

WEB RESOURCES

The term ‘tool’ can be interchangeably used with ‘techniques’, ‘procedures’, ‘processes’, ‘models’, ‘maps’ and ‘frameworks’. Naturally, there are many tools managers use in dealing with TM. However, the main set of tools for carrying out TM activities might be from different tool categories such as: auditing tools, business creation tools, creativity techniques, decision-making tools, forecasting and intelligence techniques, knowledge management, marketing tools, problem-solving tools, project management tools, strategy tools, and TQM tools.

As there are a wide range of resources available in rich formats, this section aims to point to some useful references so that the reader can obtain more detailed information on topics of interest to them.

The major source to gain a good grasp of tools is books dedicated to management, such as strategy management or project management. Another source is the wide range of materials available over the internet, prepared either by professional organizations such as EU-funded research projects or by open source communities such as Wikipedia. Given that internet sources are increasing every day, the information presented below is not exhaustive but is a representation of the major resources that any manager dealing with TM might benefit from learning about. Additional sources are listed and updated regularly at the internet site of this book.

EU SOURCES

EU framework programmes are generating many rich sources in the field of innovation, technology and knowledge management. Some of them are more relevant to TM than others.

Three examples will be given here to illustrate the case.

1 European Commission (2006) *InnoSupport: Supporting Innovation in SMEs*, Brussels, www.innosupport.net. This study presents tools in 10 distinct categories:

- ▶ *How to identify the innovation needs of a business problem:*
 - audit tools (technology audit)
 - SWOT analysis

- ▶ *How to specify the innovation needs of a business problem:*
 - black box method
 - system and process analysis

- ▶ *Tools for developing innovative solutions:*
 - foundations of generating ideas
 - brainstorming
 - 635-method
 - analogical reasoning
 - attribute listing
 - knowledge management
 - systemic management of internal innovative proposals

- ▶ *Evaluation of innovative solutions:*
 - decision-making process
 - point rating system
 - benchmarking process

- ▶ *Innovative production strategies:*
 - new product development methods
 - rapid prototyping and product testing strategies
 - production strategies
 - recycling strategies

- ▶ *How to protect innovations and intangible assets:*
 - IP protection tools
 - international regulations
 - non-disclosure agreements
 - IP management strategy

- ▶ *Financing innovation:*
 - business plan development for innovative products and services

- ▶ *Marketing of innovation:*
 - optimizing and controlling the acceptance of an innovative product/service
 - use of media to support innovation
 - competencies of internet presentation and research

- ▶ *HRM policies to support innovation:*
 - HR competence requirements for innovations
 - introduction
 - identifying training needs for innovation in SMEs
 - creating a company culture for continuous innovation

- ▶ *Innovation networks*
 - introduction
 - what: what are innovation networks?
 - why: advantages vs. disadvantages of innovation networks
 - where: utilization areas of innovation networks
 - how: ideas of how to build up innovation networks
 - examples and best case of innovation networks
 - example of a complete region acting as an innovation network
 - resources.

2 European Commission (2004) *Innovation Management and the Knowledge-driven Economy*, Brussels. This presents tools in the following categories:

- ▶ *Knowledge management tools:*
 - knowledge audits
 - knowledge mapping
 - document management
 - IPR management

- ▶ *Market intelligence techniques:*
 - technology watch
 - patent analysis
 - business intelligence
 - customer relationship management
 - geo-marketing

- ▶ *Cooperative and networking tools:*
 - groupware
 - team building
 - supply chain management
 - industrial clustering

- ▶ *HRM techniques:*
 - teleworking
 - corporate intranets
 - online recruitment
 - e-learning
 - competencies management

- ▶ *Interface management approaches:*
 - R&D marketing
 - interface management
 - concurrent engineering

- ▶ *Creativity development techniques:*
 - brainstorming
 - lateral thinking
 - TRIZ (theory of inventive problem solving)
 - SCAMPER
 - mind mapping

- ▶ *Process improvement techniques:*
 - benchmarking
 - workflow
 - business process re-engineering
 - just in time

- ▶ *Innovation project management techniques:*
 - project management
 - project appraisal
 - project portfolio management

- ▶ *Design management tools:*
 - computer-aided design systems
 - rapid prototyping
 - usability approaches
 - value analysis

▶ *Business creation tools:*

- ▶ business simulation
- ▶ business plan
- ▶ spin-off from research to market.

3 Cotec (1998) *Temaguide: A Guide to Technology Management and Innovation for*

Companies, Brussels: European Commission,. The list of tools includes:

- ▶ benchmarking
- ▶ change management
- ▶ continuous improvement
- ▶ creativity
- ▶ environmental assessment
- ▶ IPR management
- ▶ interface management
- ▶ lean thinking
- ▶ market analysis
- ▶ miscellaneous techniques
- ▶ networking
- ▶ patent analysis
- ▶ portfolio management
- ▶ project evaluation
- ▶ project management
- ▶ skills audit
- ▶ team building
- ▶ technology forecast
- ▶ value analysis.

UNIVERSITY SOURCES

Many universities and centres around the world offer useful information on different aspects of TM and management. As expected, innovation-oriented websites are popular. For example, in October 2008, the University of Brighton's Centre for Research in Innovation Management (CENTRIM) in the UK launched a new wikipedia for innovation (<http://centrim.mis.brighton.ac.uk/research/projects/innovationwiki>).

In order to best use the limited space in this book, only one university will be shown as an example of an information source dedicated to TM. The selected one is the Institute of Manufacturing at the University of Cambridge, Cambridge, UK. Its website (<http://www.ifm.eng.cam.ac.uk/research/ctm/ctmtools/>) has two catalogues that group tools relevant to TM:

- 1 The Management Tool Catalogue (T-Cat) contains more than 850 management tools and frameworks, predominantly of the 'matrix' or grid type, covering a wide range of management topics. The tools and frameworks are grouped together by topic, in sets of about 20. Each tool includes a brief description and reference. T-cat was developed by the Centre for Technology Management as part of an Engineering and Physical Sciences Research Council-funded programme, intended to support the application of strategic roadmapping methods. Table 14.1 shows the subcategories of tools and frameworks presented on the website.

Table 14.1 T-catalogue categories

<p>Technology management supporting technology management in the business, including portfolio, strategy, acquisition and R&D management</p>	<p>Innovation management supporting innovation management in the business</p>
<p>Knowledge management supporting knowledge management in the business, including learning and the management of IT systems</p>	<p>New product/service and process development supporting the management of the development of new products, services and processes</p>
<p>Business strategy supporting strategy development and deployment in the business</p>	<p>Management/business supporting general management in the business, including leadership, e-commerce, sustainability and globalisation</p>
<p>Marketing & customers supporting marketing, including customer, brand and product management</p>	<p>Behaviour, culture and HR supporting the management of behaviour, culture and human resources</p>
<p>Organisation & collaboration supporting organisational design, including collaboration</p>	<p>Change management, planning & projects supporting change management, including planning and projects</p>
<p>General problem solving supporting general problem solving and decision making</p>	

Source: <http://www.ifm.eng.cam.ac.uk/research/ctm/ctmtools/>

2 The Modelling and Decision Support Tools Catalogue contains tools for decision support presented in five categories:

- ▶ *information control*: gathering, storage, retrieval and organization of data, information and knowledge
- ▶ *paradigm models*: paradigms, frameworks or perspectives that help one ‘get a handle’ on the situation. Simulation models – models that enable answers to ‘What if?’ questions
- ▶ *ways of choosing*: techniques or tools that analyse or help to narrow the field of choice
- ▶ *representation aids*: tools and techniques that aid visualization of the data or problem space
- ▶ *processes*: these are not in themselves tools, rather, they are management techniques or philosophies. Their primary aims are to control some part of a manufacturing operation. They may also provide, or be based on, particular perspectives rather like the paradigm models above.

ACADEMIC BOOKS

1 Dorf, R. C. (1999) *The Technology Management Handbook* (Florida: CRC Press/IEEE Press). The book has 22 chapters and in each chapter there are many tools introduced in an ad-hoc manner; however, the section ‘Tools for the technology manager’ has the following specific tools:

- ▶ cash flow
- ▶ asset valuation methods
- ▶ capital budgeting
- ▶ risk management and assessment
- ▶ equity finance
- ▶ debt finance
- ▶ the nature of costs
- ▶ M&A
- ▶ pension funds
- ▶ real estate
- ▶ leasing
- ▶ sensitivity analysis
- ▶ life cycle costing
- ▶ financial ratios
- ▶ project analysis using rate-of-return criteria
- ▶ present worth analysis
- ▶ project selection from alternatives
- ▶ value focused thinking

- ▶ system models for decision making
- ▶ uncertainty
- ▶ decision analysis
- ▶ contracts
- ▶ patents, copyrights, trademarks and licenses
- ▶ IPR
- ▶ database
- ▶ decision support systems
- ▶ network management
- ▶ electronic commerce.

2 Tidd, J. and Bessant, J. (2013) *Managing Innovation: Integrating Technological, Market and Organisational Change*, 5th edn (Chichester: John Wiley). The publisher has a website (www.managing-innovation.com) designed for innovation management but it has useful tools that could be used for TM activities as well. The majority of the tools are also listed in the book:

- ▶ analogies
- ▶ Ansoff matrix
- ▶ balanced scorecard
- ▶ benchmarking to trigger innovation
- ▶ Boston matrix
- ▶ brainstorming
- ▶ business excellence model
- ▶ business process re-engineering

- ▶ cause and effect diagram
- ▶ change management
- ▶ change map
- ▶ checklist
- ▶ check sheets
- ▶ competence mapping
- ▶ competitiveness profiling
- ▶ continuous improvement
- ▶ continuous improvement: specific techniques
- ▶ creativity
- ▶ decision matrix
- ▶ design for manufacture/assembly
- ▶ discontinuous innovation audit
- ▶ five forces analysis
- ▶ force field analysis
- ▶ forecasting
- ▶ Gantt chart
- ▶ high involvement innovation audit tool
- ▶ innovation audit
- ▶ list reduction
- ▶ Malcolm Baldrige award
- ▶ market analysis tools
- ▶ Pareto analysis
- ▶ portfolio management tools

- ▶ post project reviews
- ▶ problem-solving cycle
- ▶ process flow diagram
- ▶ process models and quality management frameworks
- ▶ product life cycle analysis
- ▶ product/process matrix
- ▶ project evaluation tools
- ▶ project management tools
- ▶ quality function deployment
- ▶ risk assessment matrix
- ▶ stage-gate models
- ▶ strategic positioning
- ▶ supplier matrix
- ▶ supply chain management and learning
- ▶ SWOT analysis
- ▶ target costing
- ▶ team building
- ▶ technology portfolio model
- ▶ total (whole) life costing
- ▶ TRIZ
- ▶ value analysis
- ▶ value chain
- ▶ value stream analysis.

PROFESSIONAL ASSOCIATIONS' WEBSITES & PUBLICATIONS

Many professional associations have special services for their members and some of them are open to free access through the internet. One such example is the American Society for Quality (www.asq.org), one of the world's leading membership organizations devoted to quality. Although some tools are widely known for quality management, they can easily be used for TM activities, particularly for exploitation purposes. This argument might be understood better when the American Society for Quality's list is observed. According to the American Society for Quality, it is made up eight categories:

- ▶ *cause analysis tools*: tips and tools for the first step to improvement – identifying the cause of a problem or situation
- ▶ *evaluation and decision-making tools*: making informed decisions and choosing the best options with a simple, objective rating system, and determining the success of a project
- ▶ *process analysis tools*: how to identify and eliminate unnecessary process steps to increase efficiency, reduce timelines and cut costs
- ▶ *seven basic quality tools*: these seven tools get to the heart of implementing quality principles
- ▶ *data collection and analysis tools*: how can you collect the data you need, and what should you do with them once they're collected?
- ▶ *idea creation tools*: ways to stimulate group creativity and organize the ideas that come from it
- ▶ *project planning and implementing tools*: how to track a project's status and look for improvement opportunities
- ▶ *seven new management and planning tools*: ways to promote innovation, communicate information and successfully plan major projects.

COMMERCIAL COMPANY WEBSITES

Many consultancy companies operate in the field of technology and innovation management.

Three of them are given below to show the available resources:

1 Mindtools (www.mindtools.com) supplies the broadest coverage of management tools in a format that makes them easily read and understood. It lists five tool categories that are relevant to TM:

▶ *Creativity tools:*

- ▶ reversal – improving products or services
- ▶ SCAMPER – generating new products and services
- ▶ attribute listing – creating new products and services
- ▶ brainstorming – generating many radical ideas
- ▶ reframing matrix – generating different perspectives
- ▶ concept fan – widening the search for solutions
- ▶ random input – making creative leaps
- ▶ provocation – carrying out thought experiments
- ▶ DO IT – a simple process for creativity
- ▶ simplex – an integrated problem-solving process

▶ *Decision making:*

- ▶ Pareto analysis – choosing which changes to make
- ▶ paired comparison – working out relative importance
- ▶ grid analysis – making a choice balancing many factors
- ▶ decision trees – choosing by projecting possible outcomes
- ▶ PMI – weighing the pros and cons of a decision

- force field analysis – analysing pressures for and against change
- six thinking hats – looking at all points of view
- cost–benefit analysis – simple financial decision making

- ▶ *Problem solving:*
 - appreciation – extracting maximum information from facts
 - drill down – breaking problems down into manageable parts
 - cause and effect diagrams – identifying the causes of problems
 - flow charts – understanding process flows
 - systems diagrams – understanding the way factors interact
 - SWOT – strengths, weaknesses, opportunities and threats
 - cash flow forecasting – testing the viability of a project
 - risk analysis – managing the risks you face
 - Porter’s five forces – understanding power in a situation
 - PEST analysis – understanding the big picture
 - value chains – excellence in what really matters to customers
 - USP/unique selling proposition analysis – find your competitive edge
 - 5 whys – getting quickly to the root of a problem
 - affinity diagrams – organizing ideas into common themes
 - Ansoff matrix – understanding the different risks of different options
 - using the change curve – accelerating change, and improving project success
 - chunking – grouping information so it’s more easily understood
 - core competence analysis – get ahead, stay ahead
 - critical success factors – identifying the things that really matter for success

- impact analysis – identifying the unexpected consequences of a decision
- inductive reasoning – drawing good generalized conclusions
- the ladder of inference – avoiding jumping to conclusions
- reverse brainstorming – a different approach to brainstorming
- swim lane diagrams – mapping and improving organizational processes

- ▶ *Project management:*
 - Gantt charts – estimating time accurately, scheduling simple projects, planning and scheduling more complex projects
 - critical path analysis – planning more complex projects, a planning process for middle-sized projects, planning large projects and programmes
 - stakeholder analysis – winning support for your projects
 - action priority matrix – making the most of your opportunities
 - Ansoff matrix – understanding the different risks of different options
 - using the change curve – accelerating change, and improving project success
 - costing your time – understand the real value of your time
 - critical success factors – identifying the things that really matter for success
 - Lewin’s change management model – understanding the three stages of change
 - nominal group technique – prioritizing issues and projects to achieve consensus
 - project dashboards – quickly communicating project progress
 - RACI matrix – structuring accountabilities for maximum efficiency and results
 - bar charts
 - flow charts.

Software: MindManager: <http://www.mindjet.com/mindmanager/>

- 2 **DRM Associates and PD-Trak Solutions** (www.npd-solutions.com/bok.html#anchor2114450) has a rich subset of tools to be used for new product development. The website has grouped all knowledge related to new product development under one of five categories: strategy, organization, process, tools and design optimization, and technology.

- 3 **The Value Based Management.net** company (<http://www.valuebasedmanagement.net/>) presents all sorts of management theories, models and methods ranging from benchmarking to value mapping.

SOME USEFUL LINKS

Innovation specific sites:

<http://www.improve-innovation.eu>

<http://www.innosupport.net>

<http://www.innosupport.net/>

<http://www.openinnovation.eu/>

<http://centrim.mis.brighton.ac.uk/research/projects/innovationwiki>

Management specific sites:

<http://www.bain.com/publications/business-insights/management-tools-and-trends.aspx>

- o Balanced Scorecard
- o Benchmarking
- o Big Data Analytics
- o Business Process Reengineering
- o Change Management Programs
- o Complexity Reduction
- o Core Competencies
- o Customer Relationship Management
- o Customer Segmentation
- o Decision Rights Tools
- o Downsizing
- o Employee Engagement Surveys
- o Mergers and Acquisitions

- o Mission and Vision Statements
- o Open Innovation
- o Outsourcing
- o Price Optimization Models
- o Satisfaction and Loyalty Management
- o Scenario and Contingency Planning
- o Social Media Programs
- o Strategic Alliances
- o Strategic Planning
- o Supply Chain Management
- o Total Quality Management
- o Zero-Based Budgeting

TM-specific sites:

<http://www.ifm.eng.cam.ac.uk/research/ctm/ctmtools/>

- ‘Matrix’ tools and frameworks
- Decision support tools
- Decision support tools for design management
- New product development body of knowledge
- Value based management
- Innovation management
- Change management
- Continuous improvement
- Periodic table of visualisation methods
- Visualisation methods

http://www.nistep.go.jp/IC/ic071119/pdf/3-2_Park.pdf

<http://www.sandia.gov/PHMCOE/pdf/Sandia%27sFundamentalsofTech.pdf>

<http://www.ic.gc.ca/eic/site/trm-crt.nsf/eng/home>

Specific tool based sites:

QFD:

http://www.di.ufpe.br/~req_case/Seminarios/Prioridades/qfd.pdf

http://www.qfdi.org/what_is_qfd/what_is_qfd.html

<http://www.eod.gvsu.edu/eod/quality/quality-31.html>

<http://www.qfdonline.com/templates/qfd-and-house-of-quality-templates/>

<http://www.webducate.net/qfd/>

Balanced scorecard:

<http://www.balancedscorecard.org>

http://en.wikipedia.org/wiki/Balanced_scorecard

http://www.mindtools.com/pages/article/newLDR_85.htm

Core competence:

http://www.mindtools.com/pages/article/newTMC_94.htm

http://tutor2u.net/business/strategy/core_competencies.htm

http://en.wikipedia.org/wiki/Core_competency

<http://www.quickmba.com/strategy/core-competencies/>

Cost-benefit:

http://en.wikipedia.org/wiki/Cost_benefit

http://www.mindtools.com/pages/article/newTED_08.htm

<http://www.sjsu.edu/faculty/watkins/cba.htm>

Critical path method:

http://en.wikipedia.org/wiki/Critical_Path_Method

<http://www.netmba.com/operations/project/cpm/>

<http://www.pmi.org/html/Presentaciones/The%20Critical%20Path%20Method.pdf>

<http://hadm.sph.sc.edu/COURSES/J716/CPM/CPM.html>

<http://www.mindtools.com/critpath.html>

<http://www1.gantep.edu.tr/~aoztas/ce332-book/X/02.html>

<http://www.stanford.edu/class/cee320/CEE320B/CPM.pdf>

Gantt-chart:

<http://www.spreadsheetstore.com/t-ganttchart.aspx>

http://en.wikipedia.org/wiki/Gantt_chart

<http://www.asq.org/learn-about-quality/project-planning-tools/overview/gantt-chart.html>

http://www.mindtools.com/pages/article/newPPM_03.htm

<http://www.ncdot.org/programs/CPI/download/CPIToolbox/GANTTCHT.pdf>

<http://www.ganttchart.com>

http://www.hsc.csu.edu.au/sdd/core/package/solution_package/gantt_chart/creatinggantttchart.html

Mindmap:

http://en.wikipedia.org/wiki/Mind_map

http://www.mindtools.com/pages/article/newISS_01.htm

http://www.buzanworld.com/Mind_Maps.htm

<http://www.mind-mapping.co.uk/index.htm>

<http://www.mindmappingstrategies.com/>

Nominal group technique:

http://en.wikipedia.org/wiki/Nominal_group_technique

<http://www.siliconfareast.com/ngt2.htm>

<http://www.ncdot.org/programs/cpi/download/CPIToolbox/NGT.pdf>

http://www.emu.edu.tr/~oyagiz/MGMT585/NGT_BW.pdf

<http://www.communitydevelopment.uiuc.edu/sp/Step5/Nominal%20Group%20Technique.pdf>

<http://www.asq.org/learn-about-quality/idea-creation-tools/overview/nominal-group.html>

Concept map:

http://en.wikipedia.org/wiki/Concept_map

<http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.htm>

<http://cmap.ihmc.us/Publications/>

PEST:

<http://en.wikipedia.org/wiki/PEST>

<http://decide-guide.com/pest/>

http://www.mindtools.com/pages/article/newTMC_09.htm

Post-project review

<http://www.pma.doit.wisc.edu/close/2/print.html>

<http://www.smetoolkit.org/smetoolkit/en/content/en/436/Post-Project-Review->

Guidelines

<http://www.developer.com/mgmt/article.php/1561881/The-Importance-of-Post-Project-Reviews.htm>

www.boston-spin.org/slides/020-Feb01-talk.ppt

Scenario analysis:

<http://scenariothinking.org>

http://en.wikipedia.org/wiki/Scenario_analysis

http://en.wikipedia.org/wiki/Scenario_planning

<http://www.rand.org/scitech/stpi/Evision/Supplement/scenario.pdf>

system and process analysis

<http://www.netmba.com/operations/process/analysis/>

http://thequalityportal.com/q_patool.htm

Technology audit:

http://www.innovating-regions.org/download/technology_audit.pdf

www.inovasyon.org/getfile.asp?file=MA.TYD.pdf

Business plan:

http://en.wikipedia.org/wiki/Business_plan

<http://www.planware.org/businessplan.htm>

http://www.bplans.com/sample_business_plans.cfm

<http://www.businessplans.org/>

<http://www.teneric.co.uk/sample-business-plan.html>

Visualisation tools:

http://www.visual-literacy.org/periodic_table/periodic_table.html

<http://www.roxanneoconnell.com/VIZ/index.html>

Product development:

<http://www.npd-solutions.com/bok.html#anchor2114450>

Skill-based tools:

<http://www.mindtools.com/>

Patents:

<http://www.ippanorama.com/contents/adults/ip-xpedite>

IP Xpedite is jointly developed by APEC (Asia Pacific Economic Cooperation), KIPO (Korean Intellectual Property Office) and KIPA (Korean Invention Promotion Association) from 2006 to 2007. It deals with concept and importance of intellectual property information and how to reach and obtain valuable IP information. It contributes to enhancing efficiency in activities of research and technology development on IP.

The main target of IP Xpedite is researchers and patent staffs who need to improve the awareness of intellectual property and the ability to use IP information.

Value analysis:

<http://www.scav-csva.org/>

http://creatingminds.org/tools/value_engineering.htm

<http://www.npd-solutions.com/va.html>

<http://wendt.library.wisc.edu/miles/milesbook.html>