Existing markets	Market penetration <b>1</b>	New product development <b>4</b>
New markets	Market extension <b>2</b>	Diversification <b>16</b>

# Innovation management tools (IMTs)

---

- ◆ Types:
  - Generic diagnostic, auditing & benchmarking tools
  - Tools to address specific themes / technical issues
  - Facilitated or D.I.Y.
- ◆ Use:
  - Short intervention: typically 1-5 days advisor time
  - Quickly demonstrate value of *external advice*
- ◆ Resources:
  - Cheap in time & cost - but MD/CEO commitment vital
- ◆ Approaches:
  - Graphical visualisation; questionnaires; workshops; consultant assessment; creativity/visioning; etc
  - Flexibility is important: don't stifle the advisor

# Diagnostic tools - some cautions

---

## *Do*

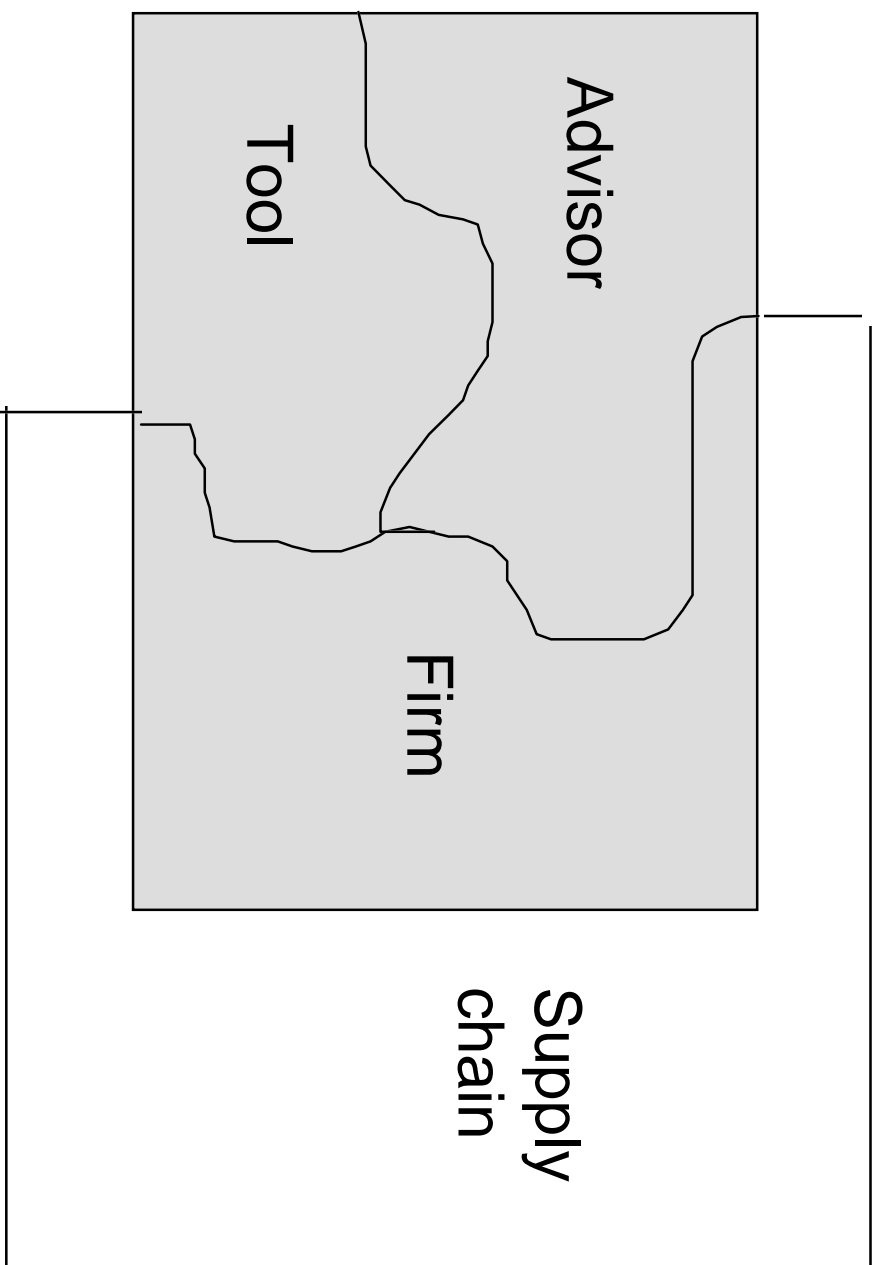
- recognize how information gets to SMEs
- look for 'best fit: advisor / tool / firm
- ensure learning is embedded in the firm
- provide for implementation & follow-up
- use a facilitator

## *Don't*

- lapse into business school jargon
- try and be all things to all men
- assume large-firm models of best practice fit SMEs

# 'Best fit'

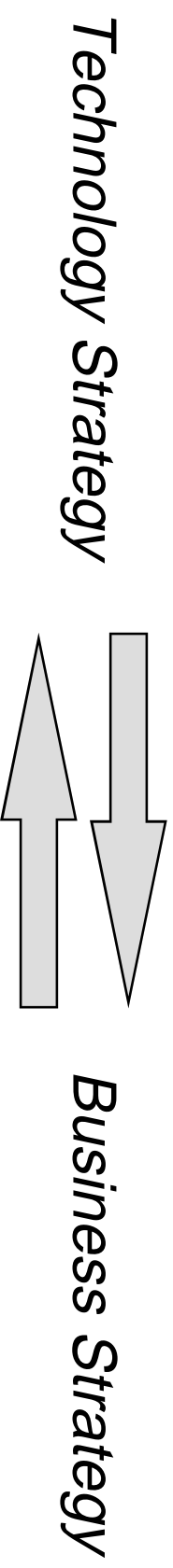
---



## What diagnostic tools can achieve

---

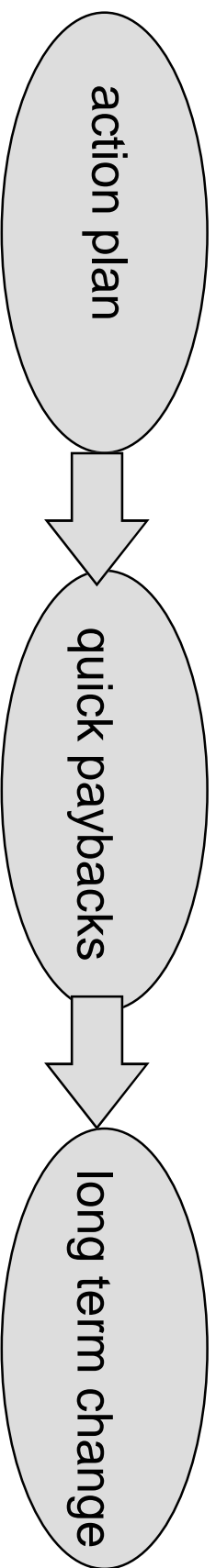
- ◆ Rapid but wide-ranging 'health check'
  - assessment based on views of the firm's own staff
- ◆ Identify issues for attention / concern
- ◆ Highlight and probe areas of disagreement
- ◆ Encourage dialogue within firm
- ◆ Benchmark practices / performance (firms or sectors)
- ◆ Emphasise people, culture and communication
- ◆ Encourage strategic thinking - with a dual perspective:



## The link to action

---

- ◆ *Enthusiasm diminished as the diagnosis led inexorably towards action...*
- ◆ Diagnosis must lead to a plan of action
- ◆ Start a process:
  - early tangible paybacks build trust and confidence for long term change



.....Then revisit and measure progress

## Some selected IMTs

---

- ◆ ADVIA (Denmark/Belgium)
- ◆ Technology Clinics (Finland)
- ◆ TEKES MINT methodology (Finland)
- ◆ ANVAR diagnosis (France)
- ◆ APPRODI training/action (France)
- ◆ Innovation Factor Analysis (Germany)
- ◆ EOMMEX diagnosis (Greece)
- ◆ Strategic, quality and business process consultancy (Iceland)
- ◆ Forbairt diagnosis (Ireland)
- ◆ Quality management audit by Innovare (Italy)
- ◆ Product / Market / Technology Scans (Netherlands)
- ◆ BUNT/FRAM (Norway/Austria)
- ◆ VISÃO (Portugal)
- ◆ Value analysis for technological diagnosis (IAT) (Spain)
- ◆ Technological diagnosis (DT-PYMES) (Spain)
- ◆ The STIN analysis (Sweden)
- ◆ The Pera Profile diagnosis (UK)
- ◆ PROBE (UK/Germany)

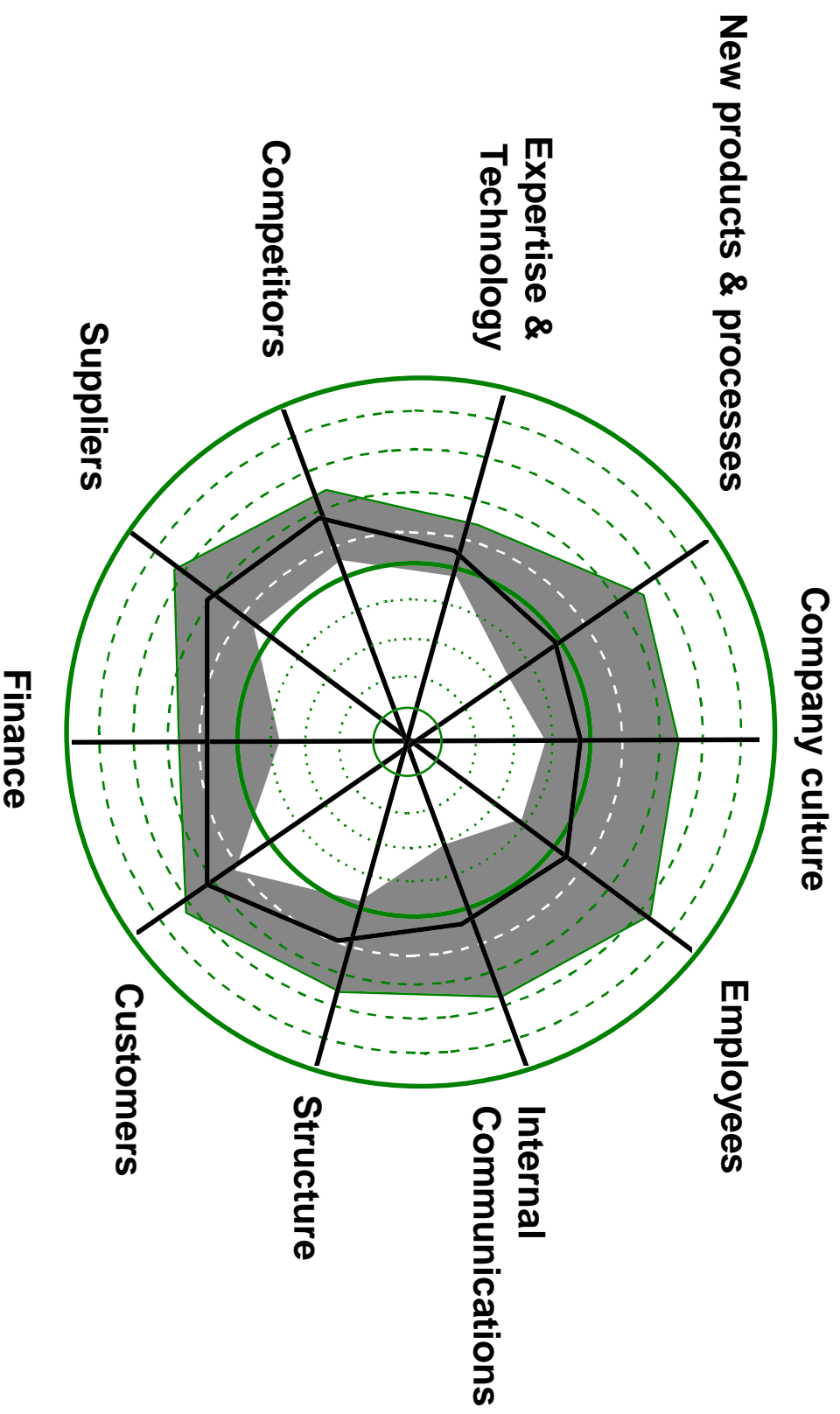
## Some families of IMTs

---

- ◆ Graphical visualisation - STIN
- ◆ Questionnaire based - Probe/Microscope, Pera Profile, Business Excellence models
- ◆ Workshop-based - Innovation Factor Analysis, Product/Market/Technology Scan
- ◆ Guidelines for consultant assessment - Forbairt MINT method
- ◆ Customer focus - Making It Pay
- ◆ Tool-kits - BUNT
- ◆ Networking - 'clubs', FRAM
- ◆

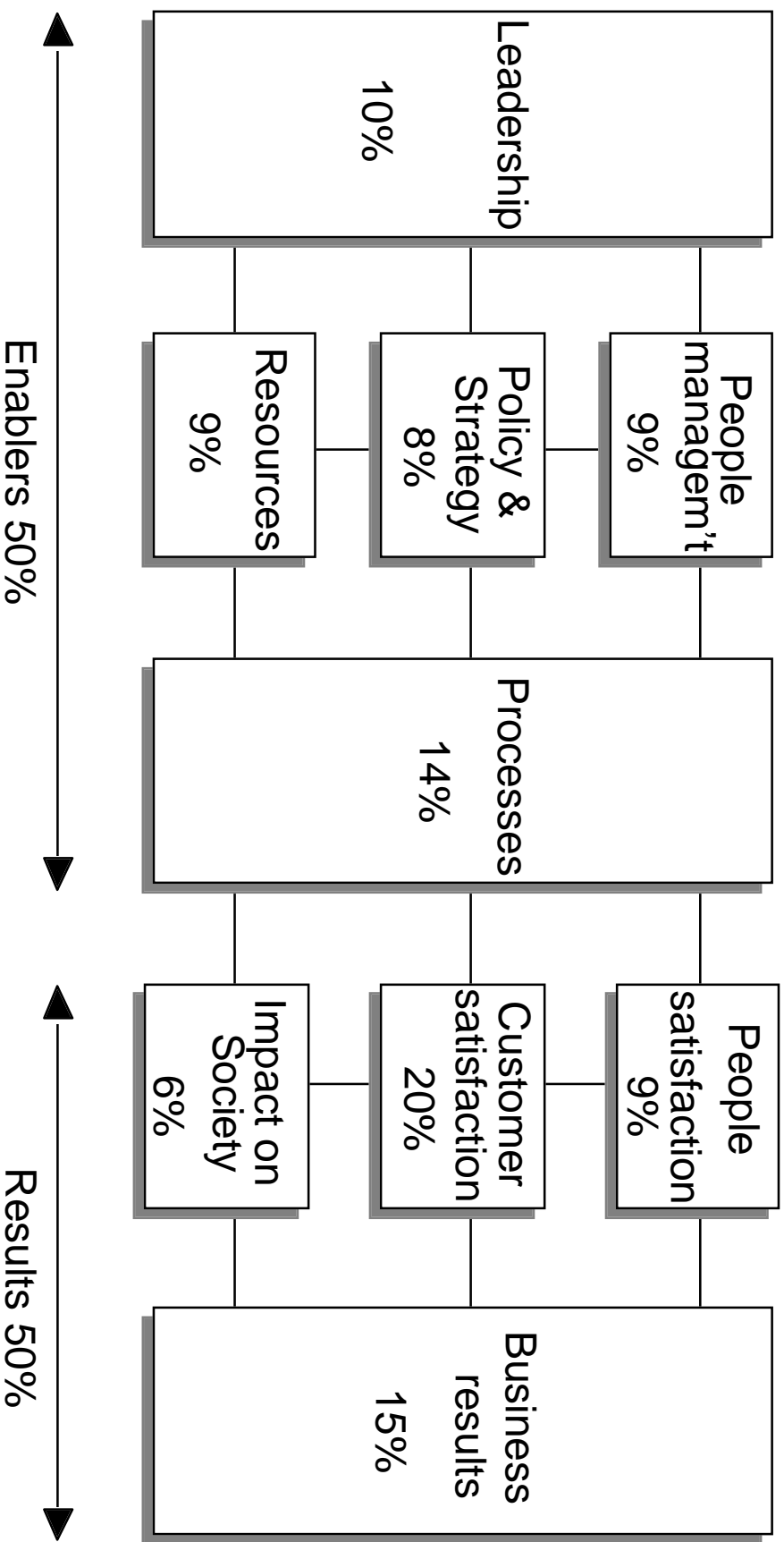
# An innovation diagnostic

---



# The EQA Business Excellence Model

---



# Good practice - tool design

---

- ◆ Founded on an open, objective model
- ◆ Simplicity and clarity in presentation & data collection
- ◆ Best fit to company situation, with clear objectives
- ◆ Compares with best practice in & beyond industry sector
- ◆ Flexible - complements, doesn't stifle creativity
- ◆ Collects basic information / expectations beforehand
- ◆ Balances comprehensiveness + time (e.g. via PC tool)
- ◆ Includes time perspective
- ◆ Consults cross-section of firm
- ◆ Uses discrepancy information
- ◆ Includes action planning step
- ◆ Linkages to other tools / steps
- ◆ Sets success criteria
- ◆ Facilitates learning by firm
- ◆ Provides for mandatory follow-up

## The added value of the advisor

---

- ◆ CEO / staff take assignment seriously
- ◆ Forces issues into the open: no place to hide
- ◆ Promoting dialogue and wide staff involvement
- ◆ Interpreting findings in relation to best practice
- ◆ **Action planning and implementation**
- ◆ Co-opt and orchestrate other support
- ◆ Follow-up
- ◆ **‘The business doctor’**

## Good practice: advisor characteristics

---

- ◆ Foundation - trust & mutual respect
- ◆ Sector knowledge + consultancy skills + training
- ◆ Comprehensive tool-kit
- ◆ Access to networks of support / capability
- ◆ Gets CEO commitment - imperative
- ◆ Firm's own assessment, not just the advisor's view
- ◆ Supplement by own observation
- ◆ Interactive analysis with a representative team
- ◆ Adds insights from other sectors/ management thinking
- ◆ Tenacity - lead firm to action; signpost to further support
- ◆ Sustained contact and follow-up
- ◆ 'The consultant as business doctor'

## The state of the tool-kit: diagnostic tools

---

- ◆ Good on strategy, process & product development
- ◆ Less good on human resources & organisation
- ◆ Stronger on *analysis* than *planning* & *action*
- ◆ Little provision for microenterprises
- ◆ Wide employee participation brings big gains
- ◆ Discrepancy information invaluable
- ◆ Advisor / facilitator adds much value
- ◆ Common good practice principles for tool design and selection and for use by advisors
- ◆

# The state of the tool-kit: deficiencies of existing tools

---

- ◆ Diagnostic tools too general - need tailoring to specific company types / needs
- ◆ Jargon and inappropriate wording for small firms
- ◆ Other tools over-concentrate on aspects of primary loop
- ◆ Major weaknesses - **implementation & follow-up**
- ◆ Short term involvement: lack of sustained contact with client firms
- ◆ Based on big-firm models
- ◆
- ◆
- ◆

# Segmentation

---

## ◆ EIMS study:

- 1 New technology based SMEs
- 2 Niche market differentiators
- 3 Technological leaders
- 4 Joint developers
- 5 Efficient classical subcontractors
- 6 Resilient SMEs
- 7 Would-be reactive SMEs
- 9 Barely surviving SMEs

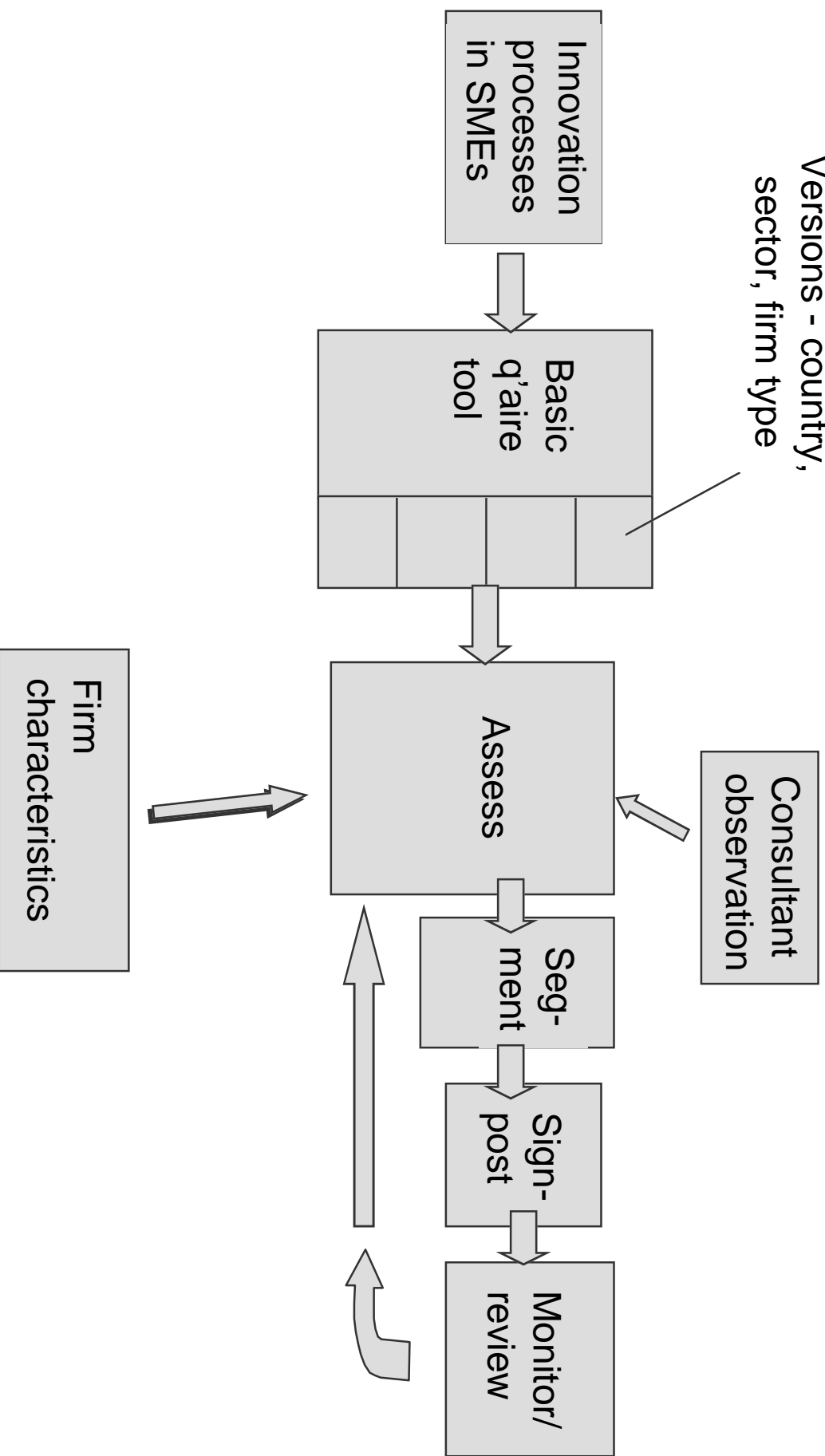
## ◆ Cf Pavitt, Chiesa et al:

- Science based - technology acquisition
- Scale intensive - process innovation
- Information intensive - product development
- Specialised supplier - product development

# Towards new generation tools

---

Versions - country,  
sector, firm type



## Some directions for the future

---

- ◆ Understand how innovation processes in SMEs differ from those in large firms. Then:
  - ◆ Modify / redesign tools for SMEs
  - ◆ Make them accessible / affordable
    - codify
    - facilitated self-help methods
    - work with groups of firms
    - informal mentoring
  - ◆ Fill gaps in coverage
  - ◆ Promote longer term involvement
  - ◆ Link diagnosis and learning to action planning, implementation and follow-up
- ◆

## Some directions for the future (2)

---

- ◆ Better segmentation of SMEs according to type and needs
- ◆ Link firms into the most appropriate information channels
- ◆ Promote networks, especially for small firms
- ◆ Focus on risk reduction
- ◆ Incremental as well as radical innovation
- ◆ Stronger role for RTOs
- ◆ Better networking among consultants / advisors
- ◆

# Case studies

## The risk reducer: Paraid

---

- ◆ Small engineering firm, Birmingham, originally making paraplegic aids
- ◆ MD ex-finance director of parent firm
- ◆ Old premises, limited space, disadvantaged area
- ◆ Desire for steady growth but limited capital
- ◆ How to predict, anticipate and overcome bottlenecks?

## The risk reducer: Paraid

---

- ◆ Business Link support for consultancy on batch production and likely bottlenecks
- ◆ Consultant help to plan expansion and secure grant support - subject to financial and jobs targets
- ◆ Strategic review of firm - 'sounding board' for MD
- ◆ Strong product strategy
  - Gradual market shift responding to regulatory changes
  - Mix of licensed & in-house products
- ◆ Extra jobs allowed manufacturing director to undertake new product development work
- ◆ Mentoring by design engineer

# The risk reducer: Paraid's success factors

---

- ◆ *Organisational and technological change*
- ◆ External consultant well chosen & well used
  - Won trust by quick tangible results
  - Broad background -> strategic view
  - Sustained informal contact
- ◆ Grant support tied to clear objectives
- ◆ Balanced new product strategy
  - Clear market focus
  - Product licensing for UK / European markets
  - In-house products complement licensed products
- ◆ Mentoring
- ◆ Culture change: ISO9000; role of business plan

## The networker: Veeder-Root

---

- ◆ Manufacturer / supplier of tank gauges, now owned by Danaher Corp., USA
- ◆ Site at Market Harborough, UK - Operations Director & 30 staff
- ◆ 2 problems following acquisition
  - Health & Safety Inspectorate approval - urgent need for Quality system
  - Overstocking due to poor stock control and long freight times

# The networker: Veeder-Root

---

- ◆ Training at research & technology organisation leading to fast track to ISO9000
- ◆ Stock problem stimulated wider review
- ◆ Use of parent company TQM expertise
- ◆ Use of Japanese quality experts (US tour)
- ◆ IT and air freight to reduce stocks
- ◆ Cellular manufacturing, kaizen -> Culture change
- ◆ Stream of process improvements, product changes
- ◆ T/O +44%, process times -40%, delivery times 8 weeks to 2 days, stock & WIP £1.3m to £0.36m.

## Veeder-Root: success factors

---

- ◆ Top level commitment and example
- ◆ Use of parent company and external expertise
- ◆ Continuous improvement (CIRCA) and quality clubs
- ◆ Involvement of *all* staff including juniors
- ◆ Suggestions welcomed, actioned, funded
- ◆ Competition entries as stimulus
- ◆ Personnel flexibility
- ◆ Asking questions, talking to people outside the firm, harvesting ideas
- ◆ Many small improvements = major performance gain