Technology Entrepreneurship

Entrepreneurship for and in Technology Ventures

MODULE 5
Patents and Intellectual Assets

Intellectual Properties and Patents (1)

- Objective of research and innovation projects: not only to create leading technology and derived products, but simultaneously *protectable value* for which real customers or specific organizations will pay money to the company rather than its competition.
- One way to generate *protectable* value is via "*intellectual properties*"
- "*Property*": the right to exclude others from (commercial) use
- Aspects of Intellectual Property (IP):
  1. a legal protection of inventions/innovations or
  2. an investment in assets to support an innovation (technology) strategy
  3. A particular kind of offering

 Ref. Runge, pp. 658; p. 885, Spec 12; p. 192/193 5.2

Intellectual Properties and Patents (2)

- A patent refers to an "*invention*";
  relates only through its commercial use to "innovation"
- Striking example of the legal protection aspect of utilizing IP through patents: when a *drug patent* expires and firms enter the market with much cheaper *generics*
- Patents are the "most tangible" among the *intangible assets* (e.g. value through license revenues)
- IP is key for a *licensing-driven business*
- Other "intellectual properties":
  - ***Secrecy*** - trade secrets (often associated with processes or formulations or "recipes"; often bound to employees)
  - "***Tacit* technologies**" and techniques (due to the interconnection with employees tacit technologies are "transient" and are intimately related to corporate culture and people's management; includes also shared experiences in "communities of practice")
  - The "***learning curve***" advantage for technology (associated with lowering costs of operation, e.g. production; a powerful form of accumulated knowledge as well as tacit technologies).

 Ref. Runge, pp. 658; p. 885, Spec 12; p. 192/193 5.3

Patents

- The holder of a patent (the "inventor") is granted only the right to *prevent others from practicing the invention in a commercial manner* as described in the patent during its term ("protection time").
- The fact that one is the owner of a patent does not allow one to prevent others from experimenting with the patented object or using it for experimental purposes without commercial gain!
- The *monopoly* to utilize an invention commercially is granted by the State – after an application for patent granting and (usually) an examination process looking for "prior art" by the Patent Office
  (cf. "Patent Pending" notices on startups' Web sites).
- Patent protection is usually *for a period* of 20 years from the date of the filing of the patent application.
- Patent law is *country-specific*. For instance, in most countries, in particular, in Europe the "*first to file*" the patent is granted to patent, but in the U.S. it is the "*first to invent*" – with a number of implications.

 Ref. Runge, p. 885, Spec 12 5.4

Costs for Patents

- Getting a patent or following patenting strategies may become expensive
- The fees payable to the European Patent Office for an "average" European application (with eight designated states where the patent is granted) after four years total ca. €4,300. After that time further fees are necessary.
- One can typically expect to spend at least $5,000 to $10,000 in obtaining an issued U.S. patent. If one wants to protect the invention outside of the U.S. one can expect to expend an additional $20,000 per each foreign country in which protection is sought.

 Ref. Runge, p. 886 5.5

Patentability

- The prerequisite of an object, a process or an application to become *patentable* relies essentially on *examination of three criteria*:
  - **Novelty**;
  - **Non-obviousness** (for a person familiar with the subject; "not obvious to a person skilled in the art");
  - **Usefulness** (demonstrating utility)
- The scope of (legal) patent protection is expressed in terms of "*patent claims*" (what is claimed vs. *what is done* in the "Description" (Examples) part of the patent)
- The *patent process* from application filing via examination and ending in granting the patent proceeds through *defined stages* with given limited time periods for action. At any time, the related stage represents a "*legal status*" of a patent .

 Ref. Runge, p. 885, Spec 12 5.6

Patent Infringement

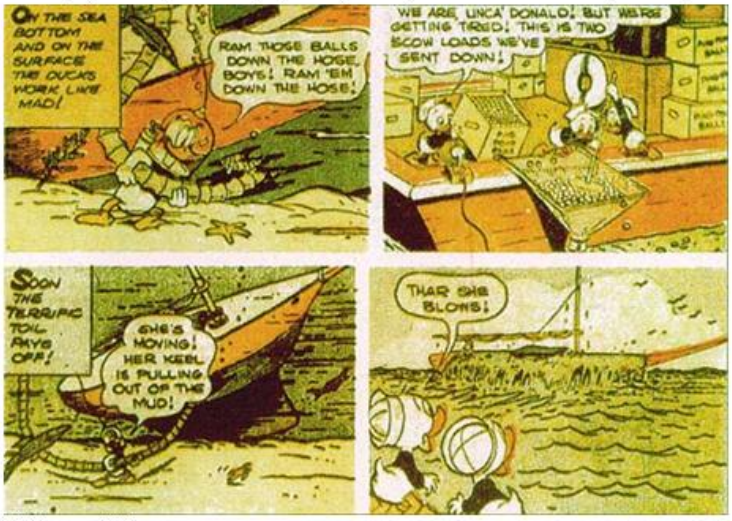
- *Examination of "prior art"* by a Patent Office determines whether something is patentable and has to inquire into *any material* relating to the concepts, processes or applications already *available to the public*.
- There are *plenty of traps and ways to infringe a patent of a competitor*.
  - Often, an invention is an improvement on a broader invention that is the subject of another "dominating" patent held by someone else. The manufacture of a patented product may require the use of process steps patented by others. Patents of others may cover important applications of a patented product.
- *Patent tracking* ("current awareness" and prior art), *assessment* and *analysis* is a key activity of *technology intelligence* in (large) firms (Ref. Runge, W. Patent Assessment and Patent Analyses – Purpose, Addressees, Context, Methods, and Technology. Conference Proceedings PATINFO 2006)

 Ref. Runge, pp. 660, 885, Spec 12 5.7

An Exotic Example of Prior Art

- In 1964 the freight ship "Al Kuwait" sank in the harbor of Kuwait. To raise the ship from the bottom, it was filled with Styropor® foam from BASF - and it worked. This was similar to a process of stuffing a ship with celluloid ping pong balls through a tube for raising presented in a Donald Duck story "The Sunken Yacht" (by Carl Barks) from 1949.

Source of graphics: http://www.styropor-verpackungen.de/inhalt/aktuelles/geburtstag.htm



 Ref. Runge, p. 421, 887 5.8

Pitfalls for Entrepreneurs Concerning Intellectual Properties

- Entrepreneurs often are so enthusiastic about *letting people know about their ideas* that they mention them at professional meetings, post them on the Web, include them in an abstract of a paper, or publish a thesis.
- *All these venues constitute a public disclosure.* (Be aware of what you disclose in your business plan!)
- After such public disclosure, entrepreneurs have one year to file for U.S. patent rights ("first to invent"), but they automatically lose patent rights for foreign filings - and that's a major loss.
- In Germany (and the EU) others may use non-publicized, but "somehow" captured ideas or even utilize the ideas to create a related patent ("first to file")

 5.9

Trade Secrets

- Patents are *not a prerequisite for economic success (in the chemical industry)* nor are they necessary to gain technologically strong positions or for technical progress (e.g. Purolite in ion exchange resins).
- Trade secrets may fall into the realm of "*tacit technology*".
- All countries with sophisticated legal systems have legal means to protect "trade secrets", usually with an emphasis on either "privacy" or "unfair competition".
  The law will not allow someone to benefit from a *breach of trust* – so it is essentially the relationship of trust that the law protects.
- Technical know-how is protectable via either patent or trade secret law. Hence, a choice must be made.
- Even for the "hot" nanotechnology area *patents may not be the option of choice for protecting technology*.
  - Inventions on the nanoscale are more difficult to "take apart". "In some respect they are like a house of cards; if you pull one critical card out, the whole thing collapses. In these large, complex molecules, each atom is influencing the stability of the entire molecule. So rather than patenting a nanotech invention and telling the whole world how to make it, it often makes sense to protect it as a trade secret."

 Ref. Runge, p. 34,35; pp. 670; p. 671, Table III.25; p. 551 5.10

Patents, Technology, Protectability and Investors

- It seems like most entrepreneurs still focus primarily on *patents as barriers to entry*.
- One of the key criteria that venture capitalists (VCs) look for in potential investments is the protectability of the technology.
- VCs know that patents usually are not enough to protect a startup's technology.
- If the patent is ever going to be enforced attorneys on both sides will clearly spend much time investigating what the claims really mean and who really has the prior art. Often the victor in patent litigation is the party with the greatest resources that can "out lawyer" the other side… which does not bode well for startups.
- Certainly no venture investor wants the capital to be used in patent litigation!
- Hence, *non-patent barriers (e.g."technical value" – 9.7) to entry* are very important to venture capitalists.

 5.11

Some Important Usages of Patents for NTBFs

- *Patent information*: a key in the industrial research process with regard to *operational, tactical and strategic* aspects. It is a key in "technology intelligence" ("patent analysis"; SWOT-analysis)! Exemplary usage options:
- Technology state-of-the-art and current awareness; scope of applications and technology protection
- Identification of competitors or collaborators – or customers
- Assessment of competitors' R&D and innovation efforts and directions
- Assessment of human resources by analyzing inventor records for competitors
- Locate licensees or options for license-in
- Discover market trends and emerging (new) technologies
- The geographic coverage of patents (IP) indicates global market strategies.

 5.12

Patent Searching

- Searching patents *comprehensively* for *content* is very complicated!
- Dealing with the question "Does ABC Co. own a patent on this product (process, application), and if so, in what countries is it valid?" seems to be quite straightforward (search for patent assignee/firm with "known" name), but note that a firm may also operate through subsidiaries with different names (Does it still belongs to ABC?)
- A (re)searcher must *choose from a broad spectrum of patent (database) resources to provide reliable answers*
- There are special patent search services
- Never forget to include *cost for patent searching* (by your firm or an outside search service) in your *financial planning*!

 5.13

Patent Databases (1)

- For *storage and retrieval* computers, patent databases and the Web play a broad and important role in the context of patents.
  Patent databases differ fundamentally according to type (and quality of database content and input as well as retrieval possibilities):
  - ***Full-text databases*** allowing to search the whole text of the patent document (and usually providing PDF- or other graphics files of the whole patent document)
  - ***Bibliographic databases***, such as World Patent Index (WPI) or Chemical Abstracts (CA); comprising, for instance, formal patent data, such as inventor, patent assignee, patent or patent application numbers, dates, kind codes (legal status) and countries (for families), content data, such as title, abstract, technology focus and condensed descriptions as well as various (*intellectual*) indexing through codes and controlled terms; some "bibliographic databases" may contain the full text of the claims.
  - ***Citation databases***, such as Derwent's Patent Citation Index (DPCI)

 Ref. Runge, p. 890 5.14

Patent Databases (2)

- Important *Web resources* concerning patents are provided by the patent offices of the U.S., European Union and Germany (US PTO, EPO, and DPA – Deutsches Patent- und Markenamt)
- The databases offered by the patent offices (on the Web) are *free of charge*
- The *bibliographic* databases, the most prominent being Derwent's WPI and Chemical Abstracts Service's CA, are not free of charge. They are accessible, e.g., via the database host STN International
- Full-text and bibliographic patent databases are often *complementary* rather than exclusive.

 Ref. Runge, p. 890 5.15

Problems of Small Firms with Patents

- Money, money, money … and expertise!
- **Searching patents of the U.S. Patent Office with Google is definitely not an answer!**
- Cost of patent tracking – searching (current awareness, prior art) including related IT-system for retrieval and storage;
  Information retrieval, in particular, patent searching with the requirement of "completeness", requires *tremendous technical and methodological experience* (knowledge of underlying databases, retrieval languages, technical subject knowledge and knowledge of international patent systems and document structures – note the *vagueness of language*, differentiate what is claimed and what is done); in large firms patent searching is usually done by specialists in Information Service organizations; utilizing external patent search services usually miss context-specific aspects of the search (and probably also technical expertise)
- Cost of getting and keeping patents (involving a patent lawyer to define and word the claims and rule out patent infringement)
  Applying for a patent may become (is) a negotiation. You generally apply for a broader patent than you think you will be granted, and the examiners reply by throwing out some of your claims and granting others.
- Cost of litigation (access to legal expertise)
- Added value of patents varies by sector – is highest in pharmaceuticals

 5.16

Patent Portfolios

- Parallel to the growth of a startup (NTBF) the strategic use of patents increases and a requirement to deal with a patent portfolio may increase.
- *Portfolio*: Reduce risk and maximize return of a set of investments by diversification (based on priority criteria) → resource allocation
- *Patent portfolio*: Some aspects and criteria for structuring
  - **Type of technology and coverage**: key, generic, enabling, enhancing, etc. (slide 4.13); a gap in a firm's technology coverage may be seen as a weakness in its technological dimension.
  - **Strategic and tactical use**: the fundamental offensive, defensive, and negotiation uses (e.g. litigation avoidance, "blocking", alliances) as required to achieve the firm's strategic objectives.
  - **Value generating**: how the patent can exclude others (effectiveness), relevance for product-specific commercialization, license-out.
- Firms in heavily competing industries need to develop capabilities in executing multifaceted patent strategies
  - Historical example: the synthetic dye industry, 1857-1914 (Murmann, 2004)
  - Currently, Merck KGaA, the world's leading manufacturer in LCD materials and ca. 60% market share, has worldwide more than 2,500 patents

 Ref. Runge, p. 669/670; p. 455,457 5.17

Patents and Out-Licensing in a Revenue Model

- Licensing has become *a strictly managed commercial process* covering the global situation
- Approaches of patent out-licensing to extract value include:
  - Up-front (basic) payment, (agreed upon) "milestones" payments
  - Royalties,
  - Exclusive Sell,
  - "Reciprocal technology sharing" ("grant-back"); cross-licensing

Historical example:
When BASF bought the patents to produce the synthetic dye alizarin by C. Graebe and C. Liebermann in 1869 in exchange of providing Graebe and Liebermann *3% of the total turnover of the product for the following 15 years*. Both also had to *support* BASF in improving the finishing process.

Another conceivable negotiable position: either $100,000 or $50,000 upfront, with a 1 percent royalty once sales passed $7 mil.

 Ref. Runge, p. 267, 673-677 5.18

Patent Valuation

- There is no market price as a basis for valuation!
- The value of a patent is an option
  - Valuation depends on context and time and relates to a point-of-time (for what purpose?)
  - Patents are investments with an "*impact value*"
  - The valuation approach must be related to the purpose of the valuation (obtain upper and lower value)

Examples of (complex) valuation methods include, e.g.

- Economic Value Approach (Monetary Impact)
  - Cost of generation, historical cost; market-related – license analogy, comparative price; profit-related – cost savings
- Portfolio Approach
  - Competitive situation, proportion of sales of an offering protected by the patent, circumventing a free or protected solution
- Startups relying heavily on a license business may have serious problems with income forecasts!

 5.19

Issues of a Licensing Businesses - Butalco GmbH: The Biobutanol Situation (CleanTech)

- **Biofuels** and other applications (**second-generation biofuels via biomass**): "Back to the Future"
  - Societal/economic drivers: "green wave" (not GMO?), high oil/gas prices
  - **Regulations**: gasoline blending – US: 30% of gasoline with fuels from renewables by 2030; EU 10% of total sales by biofuels by 2020
  - Ethical aspects (bioethanol– food use vs. non-food use; World Food Crisis)
- **Biobutanol vs. bioethanol**
  - The bonanza will cover biobutanol production
  - Biobutanol-Fermentation, since 1916 ABE-Process - modified "classical" process and new processes
  - Positioned against bioethanol as a biofuel (fuel *blending* or *replacing*?), *otherwise used as/for solvents* (n-butyl-acetate, acetone as by-product of fermentation process), *paints/coatings* and *adhesives*
  - *Biobutanol's improved performance*: higher energy yield, low vapor pressure, tolerance to water contamination (suitable for transportation via pipeline - readily integrated into the existing fuel infrastructure), blended into gasoline at higher concentrations than ethanol without the need to retrofit vehicles
  - ***Realities of the market*** through the "big boys" Shell/BP: avoid losing control of the multi-trillion-dollar transportation fuel industry to electricity providers (electro-cars) – BP committed $500 for advanced biofuels R&D

 5.20

The Biobutanol Battle Field and Some Players – Biotechnology vs. Process Engineering

Stakeholders: CleanTech investors; Government; Industry: Chemical, Energy (Oil), Agricultural

Research	**Butalco GmbH (CH/DE)** – from yeasts Founded 2007; employees (2008): 2 (?) Focus: **licensing**; seeking partners Investments: unknown (≈€1 mio.?)	In 1992 D. E. Ramey (of EEI) drove his unmodified 1992 Buick, using only butanol. Considered butanol production for decades In 2000 $0,6 mio. DOE grant for pilot plant
Development	**ButylFuel LLC (US)** Founded 2007; employees 4 Out of engineering firm (EEI); cont. process Investments: R&D grant ($1 M); >$1.2 mio.	**Gevo, Inc. (US)** Exclusive licensor CalTec, founded 2005; employees 30; established researchers from CalTec, veterans from bio-processing (NatureWorks LLC); GMO (*E.coli*) for biomass; IPO (2010): LANXESS (ca. 9%); emphasis: bio-isobutanol → isobutene → rubber; hefty patent suits with Butamax; Investments: ca. $27 mio.
Production	**Green Biologics, Ltd. (UK)** Founded 2003, employees "25" (2007) Manufacturing biobutanol (fermentable sugar via thermophiles); engineering firm coop Investments: >$15 mil.+ grants (by 2012)	
Distribution	**METabolic Explorer S.A. (FR)** Founded 1999; employees (2008): 80 Strain engineering after metabolic profiling Biobutanol, pre-industrial pilot phase Investments: $13, $59.7 mio. (IPO 2007)	**Cobalt Biofuels, Inc. (US)** founded 2006; employees ca. 50 (2010); follows the ABE-process; uses modified *Clostridium* microorganisms Investments: ca. $50 mil.+ grants (by 2011)
Market (plus infrastructure)	**BP/DuPont JV + British Sugar (UK/US)** Coop since 2003; butanol from sugar beets Focus: 1. bioethanol → 2. biobutanol Fuel station infrastructure/test field (UK); ca. 60 patents (JV: "Butamax")	**Shell (UK/NL) + Virent Energy Systems, Inc. (US)** – Founded 2002, raised $40 mio.; Coop since 2007; plant sugars via catalytic process into hydrocarbons -"**biogasoline**"

FZK-Bioliq: Ref. Runge, p. 858

 5.21

Intellectual Properties and Nanotechnology

- In (chemical) nanotechnology firms, from startups to multinationals, are aggressively *locking up critical and basic nanotechnologies*.
- For nanotechnology expectations are that *there will be unimaginable innovations based on early discoveries*. Through locking up patents one can claim a piece of the action going forward – *patent litigation is in the future*.
- To be successful in such an IP strategy, companies need to develop *intelligence strategies* covering *thorough understanding of the patent landscape; monitoring* patent publications, issuances, licenses, and litigation; and *develop concrete IP strategies that allow them to increase their chances of future profitability*.

 Ref. Runge, pp. 551; pp. 673 5.22

Intellectual Property Purchase to Start-Up

- Special startup case: no lab or product; selling only IP
- Existing intellectual property may be the only basis (opportunity) for NTBF foundation
- Licenses granted to a startup company for a set of issued and pending *patents from a university* – even for a restricted domain (e.g. Nano-Terra + Harvard University; comparable with Nanosys approach – 5.24) Approach: royalties for the university plus stake in the firm
  - **Strategy: leverage IP and expertise through product development deals with major companies and government (military)**
- Getting all *IP (patents) from a firm* and provide in exchange the firm a stake in the company (Dow Chemical - Dendritic NanoTechnologies (DNT))

 Ref. Runge, pp. 554, 559 5.23

Examples: IP-Oriented Startups

- U.S. Nanosys (ca. 500 patents): scientific connections and IP attracted investors, but it disappointed them when it called off a $100 million stock offering in 2004.
- U.S. firm Nanophase Technologies (cf. 10.19) relies primarily on a combination of patent, trademark, copyright, trade secret and other intellectual property law, nondisclosure agreements and other protective measures to protect its intellectual property.

 5.24

Remarks About Patent Infringement and Startups

A Situational Description Rather Than An Advice!

- Startups rarely get sued for patent infringement.
  Two reasons someone might sue them:
  - For money
  - To prevent a startup from competing with them.

  Startups are too poor to be worth suing for money. And in practice they do not seem to get sued much by competitors, either. They do not get sued by other startups because (a) patent suits are an expensive distraction, and (b) since the other startups are as young as they are, their patents probably have not issued yet.
- If the startup grows big enough, however, it will start to get sued, no matter what it does.
  If it goes public, for example, it will be sued by multiple patent trolls who hope it will pay them off to go away.
- If a startup wants to grow into a big company, they should apply for patents to build up the patent portfolio they will need to maintain an armed truce with other big companies.
  If they want to get bought, they should apply for patents because patents are part of the mating dance with acquirers.

 5.25

IP Management by (German) Universities

For their researchers universities (and research institutes) usually have a particular organizational unit to deal with patents and licenses

"Patent- und Lizenzberatung", Technologietransfer

- Universität Karlsruhe (TH) – Forschung- und Technologietransfer (http://www.ft.uni-karlsruhe.de/en/4009.php) → KIT/FZK Innovation Department - Patents and Technology Transfer (http://www.fzk.de/fzk/idcplg?IdcService=FZK&node=0079&lang=en)
- TU München - SFT – Servicezentrum für Forschungsförderung & Technologietransfer (Industriekooperationen, Patente und Lizenzen sowie Forschungsförderung) (http://portal.mytum.de/forschung/sft/index_html)
  - Arbeitsbereich 1: Vertragsmanagement & Legal Services
  - Arbeitsbereich 2: Patent- und Lizenzbüro
  - Arbeitsbereich 3: EU-Büro & Forschungsförderung

 5.26

Technology Entrepreneurship

Entrepreneurship for and in Technology Enterprises

It is pardonable to be defeated,
but never be surprised.

(Es ist zu verzeihen besiegt zu werden,
aber niemals überrascht zu werden.)
(Frederic II, the Great, King of Prussia)

MODULE 6
Entrepreneurship and Technology Intelligence

Notions

Intuitively "*intelligence*" is related to information, knowledge and Q&A (*intelligent* – clever, bright, smart, intellectual, responsive)

Operational definitions for the context of innovation, research and entrepreneurship:

- "***Intelligence*** is *knowledge* and *foreknowledge* of the *world around us* - the prelude to Presidential *decision* and *action*" (U.S. CIA Factbook on Intelligence; emphases added).
- "***Competitive intelligence***" (CI), often also termed "business intelligence" (BI), for a technology-based firm, is a process that "*ethically*" *collects*, collates and *analyzes* and *interprets* technology, competitor and market data and information and transforms these into *actionable knowledge* about competitors' capabilities, performance, position, strategies, intentions, preferences as well as likely future actions - including the *position of the firm itself*.
- For the business world knowledge and foreknowledge include the *corporate-internal and the external* knowledge *domains*.

Competitive intelligence is **not industrial espionage**!!!

Ref. Runge, p. 798, 799; p. 520-537
6.2

Intelligence, Knowledge and NTBFs

- *Most technology ventures are based on knowledge and intellectual assets* (Slide 3.11) that must be enhanced and managed
- From the generation of ideas, identifying opportunities, through the launch of a new product (NPD) or a new business (NBD) or firm (entrepreneurship) *intelligence* as the creation, capturing and exploitation of intelligence (knowledge and foreknowledge) is a *core theme for innovation, entrepreneurship and intrapreneurship*
- As intelligence comprises knowledge there is overlap between *intelligence and knowledge management* (KM) and *intellectual asset management (IAM)*

"*Learning Organization*":
creating, acquiring and sharing new knowledge (intelligence) *and adapting* its activities, behavior, organization and processes as a *response to environmental changes and conditions*
(differentiate individual and *organizational learning*)

 Ref. Runge, pp. 677; pp. 826; pp. 835; p. 801, Figure III.60 6.3

Competitive Information and Environmental Scanning

- "**Competitive information**" – Examples:
  - *technical* - processes, product composition or design, formulas or methods of manufacture, plant capacities etc.
  - *commercial* – business strategy, investment plans, business plans, marketing plans, names of customers, market share, etc.
- "***Environmental scanning***" is at the core of the relationship between a company and its environment
- Environmental stimuli are *captured, filtered, treated* through a kind of "nervous system" (incl. corporate culture) holding back or producing the organization's choices (cf. 12.16)
- **"*Signals*" for CI**: any information or event that may affect a *company's competitive position* (opportunity or threat)
- The Analogues (information search in scientific literature (patents) or databases – e.g. Chemical Abstracts):
  - What's going on – scientific/technical progress ("*current awareness*")
  - What is (the state-of-the-art"; "*prior art*")

 Ref. Runge, pp. 520, p. 798-808 6.4

Technology Intelligence

- *Technology Intelligence* (TI):
  actionable knowledge and foreknowledge arising from systematic processes involving gathering, analyzing, hypothesizing and disseminating information on *external scientific or technological developments, opportunities and threats* that may affect a *company's competitive position* (defined by its strengths and weaknesses).
- *Technology meets markets/demands!*
  (What, when, how, where and who):
- The model of the "*technical entrepreneur*" or "*technical businessman/woman*" (Slide 1.14) may be viewed as a specific "incarnation" of utilizing technology intelligence.
- Organizationally (in large firms) technology intelligence is preferentially led by the R&D function, but extends into other functions (e.g. Marketing).
- Some results:
  Reduced risks and *enhanced opportunities* (for technology-based innovations)

 Ref. Runge, p. 816, 817; p. 820, Figure III.65 6.5

Avoid Surprises! On a Global Scale!

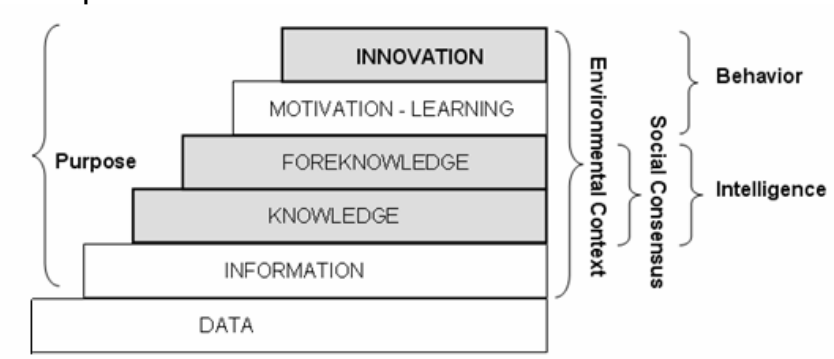
Competitive and technology intelligence:

- Targets a "*greater picture*" (the pieces of a "*puzzle*")
- Begins with an *understanding of yourself* ("*know thyself*"; firm: culture, intellectual assets and "core competencies") and the *significant factors* ("drivers") that impact your industry (segment) and your company
- Is *basically comparative* (your strengths/weaknesses; your position vis-à-vis your rivals' positions; *SWOT*)!
- Focuses on *current and future* situations, current and future competitors, current and future technologies, opportunities and threats of *complementary* and *substitutive* technologies and offerings
  (technology: functionally or commercially substitutive (*conditionally* substitutive, if – then), e.g. biobased chemicals may become commercially substitutive, if the oil price is higher than $70/barrel)
- Anticipates your *future actions and reactions* (*scenarios;* slide 6.31) and actions/trends of competitors, customers, suppliers, government (game changing regulations!) and society – "***early warning***"

 6.6

Learning

- Entrepreneurship is based on a process of learning that allows to learn from success *and* failure.
  Central component: *feedback*
- Learning in technology ventures includes "*learning for the future*": what skills to acquire *for future company's needs*
- Given that the future is not likely to resemble the past, learning from experience (on-the-job) to prepare the companies for the future will not suffice!



 Ref. Runge, p. 801, Figure III.60; p. 826 6.7

Learning, Speed of Decision Making and Action: Key for an NTBF

- The competitive advantages of NTBFs over large firms often lie within their *organizational learning* capacity, organizational *flexibility* and *speed of response* to external changes.

- **High-Speed Innovation**:
  The entrepreneur usually has to do this in a hurry. He/she starts working at high speed - not because it is a natural bent, but because one has to get this done before running out of cash (amortization of high R&D expenses)

 6.8

Information & Communication Technology (I&CT) for Intelligence

- *Supporting* intelligence *processes* and creating intelligence *products*
- For innovation and the Research function: focus on *technology in the context of products, processes, applications, markets and customers*
- "*Patent analysis*" (and assessment) is an important sub-process of Technology Intelligence.
- *Technology intelligence* includes a significant part of *commercial intelligence.* I&CT facilitates coordination of related sub-systems.
- The close interconnections between technical and commercial information in technology intelligence is particularly lucid for new technology-based firms (RBSUs and NTBFs) and entrepreneurship.

 Ref. Runge, pp. 816; p. 838, 839; Part IV (pp. 917) 6.9

Normative Attributes of Competitive Intelligence

Intelligence ("***Puzzle***") Strategy ("***Chess***")

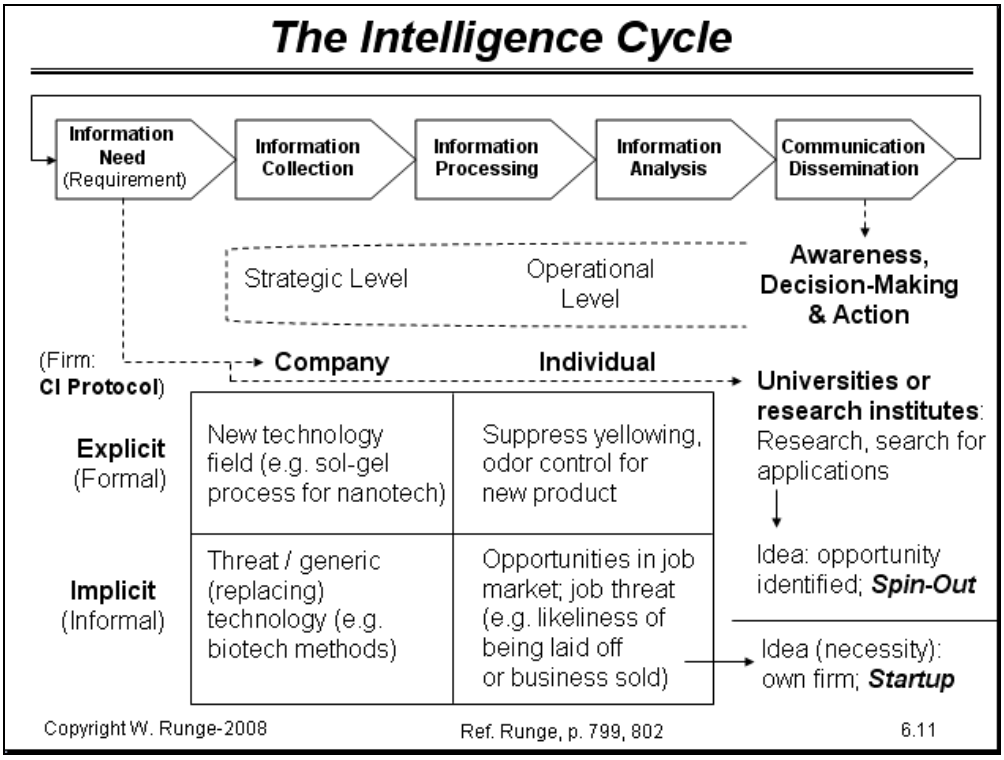
DA&4P:

- ***D**escriptive*: what *is* done (in the firm's "environment")
- ***A**nticipative*: what *will* be done (in the firm's "environment")
- ***P**rospective*: what *may* be done (by the firm)
- ***P**roscriptive*: what *cannot* be done (by the firm)
- ***P**rescriptive*: what *should* be done (by the firm)
- ***P**rohibitive*: what *must not* be done (by the firm)

Deliverables:
(verbal and non-verbal) "*intelligence products*"

- Competitive intelligence in the corporate environment is done mostly either on an *ad hoc* basis *as a project*, probably updated once a year or in other regular intervals or as a *continuous process*.

 Ref. Runge, p. 808 6.10



Intelligence Activities - Continuous Activities!

- *Intelligence activities* are necessary; not only for writing a business plan or firm startup, but *continuously for the firm's survival and growth*
- *Consciously elaborated information gaps* enable to develop better bases for risk assessment and action alternatives and options!

Some *questions* induced by "*meeting*" *intelligence*": Does the information

- has an immediate impact on the company's current or future directions?
- reflect long-term/fundamental changes forthcoming in the market, in the technology basis?
- suggest changed assumptions about market or technology conditions, of legal or regulatory or industry standard conditions?
- indicate changes in resources (tangibles or intangibles; e.g. raw material input, conversion economy) devoted to the market (or the whole industry)?
- relate to the current corporate (or technology) strategy of a competitor, indicate a change in strategy?

6.12

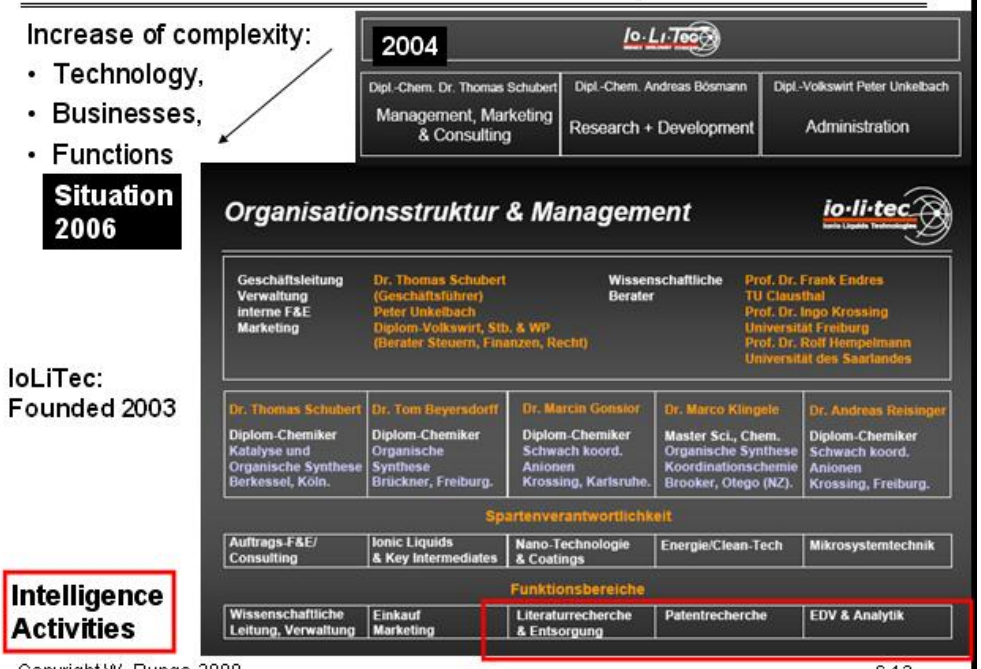
IoLiTec: Activities and Responsibilities

Increase of complexity:
- Technology,
- Businesses,
- Functions

Situation 2006

IoLiTec: Founded 2003

Intelligence Activities



 6.13

Relative Distribution of Intelligence Resources and Intelligence Efforts

- For gathering competitive information there is an "*80:20 rule*":
  - 80 percent and more of the *needed* competitive information is *in the public domain* (news, magazines, journals, Web, online databases of paper-based literature etc.)
- For (legal) competitive/technology intelligence there is an arsenal of resources and analytical tools – with associated efforts (and costs)
  - *Primary* resources (mainly humans) – 20% volume / 80% time
  - *Secondary* resources: essentially published ("open") data and information (access: free-of-charge or requiring fees or subscriptions) – 80% volume / 20% time

 Ref. Runge, p. 799, 806, 807 6.14

Information Resources for Intelligence

- Key expectations for TI/CI deliverables are *reliability* and *quality*. Hence, the *credibility* level of the resources must be made explicit and defined. Three types of resources with various levels of reliability and credibility for startups

"Primary Resources"

- **External contacts** (knowledgeable friends or co-workers/team members, advisory board, incubator and network contacts ("competence networks"), "mentors and advisor", people from customers, suppliers, networking partners, investors, etc.)
- **Intelligence agents and agencies**, intermediaries or services (for instance, free-lance researchers or technology scouts, consultants) – usually rather expensive.

"Secondary"

- ***Publicly available*** **paper and computer-based resources** accessible through various channels (for instance, journals, magazines, external online database and news services or the Internet)

- Resource content is taken "*as is*" or is subjected to further (usually computerized) *post-processing* of existing information or knowledge (e.g. visualizations, tabular representations etc.)

 Ref. Runge, p. 806; p. 813, Box III.12 6.15

Literature and Online Databases (1)

- "***Primary literature***" (paper- or CD-based and electronic online equivalents or electronic-only):
  patents and scientific/technical and business literature: journals, magazines, newsletters, trade journals, newspapers, analysts' and investment reports, market research reports, regulatory (EH&S) announcements, trade statistics, job ads etc.
- "***Secondary literature***" (reference/referral):
  abstracted, indexed and classifying primary literature; paper- or CD-based and electronic equivalents – online databases (with dedicated retrieval languages)
- Important database examples: Chemical Abstracts (CA) for science and technology, Chemical Business News Base (CBNB-RSC) and PROMT for business information, INVESTEXT (analysts' reports on companies and markets), World Patent Index (WPI) for patents
- Types: Bibliographic databases and (vs.) full-text databases; citation databases; text and chemical formulas

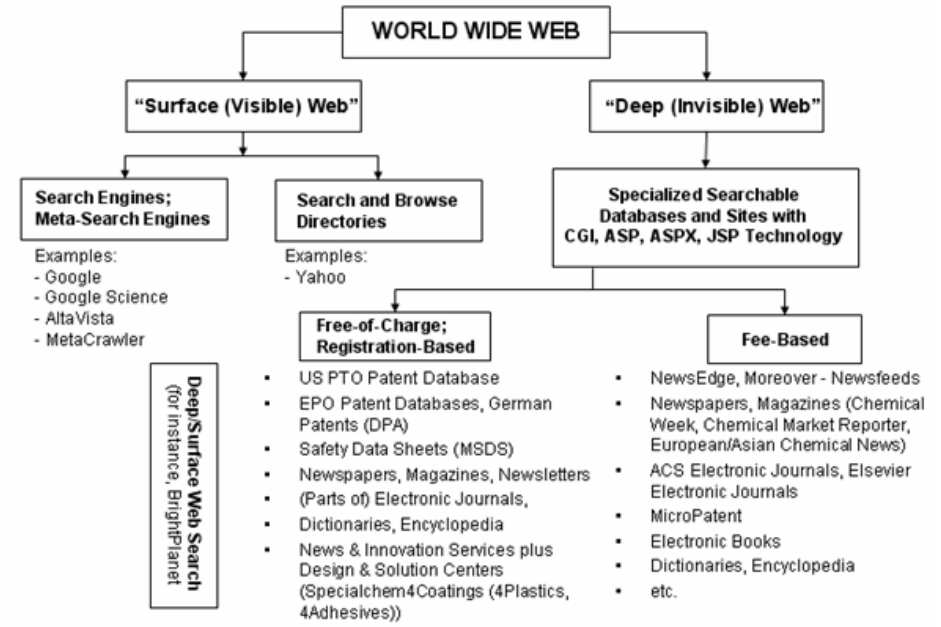
 Ref. Runge, p. 210, p. 810, 811 6.16

Literature and Online Databases (2)

- Accessible through special providers - "online hosts" - via Windows- or Web-based user-interface programs, e.g. STN International or Dialog (providing access to more than 300 technical/commercial databases); command-line interface (CLI) for "expert" searching
- *Computer-based systems are indispensable for TI/CI* as they provide many advantages (support tools!)
- *Central issues of computer-based intelligence-systems*: the myriad of information resources of different types and data and file formats, different (computer and "natural") languages and different access and search modes - The *unsolved retrieval problem* due to the intrinsic *vagueness* of natural and special (scientific/technical) languages; (issues of "relevance ranking"); special issues of (internal, specifically external) "search services"
- Using/managing computer-based information resources: A "core competency" of a firm's intelligence professionals

 Ref. Runge, p. 210, p. 810, 811 6.17

The Internet (1)



 Ref. Runge, p. xi, p. 815, Figure III.63 6.18

The Internet (2)

- Information *on corporate Web sites' (or personal or industry association Web sites)*:
- Purposeful, but (sometimes intentionally) biased by sender! Sending false signals means *counterintelligence*!
  - Company history, corporate organization and regional orientation, business visions, R&D and innovation focus, plant data (and sometimes pictures); cooperation and venturing
  - Financial data, sales figures, major markets, major competitors; plants and facilities
  - Product overviews, product sheets with physical, chemical, biological etc. data (MSDS) and sometimes valuable technology, market or industry overviews; competitive products mappings
  - Annual reports, press releases, links to company news in other sources, company presentations to analysts meetings, hiring advertisements, executives' biographies

 Ref. Runge, pp. 347; pp. 811 6.19

The Internet (3)

- Company filings (publicly traded): on the U.S. Securities & Exchange Commission (SEC) site (with EDGAR, the Electronic Data Gathering, Analysis, and Retrieval system);
  The Web is also *important resource for privately held companies.*
- (Stock) analysts' reports; presentations to analysts
- Applications for regulation-oriented approval (e.g. food use, cosmetics): FDA, EMEA/EFSA-national agencies;
- New Business Development (NBD): cooperation, venturing or acquisitions, licensing options; information about university research groups and experts as well as new technology-based firms (NTBFs) and startups (awards, business plan competition etc.)
- Technology Assessments (TA), "public opinions" (e.g. nanotech issues)
- Market research reports – mainly TOC (with key players!), abstracts or summaries, sample chapters

 Ref. Runge, pp. 347; pp.811 6.20

Innocentive as an Information Resource and for Gaining Ideas, Experience, and Some Money

- InnoCentive® (http://www.innocentive.com/) is a Web-based community matching scientists to relevant R&D challenges facing leading companies from around the globe. It is an *online forum* enabling major companies to reward scientific innovation through financial incentives.
- InnoCentive (and NineSigma - http://www.ninesigma.com/) represent a class of "*ideagoras*" ("marketplaces for minds") as a way of *self-organized collaboration* for innovation
- Ideagoras expose challenges to participants from both within the field and across many other fields allowing infinite creativity to be applied.
- Ideagoras like InnoCentive offer companies access to a wealth of new ideas and uniquely qualified minds, a fuller solution set of possible answers is quickly obtained.
- Check "Active Projects" of ideagoras whether they come close to your idea or whether someone is working to solve a problem coming close to the one you have; try to contact the solver.

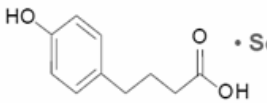
 Ref. Runge, p. 364 6.21

An InnoCentive Example

INNOCENTIVE

INNOCENTIVE 3109
R4-(4-HYDROXYPHENYL) BUTANOIC ACID
POSTED: June 26, 2001
DEADLINE: Nov 30, 2001
$25,000USD

- Solution Meets Challenge Criteria:
  - 2 steps or fewer
  - >80% overall yield
  - >95% purity
  - Delivery of 2.0g white to off-white solid
- Solver receives $25,000 USD!



Abstract

An efficient synthetic strategy for the following butanoic acid derivative is required. This molecule has been previously reported in the chemical literature but the existing known synthetic route may be lengthy, expensive and/or low yielding. Devise and execute the "best synthetic pathway".

INNOCENTIVE 3109 (R4-(4-Hydroxyphenyl) Butanoic Acid)

Retired Head of Hoechst AG
(formerly giant German chemical firm)

 6.22

Intelligence Agents and Agencies

- **Resources for the intelligence collection phase**: *complementing secondary sources* or being *the only available information source* (people-oriented methods (interviews) for special information)
- **Used mostly by companies with organized TI/CI activities and those that do not have corresponding facilities.**
  - single persons (freelance or role in the firm; "technology scouts"),
  - consultancy firms
  - dedicated "intelligence service" firms
- ***Scouting*: ideas/opportunities; identify difference between market, technology and the company's technology position; consulting; technology scouting as an arm of New Business Development (NBD)**
- ***Consultants* provide multi-client or dedicated studies (companies, markets and processes) and analyses of specific situations, such as manufacturing information and manufacturing cost breakdowns.**
- **A network of intelligence agents or agencies should be maintained by the corporate intelligence organization.**
- ***Web-based services* emphasizing "news & innovation" or "design & solution centers", such as Omnexus or the triple SpecialChem4Coatings, SpecialChem4Adhesives or SpecialChem4Plastics (require free-of-charge registration)**

 Ref. Runge, p. 762, p. 816 6.23

Intelligence for Technology Analysis

- Micro-analytical approach ("*bottom-up*"):
  - **Look at the main competing forces in the *industry* (segment)**
  - **For each *existing or new technology* list (all types of) techniques**
  - **For each existing or new technology list (all types of) competitors (including other NTBFs and startups and potential entrants)**
  - **For each *existing or new product* list (all types of) competitors**
  - **Rank identified competitors by size, importance and potential impact**
  - ***Select competitors for detailed investigation***
  - **Assess technology, position in the value chain and competitor issues**
  - ***Assess whether technology will determine the market* or ultimately other forces (production power for other technology; policy – regulations, subsidies)**
  - **Example: Patent analysis and patent assessment**
- ***Top-down* analysis is a key input to technology and strategic planning**
  - What is our competitors' technology/products development strategy?
  - Where does their strategy intersects with our?
  - How does their strategy threaten our current and/or desired position and goals?

 6.24

Some Intelligence Issues for Startups

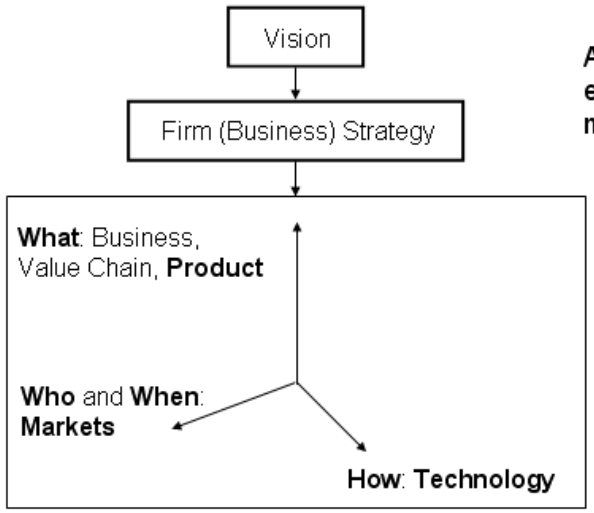
- Most of the startup firms (NTBFs) are *privately held* (rather than stock companies) which *do not publish* sales, employee, technology and strategy information.
- Intelligence activities concerning *competitive startups*, hence, have to *rely on the Internet, personal communications or intelligence agents* – or ?
- An intelligent guess ("*educated guesswork*"): analyzing the question, and through a process of intelligent deduction and elimination of the wrong choices, eventually narrow down the choice to just one; using "related" information, using an analogous question/case, making an extrapolation from historical data/facts

The "*Sufficient*" Information Guidance: TI (CI) "puts a puzzle together".
The patterns in the puzzle may be identifiable even if some of the pieces are missing!

> A central **entrepreneurial ability** is *actions when information is still incomplete*, the ability to make *early judgment* and have *confidence* to act on this judgment.

 6.25

Technology Strategy: Domain Coordinates



After having left the entrepreneurial stage and managing SME growth

⇨ Strategic Planning: **MAPPINGS, TECHNOLOGY ROADMAPPING**

The existence or development of firm roadmaps provide valuable guidance for (technology) intelligence activities!

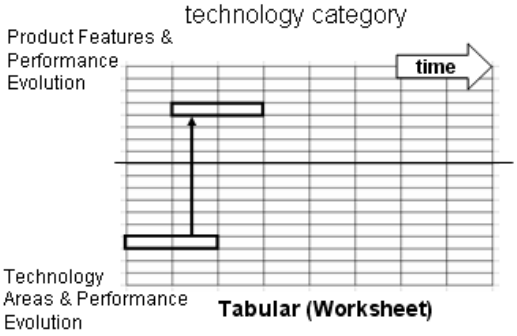
 6.26

Mapping and Roadmapping

- ***Needs***: understanding the *macro-level of technology evolution* (IP, patents!), *external drivers* (regulations, markets, demands) and how this may intersect with or is influenced by *other economically relevant factors* (social and technology; regional effects); *when* technology is likely to become competitive (with existing ones) and cost-effective and how much pressure there will be by (functional) alternatives (*substitutive technologies*); pace of commodization
- Technology as a means to an end (innovation!) interconnects R&D *and* Production always closely.

- **Maps** interrelate categories using text and graphics and visualize them by tables, charts, flow charts, etc.
- "**Roadmaps**" indicate a direction for product and technology development (cf. patent/invention maps) and document the decisions a team has made to pursue one of many possible routes (*timelines*!)
- Paths: generalizations to specializations

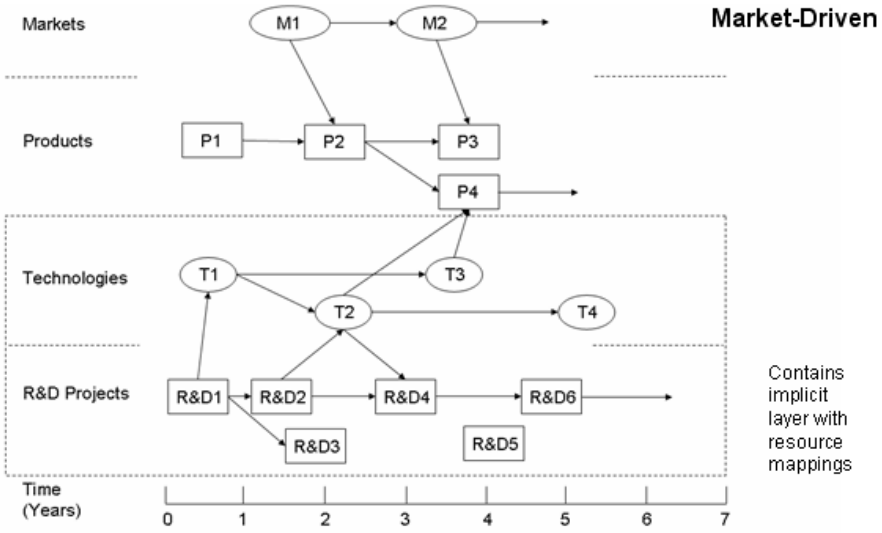
For instance, product versus technology category



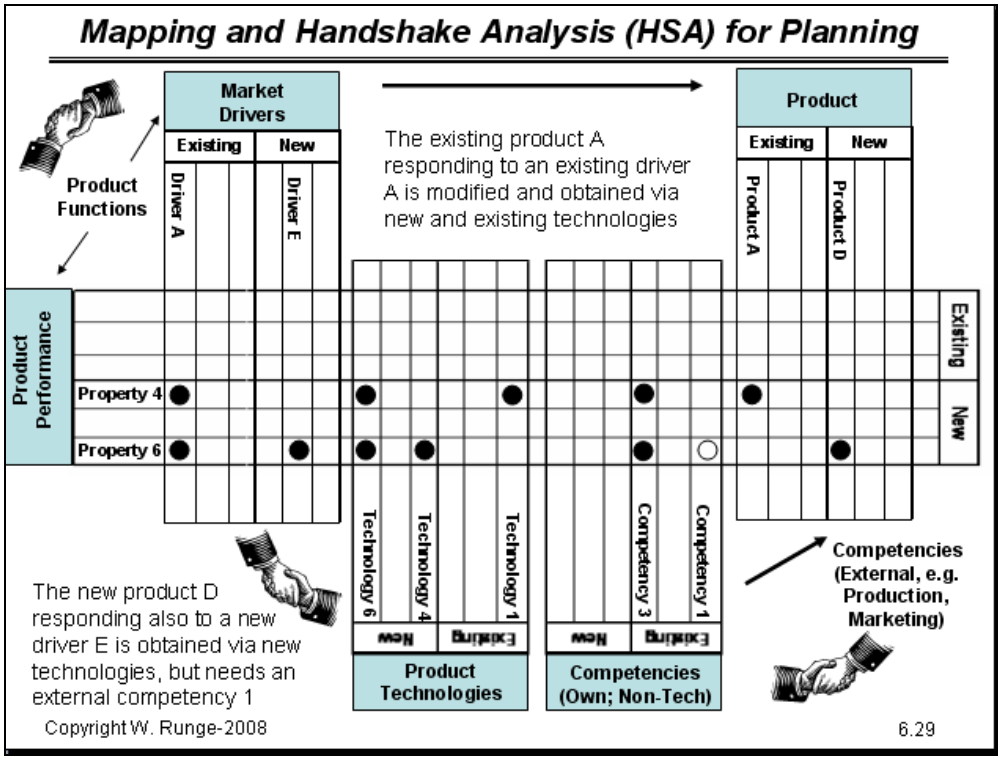
Ref. Runge, p. 142-147; p. 451, Spec 6
6.27

Generic Technology Roadmap Nodes and Links

- **Skills/Competencies/Know-how** required to deliver the technologies or offerings. These may or may not be available in the organization
- **Resources**. All aspects of human, intellectual, physical and financial assets, together with the identification of the internal and external sourcing requirements. This part of the roadmap is the expression of the costs.



Ref. Runge, p. 460, Figure II.39
6.28


Mapping and Handshake Analysis (HSA) for Planning
Market Drivers
Existing
New
Driver A
Driver E
Product Functions
The existing product A responding to an existing driver A is modified and obtained via new and existing technologies
Product
Existing
New
Product A
Product D
Product Performance
Property 4
Property 6
Existing
New
Technology 6
Technology 4
Technology 1
Competency 3
Competency 1
Product Technologies
Competencies (Own; Non-Tech)
Competencies (External, e.g. Production, Marketing)
The new product D responding also to a new driver E is obtained via new technologies, but needs an external competency 1
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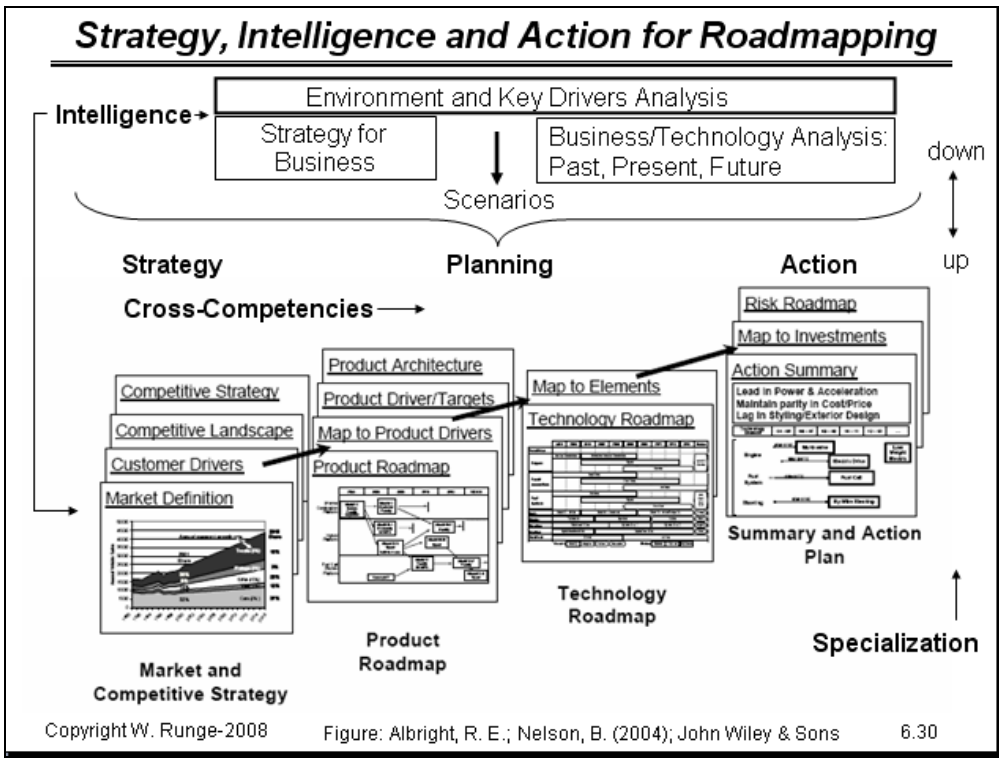
6.29


Strategy, Intelligence and Action for Roadmapping
Intelligence
Environment and Key Drivers Analysis
Strategy for Business
Business/Technology Analysis: Past, Present, Future
Scenarios
down
up
Strategy
Planning
Action
Cross-Competencies
Competitive Strategy
Competitive Landscape
Customer Drivers
Market Definition
Market and Competitive Strategy
Product Architecture
Product Driver/Targets
Map to Product Drivers
Product Roadmap
Product Roadmap
Map to Elements
Technology Roadmap
Technology Roadmap
Risk Roadmap
Map to Investments
Action Summary
Summary and Action Plan
Specialization
Copyright W. Runge-2008
Figure: Albright, R. E.; Nelson, B. (2004); John Wiley & Sons
6.30

Tracking "External Roadmaps":
Relevant for Co-Evolutions of the Chemical Industry

- **Reference to generally available roadmaps initiates corporate strategies and planning and may enforce *speed-based innovation*!**
- **The "International Technology Roadmap for *Semiconductors*" (ITRS): used to "synchronize" the innovation and R&D efforts of the chemical industry with the needs and development pace of the semiconductor industry (*success*: CMP; *failure* "low k" material!)**
  Moore's Law (for the chip sector): since 1965 the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future (now 18 month doubling period).
- ***Flat-Panel Display (FPD):* U. S. Display Consortium (USDC) - "Global FPD Industry 2003: An In-depth Overview and Roadmap"; roadmap-like "laws" - Nishimura's Law (average screen area of FPD panels), Kitihara's Law (the number of bits needed to specify the image on the screen), Odawara's Law (panel prices; each doubling in the cumulative area of flat panels produced results in a cost reduction of 22-23%)**
- ***OLED*: USDC - "International OLED Technology Roadmap: 2001-2010"**
- ***Photovoltaic* (PV) Roadmaps (EU, JP, US)**
- **The U.S. Vision 2020 is associated with *roadmaps for many areas* (e.g. R&D Roadmap for Nanomaterials By Design – December 2003)**

 Ref. Runge, p. 142, Box II.1; p. 458; pp. 451, Spec 6 6.31

Dealing with the Future - Scenarios

- Caveat: expert opinions (for prediction or forecast; interviews, surveys) **Delphi Methods:** *Lockean Delphi* relies on (expert) agreement as the sole or major principle for producing information ("consensual Delphi"). *Kantian Delphi* is to *elicit alternatives* on which to base a comprehensive overview of the issue.
- **Scenario**: A *plausible* description of *how the future may develop*, based on corresponding information using a coherent and internally consistent set of assumptions about key relationships, driving forces (e.g. technology changes, prices) and constraints. Scenarios are neither predictions nor forecasts; they are used for *strategic planning*, but also *models for behavior*.

- **Scenarios** help *linking the uncertainties about the future to the decisions that must be made today* (alternatives and options).
  - Working today with the uncertainties of tomorrow;
  - Benefiting from entirely different perspectives and thought processes;
  - Communicating and applying scenarios beyond the boardroom;
  - Achieving both short- and long-term competitive advantage.
- Are **"Structured stories":** *Communicable and useful* (understandable options; "victory conditions" and specific rules).
- At industry, corporate and technology level (TI, CI)
- Focus: not answering the question "What will happen?", but ***"What will we do if it happens?"***
- *Triggers institutional learning*, if from a set of scenarios a clear signal emerges which requires action or change of behavior

 Ref. Runge, pp. 525; p. 531, Box III.1 6.32

Curriculum Certificate: Creating a "Model Business Plan"

- An *exercise in technology intelligence* (TI) and/or market research (provided:
  largely unstructured text plus some relevant files
- Using (only free-of-charge) Internet information resources and information
- A *demonstration* of the significance of already this part of publicly accessible information for TI
- *Learning* of technology intelligence based on real cases (for entrepreneurship and intrapreneurship)
  - Components of a business plan, developing a short presentation
  - Financing approaches by NTBFs

 6.33

Dealing with the Future - Questions

- **Dialogue and Group Action**: :
  Read about a **"Perfect Forecasting Device"** (5 min.)
  Extract *fundamentals, barriers and limitations* for predicting the future and create a list (5 min.);
- Use what is available in the Ref., add interpretations!
- **Discussion** (5 min.)

- If you *start off with the right questions*, you are *more likely to find the right answers*. But start off with the wrong questions, and you are lost from the beginning.
- "The educated person used to be the one who could find information. Now, with a flood of data available, the educated mind is not the one that can master the facts, but the one able to ask the '*winnowing question*'." (emphasis added)

 Ref. Runge, p. 845-848; p. 519, 520 6.34

Technology Entrepreneurship

Entrepreneurship for and in Technology Ventures

MODULE 7
The NTBF Startup Phase: Operational Competencies, Resources and Innovation Architecture/Configuration

The Entry into NTBF Foundation

- ***Relevant experience*** **of an NTBF founder?**
  Age between 30 and 40 years; average 13 years' work experience before establishing an NTBF
- Have an idea, an opportunity, a vision and mission, values, organizational and operating principles
- Have a *proper firm name and logo* ("nomen est omen")
- Then, founding officially an NTBF requires decisions which will *interrelate*
  - **Timing**
  - Aspects of **organizing entrepreneurial activities**
  - Aspects of **tangible and intangible resources** (here, in particular, **financing** and human resources)
  - **Location** (an exercise dealing with tangible and intangible factors)
  - **Legal aspects** (concerning firm structure, offerings (regulations), permits, intellectual properties - patent attorney?)
- Have, if applies, your "exit strategy", investors will have one

 7.2

The Entry into NTBF Foundation: Leading and Resources

- The Entrepreneurial Leader – Personal Factors
  - Learns and teaches – faster, better
  - Deals with adversity, is resilient
  - Exhibits integrity, dependability, honesty
  - Builds entrepreneurial culture and organization
- Working with Resources
  - Tackles the situation as a set of tangible and intangible resources

  Approach:
  - "*Tangible assets*" are *managed* efficiently according to "best practice"!
  - Working with "*intangible assets*", e.g. your personality and your people, customer relationships; firm culture is seen as a *fundamental differentiator* for sustainable competitive advantage and growth

 7.3

Leaders versus Managers

$$\frac{\text{Doing the right things}}{\text{Doing the things right}} \sim \frac{\text{Leadership}}{\text{Management}} \sim \frac{\text{Effectiveness}}{\text{Efficiency}}$$

Key Personality Aspects of Leadership (Interactions with Others):

- Leads by example and is a powerful, positive force
- Has a personality that inspires and creates trust
- Is accessible and available, a great listener
- Knows how to delegate and empower

Influence > attitudes > behavior
Power > behavior > attitudes

Management:

The art, or science, of achieving goals and targets through appropriate resources - with least cost and minimum waste
(Repeat:
"Tangible assets" are managed efficiently according to "best practice"!)

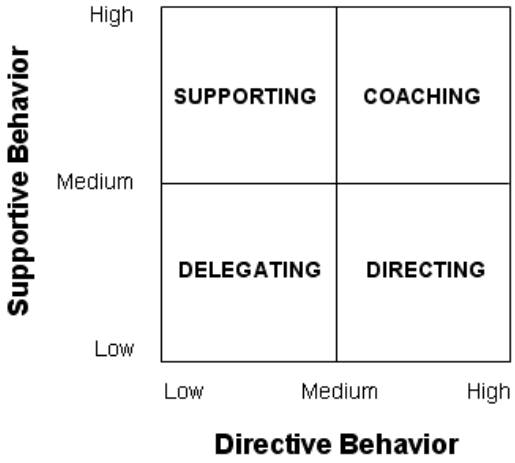
- **Management (not only) for Entrepreneurship:**
  „Ein Manager ist ein Mann, der genau weiß, was er nicht kann, und der sich dafür die richtigen Leute sucht." (cf. Avery, slide 3.6)
  (Philip Rosenthal)

Having/recruiting a *proper, professional "manager" is crucial for growth*!

 Ref. Runge, p. 17, Box I.4; p. 628 7.4

Leadership Styles and Employees

Management is about business results and processes. Leadership is about people.



Development Level	Leadership Style
Low Competency - High Commitment	**DIRECTING**: Structure, control and supervise
Some Competency - Low Commitment	**COACHING**: Direct and support
High Competency - Variable Commitment	**SUPPORTING**: Praise, listen and facilitate
High Competency - High Commitment	**DELEGATING**: Turn over responsibility for day-to-day decision-making

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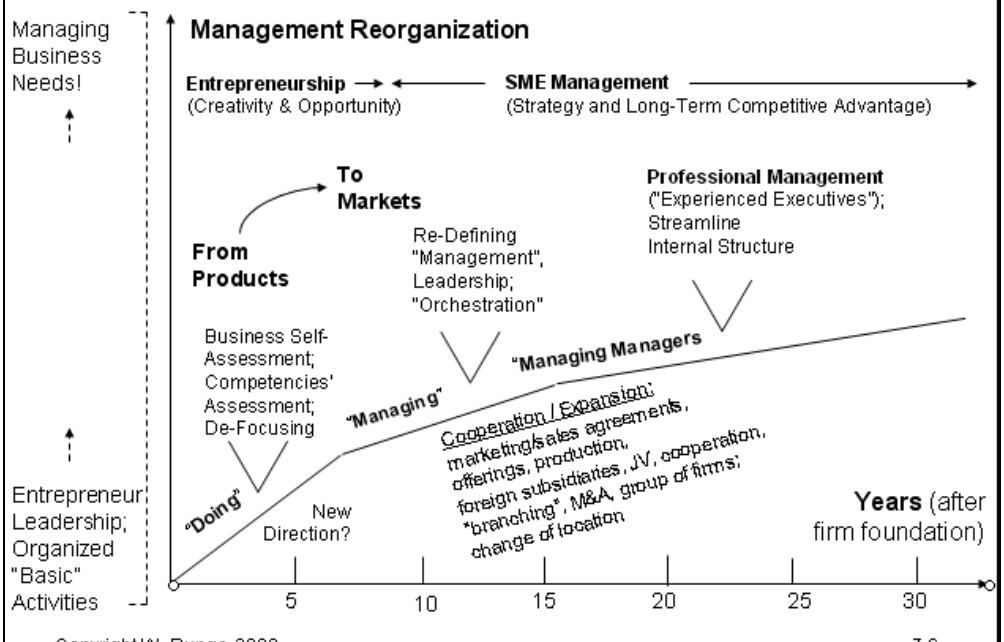
Stepwise Growth and Reorganization of NTBFs



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Overlay for Startup Life Cycles: Economic (Industrial) Cycles

Flat or down (economic, industrial) cycles require *other management skills* than managing growth of an NTBF!

- Adjust the business model (to a different growth level) and expenses
  - **You cannot continue the same way as in growing mode**
  - **Cut your losses (cut your "burn rate")**
- Ask yourself, can I afford to run this business at critical mass?
  - **Know your critical mass; if you cannot reach it, get out of the business (return the money)**
- Look for areas of incremental growth.
  - **Be not locked in your "breakthrough" (which usually takes longer than the cycle; incremental developments may lead to survival**

Lead with *tight execution* skills and *flexibility*!

 7.7

Commercializing Nanotech: Nanogate AG (cf. Slide 3.7)

- *Lesson from biotechnology.* Enabling technologies (technologies that allow you to make, do, process, etc.) do not create big wins unless they translate into a breakthrough *consumer* technology.
- Nanogate AG is one of the few nanotechnology companies on the global market to achieve a strong ***profit*** and has a lead in chemical nanotechnology (for coatings). Founded by **chemists** Rüdiger Naß/Gerhard Jonschker plus **business manager** Ralf Zastrau in 1998/1999; IPO 2006) ◀
- Nanogate AG is a holding (consortium) company with several subsidiaries/components – Nanogate Coating Systems GmbH, NanoTec Beteiligungen GmbH, HOLMENKOL Sport-Technologies GmbH & Co. KG (24.9% ownership), Nanogate Advanced Materials GmbH (JV with Air Products and Chemicals Inc.)
- **Organizational structure**: Industrial Systems and Consumer Systems.
  The Industrial Systems comprises the technologies for the development, production and integration of **nano composites and nano formulations** that are implemented **exclusively in industrial processes**.
  In Consumer Systems the emphasis is on manufacturers of consumer goods and strategic marketing partners. Here Nanogate offers *solutions* that can find application in the **customers' end products** and above all *differentiate themselves* through their simple and secure application. ◀
- Nanogate uses chemical nanotechnology as an enabling and/or *enhancing* technology. ◀
- With its Nanogate-Technologie® the firm can change (enhance) the properties of basic materials, **enable other uses** or assign **completely new functions**. The commercial value and profits per piece can be increased significantly. This is the "Nanogate added value principle".
  ("We provide our customers with a competitive edge by enhancing products with the aid of nanotechnology, and make it possible to program and integrate materials with new or additional functions.") ◀
- Nanogate Technologies GmbH is using nanotechnology to produce a **coating** about 100 nanometers thick that renders surfaces such as tiles and sinks stain- and scratch-resistant, and markedly easier to clean.
- Nanogate **covers a wide range of industries, functions and substrates** already on the basis of technology platforms.
  Nanogate provides many ***services along the value chain*** - from development and production of innovative nanocomposites and nanostructured materials to powerful support for innovation and product integration. ◀
  "We deliver everything, including *instructions* and sometimes *even the equipment to apply nanotech-based coatings* ("nanoformulations") that give surfaces certain useful properties.
  "As an enabler, we occupy the interface between the specialized developers and manufacturers of basic materials as well as industrial customers.")
- Nanogate **cooperates** with its *customers* as well as with providers of basic materials (*suppliers*). Spinoffs and strategic partnerships are one way to keep Nanogate focused on its goal of developing marketable products for its nanocomposites, ceramics and powders. ◀

 Ref. Runge, p. 550; http://www.nanogate.de/de/ 7.8

NTBF: How Much Money Needed and Financing Modes?

New businesses often need outside funds (= capital).

Amount depends on firm's structure/stage (cf. 3.12, 10.7, 10.8)

- **Offerings** (essentially product, service, know-how etc., slide 3.5) – what about marketing and sales?
- **Research** and (?) **manufacturing** (lab space, instruments, raw materials and equipment); technical service needed; patenting and regulatory fees?
- **Human resources**: will the founder(s) do essential work; hire employees to take over many of the day-to-day operations?

Debt financing vs. *equity* (unborrowed funds) financing

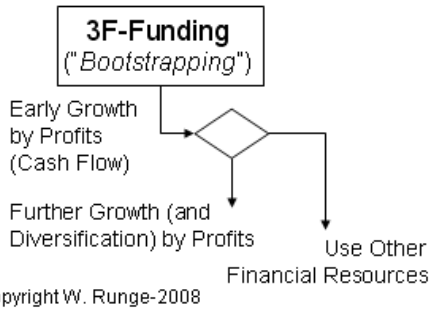
- ***Debt*** is a direct obligation to pay something (cash) to someone (an investor or lender). In exchange for having lent you the money, an investor will expect to be paid *interest* (interest rate usually reflects the level of risk the investor is undertaking by lending you money!).
- ***Equity*** financing involves *no direct obligation to repay any funds*. It does, however, involve selling a partial interest in your company. In effect, an *equity investor* becomes your business partner and will have *a degree of control over how your business is run*.

 7.9

Particular Firm Stages for Financing

Pre-Commercialization	Commercialization	Management Buyout, Business Succession
• Pre-Seed Stage • Seed Stage • Startup Stage	• Early Stage • Growth Stage • Diversification	

- Concerning financing (NTBF) development in stages does not represent a build-up process
- A "*financing stage*" is a *cross-roads*, a decision-point, on kinds of financial resources to be used for further firm development towards the goals



Financing Stage		Characterized by:
Pre-Seed	(RBSU: Incubation)	Preliminaries of developing a technology-based offering; technology/market search, feasibility study
Seed		Elaborating an idea (often used for proof-of-concept), a business plan, and further research. No commercial sales.
Startup		Product development, preliminary marketing, key management role in place. Understanding of regulatory requirements.
Early Stage – Later Stage		Initiate commercial product development and sales efforts (demo, prototype)
Growth Stage		Business, marketing and production expansion.
Diversification		Expansion into new technology/applications
Management Buyout (MBO (and Business Succession)		Purchasing an existing firm or a business by former managers/employees or by "outsiders"

 7.14

Financing Technology-Based Firms: The ABC

A. Cash: Amount (Needed, When) and Purpose

"3F"(?) + ???
("Bootstrapping"?)

↓
Communication- und Presentation Skills

SOFT SKILLS

Negotiation Skills
↑

B. Sources of Capital

C. Deal Structure

 7.11

Funding Fundamentals - Debt or Equity? (1)

Once you have determined the expenses of your new firm (cf. slides 10.7, 10.8), you will need to estimate what percentage of the *funds you can supply yourself and what percentage you must find elsewhere*.

- Many new startups start out by borrowing money rather than by selling stock. If the business does well, one may at some point of growth combine both types of financing as the needs change.

Never, never, undercapitalize, as it is easier to get more money up front than to have to ask for more later!

Debt or Equity?

Debts *Advantages:*

- You retain control of your company.
- Debt is limited to the loan repayment period.

Debts Disadvantages:

- The difficulty in obtaining them - Debts investors look for security
- A new business is likely to be charged a higher interest rate than a well-established business.
- Monthly payments on a loan (Cash may be scarce and expenses may be higher than estimated during the early years. "Penalties" for late or missed payments may emerge.)

 7.12

Funding Fundamentals - Debt or Equity? (2)

Equity Financing

- Selling a partial interest (ownership) in your company.
  An equity investor becomes your business partner.
  Equity investors may not agree with your plans for the business.

Advantages:

- With equity financing, you *do not repay* the money invested by others
- Assessment of your business idea and opportunities. It is in an equity investor's best interest for your business to grow and expand; he/she will be more likely to consider *sound business ideas* than will a debt investor, who is more concerned with the security of the deal proposed.

Disadvantages:

- You give up some control over your business.
  It may be very difficult to retain control in the future
- Equity investors can resell their interest in your company to other investors.

Stock? Complicated and time-consuming - you must comply with a number of legal and reporting requirements for the life of the business.(cf. Nanogate IPO prospectus http://www.helaba.de/hlb/generator/Sites/Helaba/Download/IPOs/msNanogate.de.pdf)

 7.13

Revisited: Funding Considerations

Don't start a company just because you can; have a really good idea and opportunity that are good regardless of the funding situation!

- Funding is usually *related to the development stage* of the NTBF
- *Many kinds of sources for financing* a new or growing firm exist – private and public
  Sources should be assessed and compared in the particular context and managed carefully!
- *Balancing own financial resources and capital by third parties* may provide *longer term financial security* and *relative independence* from individual capital providers!

 7.14

NTBF Funding Fundamentals – Some Sources (1)

- ***Banks*** come in all shapes and sizes (very special in Germany!) and *there are some real differences among them*. They may operate quite differently and have different attitudes concerning startups.
  - Bankers tend to be very cautious about lending money. Their primary concern is always the safety of their funds. They usually refer to lend to established businesses.
- ***Venture capital firms*** *(VC)* provide equity funds to new and young companies.
  This immediately separates venture capital firms from *investment firms*, which prefer to invest in existing, financially secure businesses. *VCs play an active role in the strategic planning phase of the business and seek continuing involvement.*
  They have very rigid investment standards.
- *Venture Capital Firms* are looking for three basic things.
  - High return (5-10 times their original investment within 5-7 years).
  - Easy exit
  - Fit of the startup/NTBF into the VS firm's strategy and portfolio

 7.15

NTBF Funding Fundamentals – Some Sources (2)

- ***Corporate venturing*** (corporate venture capital firms, e.g. BASF Venture Capital GmbH) also makes an investment in businesses in exchange for an ownership interest; *not motivated purely by profit*.
  - Seeks access to new markets in addition to realizing a financial gain
  - Often focus on "late-stage funding" rather than "early state" (seed)
  - Can add credibility when you seek funds elsewhere
  - The expertise of the corporation can be useful in marketing/selling, manufacturing, product development, access to firm resources and advice etc. Sometimes firms sent an experienced manager as an executive into the NTBF (or a supervisory board).
- ***Angel investor*** (called "*business angel*" in Europe): is someone who invests in a business venture, providing capital for startup or expansion. Often these individuals are looking for a higher rate of return than would be given by more traditional investments and will be looking to *play an active role in the management of the company*.
- Sometimes potential purchasers (*customers*) of the offering may be interested in providing financial help for the start or expand the business.
- There are a large number of *government financing* sources.
- One path to *becoming an entrepreneur is to buy an already operating business* from its present owner.

 Ref. Runge, p. 554, 558, 685, 695-697 7.16

"Angels" and Corporate Venturing Special

The Two "Wings":

Angel Investor

- *Financial Resources*
- Focus on typical (or higher) amounts of financial gain
- *Experience*
- Provide networking opportunities
- Seek active role in management
- Exit (?)

Corporate Venturing

- *Financial Resources*
- Financial gain not primary goal
- For NTBF access to *expertise* and *resources of venturing firm*
- Have networking options
- Seek access to competencies and technologies in NTBF
- Exit – takeover of NTBF (cf. hte by BASF)

 7.17

Governmental and Other Public Resources for NTBF Foundations

Two Sides of the Coin

Special programs to support firm foundations financially

Grants for research project (scholarships)

- Federal and State Government – capital and credit; debts financing
- PPP – Private-Public Partnerships
- Venture capital
- Financial contributions ("Zuschuss") for innovation activities

- Governmental or NGO* (e.g. DBU)* grants for technology projects, scholarships
- Research grants from science organizations (DFG in Germany, NSF in U.S.)

*) NGO: Non-Governmental Organizations
Deutsche Bundesstiftung Umwelt

 7.18


Spotting Financial Resources and Advices
Ownership, Legal Form of Enterprise
Location and Networking
Advisory Board
"3F" Resources (Family, Friends or Fools)
"Bootstrapping"
Federal State Resources
Governmental Resources
Banks
To spot resources consider:
Supranational Support (EU)
Angel Investors (Business Angels)
National Research & Technology Programs
Consultant Firms; founding angels
Venture Capital, Investment Funds
Business Plan Competitions
Nation-Wide Competence Networks
(Global) "Visibility"
"Early-Stage" ("Seed") vs. "Late-Stage" Funding
Corporate Venturing
"Retired Experts Circles"
Governmental Programs: Direct (funds, grants) and indirect support (subsidies, credit, tax incentives, etc.)
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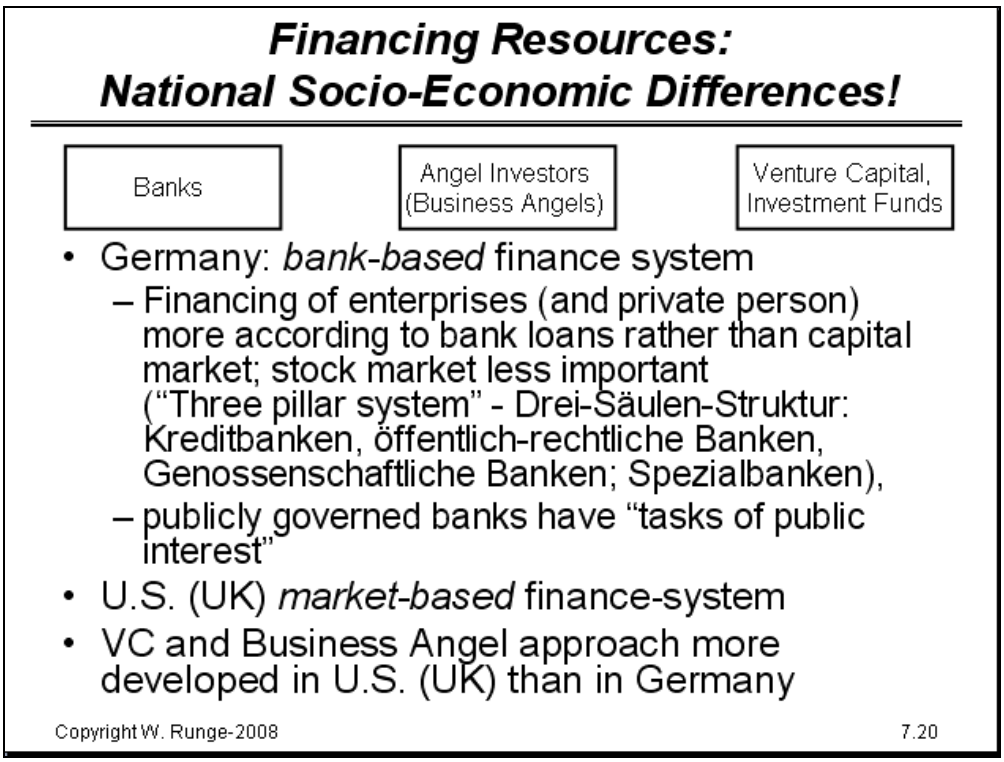
7.19


Financing Resources:
National Socio-Economic Differences!
Banks
Angel Investors (Business Angels)
Venture Capital, Investment Funds
• Germany: bank-based finance system
– Financing of enterprises (and private person) more according to bank loans rather than capital market; stock market less important ("Three pillar system" - Drei-Säulen-Struktur: Kreditbanken, öffentlich-rechtliche Banken, Genossenschaftliche Banken; Spezialbanken),
– publicly governed banks have "tasks of public interest"
• U.S. (UK) market-based finance-system
• VC and Business Angel approach more developed in U.S. (UK) than in Germany
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7.20

Bootstrap Startups

- Start usually with "3F" funding and only "business summary" (or modest business plan), strategy logics
- Look for quick route to breakeven and positive cash flow; re-invest profit; keep cost to a minimum
- Often unsure about markets (unless they identified a niche for them); learn from the customer(s) and adjust the business model
- Build their experience and know-how as they go; adjust the revenue and profit engine
- Start expanding, once the new venture starts growing while keeping the cost curve below the revenue curve
- Probably the best method to get an entrepreneurial firm operating and well positioned to seek equity capital from outside investors at a later time

 Dorf & Byers, p.411, 412 7.21

Financing Modes of NTBF in Germany

- Own funds is most important with cash flow coming next, then loans
- Ca. 75% of "young" firms founded in 2005/2006 reported already to make profit

Tabelle 6-1: Finanzierungsquellen von jungen Hightech-Unternehmen seit 2005

	Gründungskohorten			
	2001/2002	2003/2004	2005/2006	2001-2006
Cashflow	73,89	70,59	73,38	72,59
Eigenmittel	41,26	52,08	80,94	57,56
Mittel von Verwandten und Freunden	11,49	14,40	17,63	14,45
Finanzmittel von Dritten	4,67	4,47	5,96	5,01
Bankkredite	18,74	16,95	21,38	18,96
Öffentliche Zuschüsse	9,31	17,07	25,04	17,00
Sonst. Finanzierungs-quellen	20,94	16,80	13,06	17,00

Lesehilfe: 18,74% der in den Jahren 2001 und 2002 gegründeten Hightech-Unternehmen haben zwischen Januar 2005 und Februar 2007 neues Kapital in Form von Bankkrediten erhalten.
Quelle: ZEW-Hightech-Gründungspanel 2007.

Typical Examples: ProMinent GmbH (3.6), WITec GmbH (7.25)

Private investors, Business Angels, Venture Capital

BUT: Note the bias of TDL in the statistics

 Ref. ZEW-Studies on High-Tech Foundations, 2006-2008 7.22

Ownership and Legal Forms of NTBFs

- *Liability* has to be seriously assessed before making decisions about the business' legal structure (cf. 1.11).
- Issues in choosing the firm type:
  - Cost of incorporation
  - Minimum number of promoters
  - Limit of liability
  - Record keeping and statutory requirements
- *(Publicly traded) stock company* (AG in Germany) with ownership of investors - the typical form promoted in entrepreneurial education in the U.S; in Germany more balanced approach.
- Unlimited Liability Companies – Proprietorship
  - Single person operation:
    No difference between the owner and the company
  - Easiest to set: letter head, business card, current account
  - Profit of the company is the owner's income
  - Unlimited liability
  - (Nominal) registration with tax office (income tax).

 7.23

The Attractiveness of an LLC/GmbH

- A growth engine for German and American small businesses (across all fields)!
  Usually venture capitalists do not like to invest in LLCs.
- *Limited Liability Company* (LLC in the U.S. – in Germany GmbH – in UK Ltd.)
  - The LLC structure is extremely flexible in allowing different classes of ownership.
  - Owners separate from the company
  - *Company is an artificial (legal) person*
  - Separate income tax returns
  - Limited Liability
    - Debts, non-performing assets
    - Product liability, service liability

The LLC *tend to force the founders/partners to make profits as soon as possible.*

Founders of LLCs have to *sell their products to customers*, not sell their "milestones" and "image" to investors in subsequent financing rounds

 Ref. Runge, p. 236 7.24

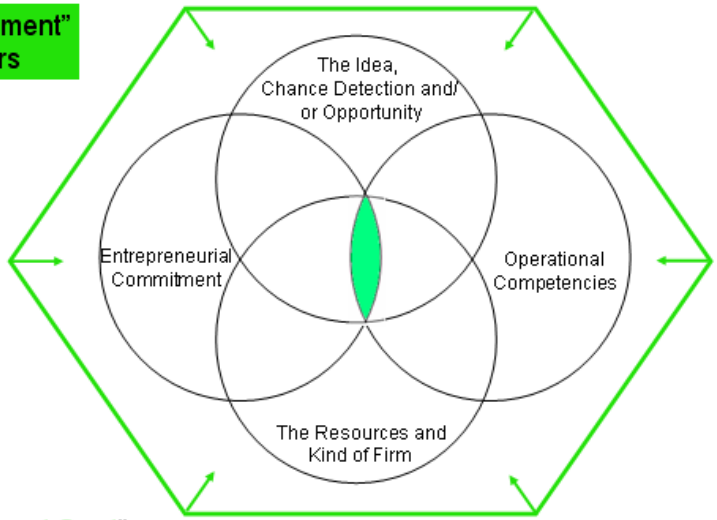
Some Successful LLC-Startups

- **Nanofilm LLC** (http://www.nanofilmtechnology.com): Nanofilm is profitable; German firm Carl Zeiss has a stake in it (cf. slide 4.37)
- **Nano-X GmbH** (http://www.nano-x.de/), founded 1999, spin-out from INM; one of the few nanotech companies with money-making products, growing on its own sales. Develops/produces customized materials with multi-functional properties (chem. nanotech); services: consultancy to target-oriented adjustment developments to production, support of application of the desired *coating* solutions; has patents; sales/employees (2007): ca. €6 mio., 50
  WITec GmbH (http://www.witec.de/): founded in 1997; profit is reinvested into the further growth of the company and into its own research and development; sales (2007) €7.1 mio. ("*organic growth*");
  Manufacturer of high-resolution optical and scanning probe microscopy solutions ("nano-tool") for scientific and industrial applications – an *enabling technology for chemical nanotechnology*;
  after 10 years in 2007 28 employees, average annual growth rates of 25%; nanotechnology, materials research and life sciences markets; modular product line and various patents.
- **BlueBioTech GmbH** (http://www.bluebiotech.de): founded 2000; recently doubling revenues over 2 years, €6-€12 mil. in sales in 2006; research, development and *production (in Germany and China) and sales* of micro algae as well as natural dietary supplements (brand: BluBio®); sole manufacturer, with German expertise and technology, of micro algae in China; patents for production

 7.25

The Entrepreneurial Configuration

"The Environment" and Its Drivers



The "**Sweet Spot**":
Matching opportunities, resources and firm form with competencies and entrepreneurial commitment for a decision to found a firm

 7.26

Attractiveness of an NTBF for a Large Firm: Puron AG

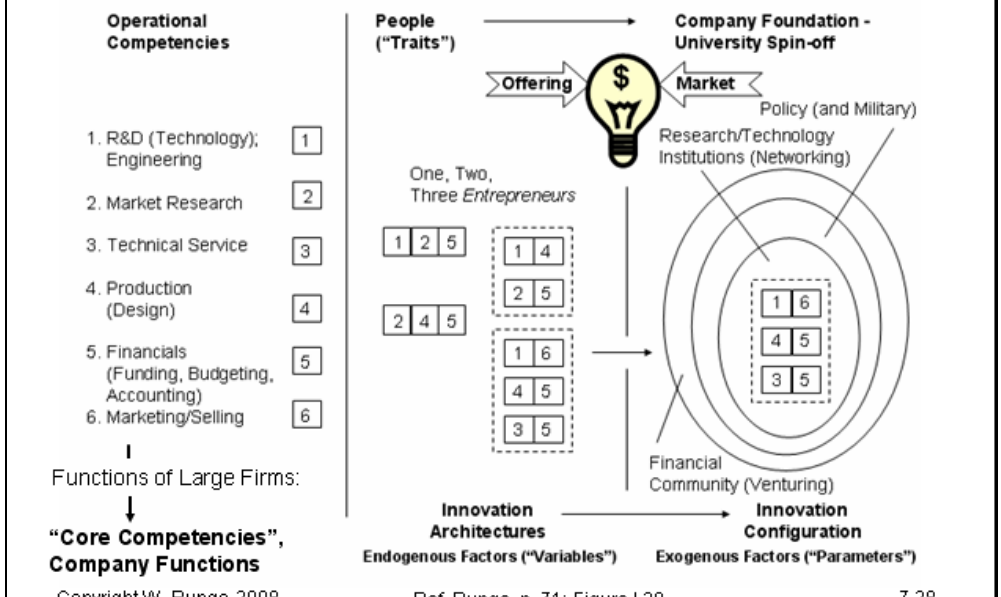
- Established in Aachen, Germany in November 2001 by three founders ("*entrepreneurial triple*") from the membrane and mechanical engineering areas as a *spin-out* from the Technical University of Aachen (RWTH).
- Puron GmbH concentrates on submerged *membrane bioreactors* (MBRs) to *combine* biological wastewater treatment with solids separation in one reactor system, but also industrial and drinking water (*customers* from the municipal, state or private water treatment industry)
- The *German federal state of North Rhine Westphalia promoted and supported the foundation of PURON* for more than 2 years by means of its PFAU program (Program on the Financial Promotion of University Spin-Outs).
- Puron was subsequently floated (AG; venturing by E.ON Venture Partners GmbH) to raise additional capital for growth. In 2003 Puron had 14 full-time employees and 8 part-timers and was a 2003 finalist for the "German Founder's Award" (visibility!).
- In November 2004 U.S. Koch Membrane Systems acquired Puron AG (KMS GmbH).

Competencies and Operational Clustering of Business Processes

Founders	Competency	Operational Responsibility
Dr.-Ing. Klaus Voßenkaul (Chairman of the supervisory board)	Doctorate in membrane and module technology	Research & design, marketing and sales
Dr.-Ing. Stefan Schäfer	Doctorate in seawater desalination	Production and finances
Dipl.-Ing. Christoph Kullmann	Graduated in mechanical engineering	Service & piloting, purchase and finances

 Ref. Runge, p. 95; p. 96, Table I.9 7.27

Combining Operational Competencies into an Entrepreneurial Innovation Architecture and Adding Key External Factors for an Innovation Configuration



 Ref. Runge, p. 71; Figure I.20 7.28

A German Approach: Family-Controlled Firms and "Hidden Champions"

- Across industries (including the chemical industry) and more than in any other European country in Germany *private and family-controlled publicly traded companies* represent a very significant part of the national economy.
- "*Hidden Champions*": **success architectures** of German (European) medium-sized companies that share *basically comparable structures and strategies*.
- **Characteristics**: How they are structured, staffed, led and managed

  People-oriented (almost never layoffs!), a highly skilled, well-paid workforce
- They *lead their world markets*, but *can develop in the clandestine*, *not observed and tracked by the public*.
- Roughly 10% of the Hidden Champions are (totally) publicly traded, the majority is privately held/controlled.
- Statistics:
  - On average $120 million in annual revenues (but single firms may exceed $1 billion)
  - Ca. 50% of sales (but often more) from exports

 Ref. Runge, p. 236, pp. 239 7.29

Hidden Champions: Architecture and Entrepreneurial Characteristics

- A clear strategy; highly focused, doing one thing extremely well
  - Focused its energy on the *long-term* development of *a global market niche*
  - *Know their customers* very well
- They always aim to be No. 1; not No. 1 in home markets, but globally.
- Invest heavily in *research and development*
- Provide superior *customer service*
- Manage *finances* very professionally
- Develop high-quality, high-technical-feature and high-performance *products* with *superior gross margins*.
- Founded and led often by *personalities* with determination, risk taking, persistence and inspiring abilities, who "walk as they talk", have high credibility and act as examples.
- Often managed by hands-on CEOs whose *knowledge of the key technologies is equal to their knowledge of the customers* that they personally work with ("*technical entrepreneurs*")
- "The customer as innovator"

 7.30

Hidden Champions: Examples

- Prominent Dosiertechnik GmbH (Slides 3.6, 4.3)
- Kraeber GmbH & Co (http://www.kraeber.de/)
- SAP AG (Ref. Runge, p. 241), a hidden champion that became Germany's biggest success story after 1970

- Private or owner/family-controlled (Ref. Runge):
  - Boehringer Ingelheim Pharma GmbH & Co. KG
  - Henkel KGaA (now Henkel AG & Co. KGaA)
  - Merck KGaA
  - Wacker AG
  - Altana AG
  - BMW AG

  (Quandt–family; Quandt-heiress Susanne Klatten)
  - Porsche AG (→ VW AG; Porsche/Piëch families)
  - The Würth Group (Reinhold Würth; Ref. Runge, pp. 256)

 Ref. Runge, p. 236, pp. 239 7.31

Technology Entrepreneurship

Entrepreneurship for and in Technology Ventures

Hier [im Wissenschafts- und Technologiepark Adlershof] laufen sich Wissenschaftler und Unternehmer täglich über den Weg. Das eröffnet Gelegenheiten für das Ungeplante, für die Überraschung.

MODULE 8
Clustering, Networking and Alliances for Startups and NTBF

Initial NTBF Constellations

Directing location selection:

- RBSUs often *do not have a marketable product before or shortly after formation*
- Many NTBFs originate from a parent or an "***incubator***" organization, typically either an academic institution, research institute, national or state laboratory or large well-established firm ("spin-out"; RBSU)
- NTBFs tend to *cluster around their respective incubator organizations*, forming *regional networks of expertise*
- Many retain contacts with their parent organizations to *gain financial and technical support*

 8.2

Sources for Obtaining Entrepreneurial Experience

For NTBFs, an MBA is not a way to gain experience, it is a way to gain perspective.

Remember: On average, *technical entrepreneurs* will have *ca. 13 years of work experience before establishing an NTBF (slide 7.2).*

- ***Fundamental and special experience*** **can be gained from *work in industry*, particularly working in leading positions for "New Product Development" (NPD), for "New Business Development" (NBD), in/for firm spin-offs – or having worked in R&D and Marketing functions (1.4)**

Other constellations for gaining entrepreneurial experience:

- **Coop with "entrepreneurial professors" (e.g. MnemoScience; 11.27)**
- **Common projects of industry and university/research institute (cf. 3.7; Nanogate); industry coop (doctoral thesis); work in startup (cf. IoLiTec)**
- **Work in industry labs on campus:**
  - BASF runs a laboratory at the Institut de Science et d' Ingenierie Supramoleculaires (ISIS), Louis Pasteur University, Strasbourg (France) with the goal of linking its R&D activities closer to academia Catalysis Research Lab (CaRLa) of BASF and Heidelberg University in the Technologiepark Heidelberg (led by BASF)
- **Start as a consultant - Quiet Revolution, Ltd. (4.19), ChemCon GmbH**
- **Failure – e.g. own failure (with a project, firm foundation)**
- Having already founded a firm – "**serial entrepreneur**"
- Due to the high amount of needed capital and long lead time for lab-oriented startups (chemistry, biotechnology), from the perspectives of a academic entrepreneur the ideal strategy would be to *conduct as much development work as possible in an incubator organization* before starting the new venture.

 Ref. Tidd et al., p. 355, 359; Runge, p. 691, 692 8.3

Location for the Enterprise: Clusters

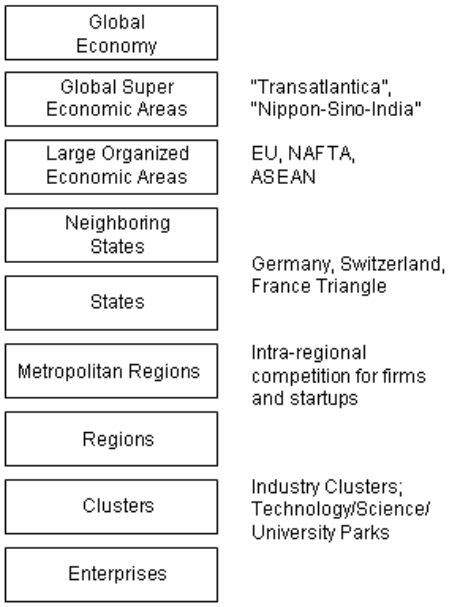
- *"Clusters"* are a common reality in all economies and industries (the most famous one: "*Silicon Valley*")
- "A **cluster** is a *geographically proximate group of companies* and *associated institutions* in a particular field, linked by *commonalities* and *complementarities*." (Michael F. Porter)
- NTBF tend to locate *around incubators* or in *regional networks*
- Clusters form a layer of competitiveness

 Ref. Tidd et al., p. 350; Runge, p. 273, 539/540 8.4

Entrepreneurial Economy

- For years, regions both inside and outside the U.S. have attempted to replicate the innovation success of the *Silicon Valley* high-tech cluster.
- ***Economic development*** **is a** ***collaborative process*****, which includes the individual state on various levels, private enterprises, public organizations and private associations and initatives.**
- ***Policy*****: Support development and/or enhancement of** ***entrepreneurial support infrastructure and networking*** **including business incubation centers, seed and venture capital, and access to business startup financing and assistance.**

Layers of Competitiveness



 Ref. Runge, p. 273, 277, 296 8.5

Clusters (1)

- Porter has described how clusters or locally based networks of firms in the *same industry* could constitute a *source of competitive advantage*. Most advanced economies are increasingly using *cluster policies* as they are market driven.

Policy-Driven Clusters:

- "Industry Park" or "Technology Park" through *public initiative* (cf. the role of Industry and Science Parks for China's development)

  A *Technology Park* is an initiative that supports the following economic objectives:
  - Enterprise development
  - Job and skill creation
  - Investment Attraction
  - *Innovation and entrepreneurship*
  - Export and trade
  - Diversification of the regional economy
  - Sustainable economy

http://en.wikipedia.org/wiki/Business_cluster
Competitiveness. Cluster-based policies:
http://www.competitiveness.com/nps/corporate/com/en/clusters/whatisacluster.pdf

 Ref. Runge, p. 278, 282, 314, 320 8.6

Clusters (2)

- **Private Clusters, e.g. Large Firm Rooted Clusters**
  Routed in firm's resources optimization (Currenta: Bayer ChemPark – Start-Up-Initiative) or "residues" of a firm's reorganization or divestiture (Industriepark Frankfurt Hoechst)
- Specialized (*policy-driven*) clusters - ***Science Parks***
  - Seen as a vehicle for "*technology transfer*" (science2business)
  - *Characteristics*: Comprises a region with a *large skill base due to leading edge organizations* (universities, public and semi-public research institutes and laboratories, firms with strong R&D activities) at the forefront of research and development
  - *Value addition*: infrastructure (may include high-tech instruments for experiments), park management, flexibility of building layouts, non-profit R&D; profit-oriented R&D, education institutions, government and the community - learning by example or imitation
  - *Attracts innovative together with fast-track companies as the ideal catalyst for business startup* (new firms, university spin-outs, firm spin-outs and subsidiaries and joint ventures); often early-stage technology (RBSU – Research-Based Startups)

 Ref. Runge, p. 277, 279 8.7

Clusters (3)

- Technology Park examples:
  - Karlsruhe (IT-oriented)
  - Heidelberg (a science park; covers the biotech cluster of the Rhein-Neckar Metropolitan Region and the BASF-CaRLa, slide 8.3)
  - Berlin-Adlershof (the largest science and technology park in Germany; covers science institutes of Humboldt-University Berlin, other research institutes and ca. 400 firms)
  - Chemiepark Leuna (a policy-driven re-foundation of the original "Chemie Dreieck" after the German Re-Unification)
- Research Triangle Park, N.C. (U.S.)
- The Cambridge or Oxford Science Park (UK)

 Ref. Runge, p. 277, 279 8.8

Eco-Clusters, Biorefineries and CleanTech

Eco-Cluster:
Cluster of biobased or ecology-related firms producing chemicals, fuels, power, products, and materials

- May operate with (and develop) other types of renewable energy (photovoltaic, solar cells; wind, etc.) for cluster-internal use

Biorefinery:
May include a mix of industries which can use *biobased input* (material) and process biobased material

 8.9

Some Cost Elements for Firm Foundation in a Cluster

- Rental of office and lab space and special facilities (e.g. clean rooms)
- Cost of office/administrative services
- Hourly rates for using cluster-owned sophisticated high-tech (expensive) instruments or devices
- (Sometimes) Consulting and advice for firm foundation

 8.10

Clusters and Competitiveness via Proximity

- **Clusters improve firms' productivities and efficiencies**
  - *Access to infrastructure*: easy access to specialized suppliers, services and human resources, raw material and intermediates, energy, water, information technology – and waste disposal
  - *Simplified communication*, coordination and cooperation among firms
  - *Information spillovers*
  - Rapid *diffusion of best practices*; and ongoing, visible performance comparisons with local rivals; firms providing role models for other firms
  - *Compete globally* thanks to a better access to information and specialized resources, flexibility and rapid adoption of innovations
- **Clusters stimulate and enable innovations**
  - Enhanced ability to *perceive innovation opportunities*
  - Imitation facilitates faster *innovation adoption*
  - Presence of multiple suppliers and institutions to assist in *knowledge creation* (knowledge and technology transfer)
  - *Ease of experimentation* given locally available resources
- **Clusters facilitate commercialization of innovation**
  - Market potentials for new firms and new lines of business are more apparent
  - Commercializing new products and starting new companies is easier with the available skills, suppliers, etc.

 8.11

Incubation

- **Business *incubation* is a *business support process* that *accelerates the successful development of startup and fledgling companies* by providing entrepreneurs with an array of *targeted* resources and services.**
  These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts.
- **Technology-oriented incubators help with**
  - Business plan development, including financial and marketing analysis;
  - Market research and competitor analysis;
  - Marketing and sales strategy development;
  - Management consulting;
  - Technology assessment;
  - Patent and trademark applications;
  - Location of and access to financing sources;
  - Prototype development.
- Research/Technology incubators: universities – MIT etc.; MPI, FhG, FZ(K)

 Ref. Tidd et al., pp. 351; Runge, p. 464 8.12

Networking: A Part of or More Than Clustering

"Networking" - *Lifting Physical Proximity*:
a *more or less tight interconnection* of organizations (or people) with a more or less clear *purpose*, including connections across regions, countries or continents (cf. "*competence networks*" in Germany)

- For startups the term networking will refer essentially to *people networks* – meaning *communication*, strengthening or weakening ties or *finding common interests and purpose*.
- To succeed, for startup companies it is advisable to have or build a *supportive network*, e.g. contacts to people of the incubator or to anywhere in the world, people from other scientific disciplines etc.
- A startup's "*advisory board*" is also a good springboard for networking
- Once you have these networks, interesting and unpredictable things can happen – for your benefit.

 Ref. Runge, p. 277 8.13

Networking Aspects

Knowledge and Competency Orientation

- Advice and Contacts (Advisory Board)
- Visibility
- Credibility
- Information Sharing
- Intelligence (Competitors, Markets, Industries)
- Project (research, development) alliances ("Verbundprojekte")

Customer Orientation

- "Virtual Company" (several NTBFs, SMEs) with complementary offerings; one-stop-shop, referral
- Customized offering
- Resource sharing
- Financings: customer prepayments
- Specific Information sharing

 8.14

Opportunities for Network Building

- Special conferences, exhibitions, fairs and associated "events" may facilitate *contacts* with potential partners to discuss business or technology partnerships and focus on transversal cooperation.
- An (exhibition, conference) "event" is the ideal environment for *exposure* and *visibility*:
  - Enterprises offering and/or using innovative technologies
  - Enterprises that are looking for specific expertise and know-how
  - Scientists and research institutes offering application-oriented research results
  - Scientists/researchers of startup meet researchers of industry
- Further events aim to bring together young *entrepreneurs* and *decision-makers from large corporations* in the technical sector, to exchange ideas and establish collaborations or to meet *venture capitalists* to look for financing

 8.15

Remarks Concerning Technology Parks

Non-Financial Considerations

- Though usually having involvement of policy (government, federal state, regional authorities) technology parks are usually formally independent, *profit-oriented organizations* (e.g. as a GmbH/LLC)
- Technology parks follow a strategy; they often *focus on a particular industry* (Technologiepark Karlsruhe on IT) which, however, may bind the park to the economic developments of that industry.
- A firm founder should *know park characteristics and orientation* to be aware of likely future park developments and consequences for clustering and networking
- Using a "non-chemical" technology park for a chemical startup (essentially a customer or/and supplier criterion)?
  - The chemical startup envisions future applications of its offerings in another industry (e.g. park with biotechnology or photovoltaic)
  - The chemical startup needs to access to an enabling technology (e.g. analytical instruments and devices in "physics" oriented parks)

 8.16

Summarizing Location Selection Criteria

1. **"Proximity"**
   - Social environment – "roots" (family, friends, etc.)
   - Incubator relationships (e.g. university spin-out – university providing (cheap/free-of-charge) lab space and instrument access; keeping tight networks with left organization; access/social contacts to "advisors")
   - Nearby "science/technology parks" with corresponding facilities, customers, suppliers
   - Financing options (e.g. accessible sources of capital, state support)
2. **Business and Technical Environment**
   - Accessibility via common travel and transportation means (plane, railroad, car)
   - Networking with business and scientific/technical environment (proximity to customers, large companies, universities/research institutes etc.); "industry clusters"
   - Cost for (renting) buildings, laboratories and other infrastructure (e.g. office, IT infrastructure)
   - Competitive offerings of support by federal states or regions (funds; building; service/manufacturing environment; logistics); competition between region in terms of financial support, administrative/bureaucratic procedures etc.
   - "Normal" versus "Metropolitan Regions" ("Metropolregionen")
   - Attracting competent/top people
3. **Living**
   - "Quality of life" (one argument to attract high-quality personnel!)

↑ Firm Foundation and Options for Growth ↓

 Ref. Runge, p. 277-280 8.17

Summary: Alliances for Startups and NTBF

- Alliances (cf. slide 1.17) comprise aspects of *networking, resource/competency management, revenues and growth*
- Alliance configurations:
  - **Joint Research Agreement (JRA); JDA (…Development …)**
  - **Contract Research (often one offering of startups or NTBFs)**
  - **Joint Venture – JV (Nanogate/Air Products & Chemicals – 7.7)**
  - **Supplier/customer agreements; including contract manufacturing**
  - **Production Agreements (quantities exceeding pilot plant volume)**
  - **Marketing/Sales/Distribution Agreements (often an option for "global reach" or an entry of large firms for future acquisition (Closure Medical – U.S.)**
- Examples:
  - **IoLiTec GmbH – (distribution of ionic liquids via Merck KGaA, Sigma-Aldrich & cooperation agreement with Evonik Industries); consortium: startup (IoLiTec) - large firm (Merck KGaA) – university (Katholieke Universiteit Leuven)**
  - **BlueBiotech GmbH – (*research and production* of micro algae and natural dietary supplements as well as active pharmaceutical ingredients (APIs); marketing and sales by Kraeber GmbH & Co.; additional production of micro algae through JV in China ("algae farm" – slide 7.25)**

 Ref. Runge, p. 39, Box I.7; p. 98, 539, 550 8.18

Technology Entrepreneurship

Entrepreneurship for and in Technology Ventures

Don't assume people will want your technology and offerings – prove it – as you develop them!

MODULE 9
The Entrepreneurs' Market Research and Marketing

Marketing only for "Marketers"?

Marketing is too important to be left to the marketing department!

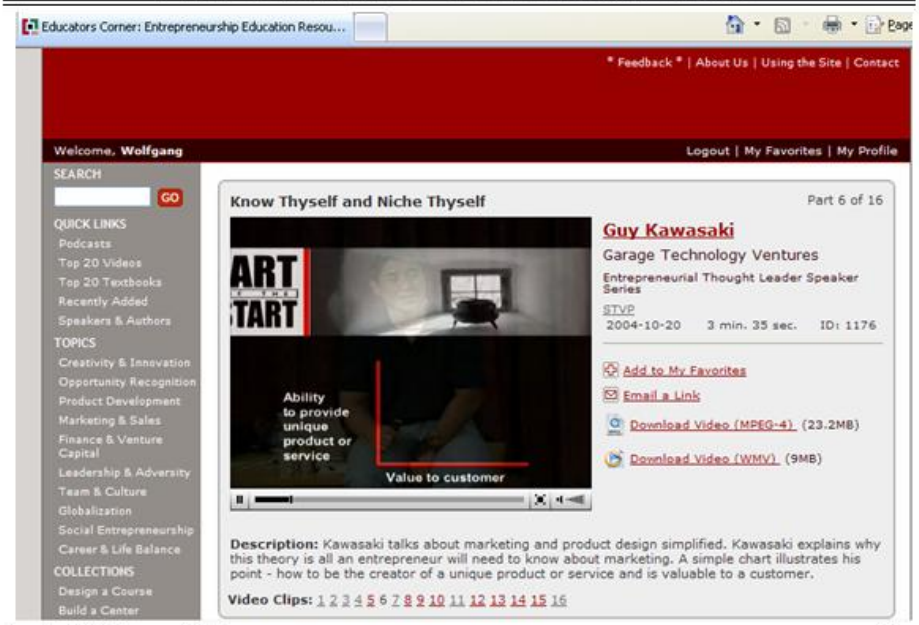
Marketing **is so basic that it cannot be considered a separate function.**
It is the whole business seen from the point of view of its final result, that is, from the customer's point of view.

Peter Drucker

David Packard

 9.2

The Key Relationship for an Entrepreneur's Marketing Efforts



Copyright W. Runge-2008 Ref. http://edcorner.stanford.edu/authorMaterialInfo.html?mid=1182 9.3

Non-Technical Questions to Business-Minded R&D People

- Who are the *potential customers*?
- What does a *customer need, (or might need)* to do differently or better?
- How might a *customer's need be met* (technology, generic solution)?
- What *feature set* will appeal most to customers?
- What are typical *indicators that there would be value* to the customer?
- What are the *driving forces in the market* that create the need and opening?
- What is the *size and growth rate for the particular market*?
- *Why* is there a *need for a new offering*?
- Is this a *primary need or a substitution need*?
- Is there a *time-based window of opportunity*?
- Why will customers buy the firm's offering?
- *What might be the size and the growth rate for the offering* (quantities to be produced and layout for the size of the production plant)?
- *Who are our competitors*, what are they doing, and how will they likely react against our offering?

The ***Marketing Mix*** - a Marketing Mantra:

5 P **(*4 P*) – Product, Place (Distribution), Price, Promotion, Position**

Copyright W. Runge-2008 Ref. Runge, p. 778, 780 9.4

NTBF and Market Inquiry

One often observed weakness of NTBFs is lack of market knowledge!

Market Research:

A systematic, objective collection and analysis of data about a target market, competition, competitive offerings and/or "environment" and drivers with the goal having increased understanding of them

Marketing:

The management process responsible for *identifying, anticipating and satisfying customer* requirements profitably and *retaining* them

- There is *considerable overlap between marketing and market research*. Market research is sometimes viewed as a part of marketing – or *belonging partly to technology intelligence*.
- Marketing or/and intelligence both enter into *strategy*.
- Framework for *Entrepreneurs' Marketing:*
  - Market Discovery ("Opportunity")
  - Offering (e.g. Product) Development
  - Marketing Strategy (Plan)
  - Offering/Product (Company) Launch
  - Measurement and Refinement

 Ref. Runge, p. 816, 826 9.5

Market Research and Competitive Intelligence

Market Research	Competitive Intelligence
• A snapshot of a particular time	• An action fill where the stars and the plot are always changing
• Tactical and methods-driven	• Strategic and results-driven
• Draws mostly from consumers	• Taps a wide range of constituencies, including customers, competitors, suppliers, distributors, substitutes, government etc.
• Relies on direct contact	• Exploits primary and secondary information resources
• Reflects customers' thinking and beliefs, which may be different from reality	• Captures the facts - what is actually occurring, hypothesizes what is likely to occur
• Primarily quantitative with a qualitative component	• Primarily qualitative; may include a quantitative component
• Objective: Answer questions	• Objective: Answer questions; raise questions; provide recommendations; initiate action

Competitive intelligence and particular market research areas cannot be strictly separated.
Depending on the organizational environment they may have converged.

 Ref. Runge, p. 780; p. 802, Table III.40 9.6

Value Creation: Market and Technical Value

Market value **comprises the degree to which a real customer *perceives the need* for the company's offering (e.g. product) and after a cost/benefit assessment *pays the offering price* to purchase it.**

Technical value **provides *different perspectives* for producer/supplier and customer.**

Producer (Supplier) Perspective

How *protectable from the competition* the product is or how *exploitable* the product is as a basis for further offerings; related to e.g.

- Patents (Patenting Strategies!),
- Know-how, technical reports,
- Synergy with other products,
- Imitation barriers
- Related service that can be provided, Lower cost of manufacturing,
- Product switching cost with the customer.

Customer Perspective

- Meeting or exceeding *design specifications* expressed by the price the customer accepts to pay (cf. Slide 9.12)

Market value and technical value does not necessarily match!

 Ref. Runge, p. 613 9.7

More on Value

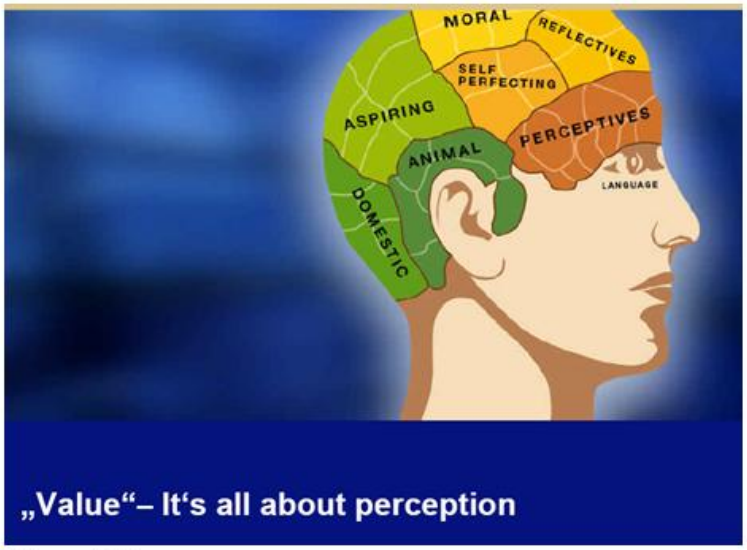
- Value is the worth, importance/relevance or usefulness.
- In business, value refers to the worth in *monetary terms* of the *social and economic benefits* a customer pays for an offering (incl. service).
- Concerning value most *technology-based products* are initially focused on *functionality and/or performance*.

Values Offered to a Customer:

Product	Performance, quality, features, consistency, safe, self-explanatory, easy to use, selection (version), brand
Price	Fair, visible/transparent, reasonable, consistent
Access	Convenient, location, nearby/at-hand, easy to find - in a reasonable time
Service	Ordering, delivery, return, check-out, warranty
Experience	Intimacy, emotional, respect, fun

 Ref. Dorf & Byers, p. 65 9.8

"Perception is Reality"



 9.9

Inquiry into the Market

Market Overview

Context

- General *industry* definition
- Current size and demand
- Technical evaluation of industry
- Potential *target market*
- Potential target market growth
- Market share of competitors
- Direction of industry
- Current conditions of industry

Approach the Market

- Clearly defined long range market strategy
- Market segmentation
- Initial plan to obtain a market share (product to market fit)
- Resources available - or allocated to market penetration
- Supporting assumptions on ability to hold market share

- **Market Analysis** - Who are the customers? Be specific!
  - Industrial customers - Professional customers - End-Users (consumers)
  - Most marketing methods are generally developed for consumers!
- When analyzing your market, an "*80:20 Rule*" is a good rule-of-thumb: *20% of your customers will consume 80% of your business's products or services*. It is your job as an entrepreneur to identify your "20%" and (initially) market toward them.

 9.10

Market Research: Regulations and Standards

- *Ecology constraints* for the chemical (pharmaceutical and biotechnological) markets (drivers for *regulation-driven innovation*!): Environmental Health and Safety (EH&S) regulations and Industrial Hygiene (IH) – governmentally enforced by law (cf. 1.11)
- WHO recommendations and national regulations (e.g. MAK; Germany)
- Legal regulations emphasize production, use, handling and distribution (air, water, earth/soil)
  - HAP (Hazardous Air Pollutants) and VOC (Volatile Organic Compounds; e.g. organic solvents replaced by water for coatings and adhesives)
  - Metals (Cd, Pb, Hg, Sn etc.) and Non-Metals (B, As etc.)
  - Agrochemicals (pesticides)
  - Animal exposure (feed)
  - Human exposure (health and nutrition, pharmaceuticals)
- For instance, currently, nanotechnology is under scrutiny concerning ecological effects.
- Registration systems for occupational health and safety, for drug and food use etc.
  - EINECS (European INventory of Existing Commercial Substances) – U.S. through TOSCA -Toxic Substances Control Act
  - REACH (EU; Registration, Evaluation & Authorization of Chemicals)
- *Non-legal regulations* = industry standards, e.g. ISO (or DIN), cGMP - "current Good Manufacturing Practice, a quality standard

 Ref. Runge, p. 22/23, 115, 116, 262 9.11

The Entrepreneur's Focuses Concerning Markets and Selling

- Market Research and Analysis
  - Customers (Industrial customers; Customers-of-Customers)
  - Market size and trends
  - Regulations and norms
  - "Market Attractiveness" (9.17)
  - Competition
  - Estimated market share and sales
  - Ongoing market evaluation
- Marketing Plan
  - Overall marketing strategy
  - Pricing
  - Sales cycle, tactics
  - Service and warranty policies
  - Advertising and promotion

As a rule of thumb, the *selling chance of a product* is determined to 70% by the *definition of the requirements*.

Do you know who is making or influencing *purchasing decisions* with your customer - the Purchasing Department, or Technical Service, Engineering or R&D?
(cf. Specialty Chemicals, slide 4.21)

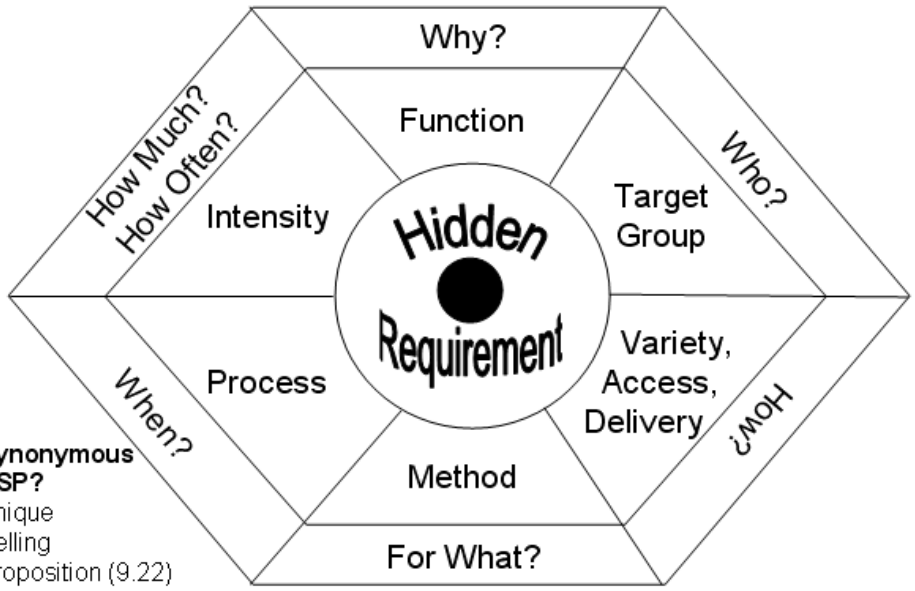
 Ref. Runge, p. 780 9.12

Forecasting Demand – And Need

- The *sales forecast* is the driver of the production plan, the personnel plan, the financial plan, etc.
- Who prepares the sales forecasts?
- Production/operations (people) or marketing people?
- Shall manufacturing produce whatever product/services it believes the marketing should sell?
- Estimating market demand: by analogy
- Use qualitative and quantitative methods, but don't forget *input from "field (sales) people"*

 9.13

Inquiry into the "Unique Selling Point"



Synonymous USP?
Unique Selling Proposition (9.22)

 9.14

Positioning Against Competitors (?)

- Example – Osmonics (slide 3.6)
  - **Counter-intuitively, Dean Spatz [Osmonics' founder] believed that competition from very large industrial companies, such as Dow Chemical or Dupont, also helped his firm's prospects: "It turns out that if you're a startup company and you have big name competitors, that gives you a lot of credibility."**
- What is important to the market?
- Utilize extensive market and competitor analysis as the foundation of everything they do
- How do I stack up?
- Herbert H. Dow: "If you can't do it better, why do it at all"

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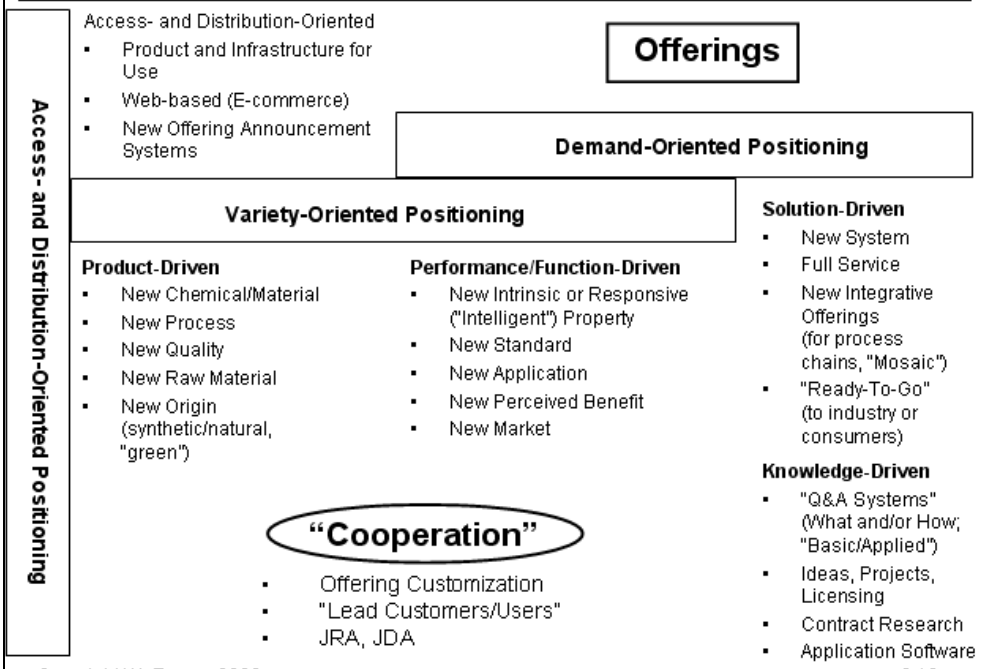
Strategic Positions in Relation to Customers



Copyright W. Runge-2008 Ref. Runge, p. 705; Figure III.38; p. 763, Box III.10; p. 153 9.16

Attractive Markets

- Segments with lots of demand (or "guaranteed" demands); accessible segments
- Markets in which you offer a USP ("Unique Selling Proposition" – cf. 9.22, 9.23); you are able to differentiate from competitors
- No "imitations"/copies; (almost) no substitute
- Markets in which suppliers and distributors do not have power

Market Attractiveness Quantified (an ideal example!):

Based on …	Rating Scale of 1-5	Weighting Factor
• Market Segment Size	5	0.50
• Annual Growth Rate	1	0.15
• Segment Profitability	1	0.20
• (Inverse) Level of Competition	1	0.15
Market Attractiveness Score		Y = 3

Startups rarely have quantitative figures about their markets ("niches")!
How to estimate the market potential of niches?

 9.17

Using Market Research Services

- Usually (very) expensive!

Alternative approach: at first, *do-it-yourself*

- Get a rough view from the Internet (market/patent information, competitors, partial results/abstracts from market research reports)
- Talk to people who know (or know who might know)
- Structure what you have available
- Position your idea in the context of the information you have got and what you intend to offer (is part of the opportunity analysis; cf. slide 4.23, 4.24, 4.25)
- Only then you will be in a position to *ask the right questions specifically* (the gaps you need to fill) and you may want to involve a market research firm or consultant ("pre-launch cost") – or go into the field yourself

 Ref. Runge, p. 81 9.18

Surveys

- Survey is often a first step of market research. A survey collects information from a specific group of people or data on a specific subject

Forms of survey interviews:

- Personal interview
- Focus group and group interview
- Telephone interview
- Mail interview(letter, e-mail)

 9.19

Market versus Industry: A Macro / Micro Distinction

- Large and growing markets are important, but…
- Structurally *attractive industries* are also important
  M. Porter: the five/six forces approach
  1. Firm rivalry/competition
  2. Threats of entry by new competitors (cf. slide 4.32)
  3. Threats of substitute products
  4. Bargaining power of customers
     (NTBF caveat: a single or one major customer!)
  5. Bargaining power of suppliers
  6. Bargaining power of complementors

 9.20

Being Market Leader in a Declining Industry?

Domains:	Market	Industry	
Macro Level	Market Attractiveness	Industry Attractiveness	Does not necessarily match!
Micro Level	Segment Benefits and Attractiveness	Sustainable Competitive Advantage	Scores are not additive!

Better to have 10%, and rising, market share of a $1 billion market than 100% of a $100M market

 9.21

Feasibility and USP Check

Feasibility?

- Is there really a market for you?
- Have you analyzed how successful your product or service can be?
- Does your company have the strength to get the job done?
- Have you prejudices? Let outsiders know why this will work and be able to support what you believe in!

USP - *Unique Selling Proposition*
(usually related to *promotion/advertising*; "slogan", even logo)

1. Each advertisement must make a proposition to the customer: "buy this product, and you will get this specific benefit."
2. The proposition itself must be unique - something that competitors do not, or will not, offer (or can rarely imitate)
3. The proposition must be strong enough to pull new customers to the product.

- Consider, however: Is the uniqueness too small or too technical for customers to observe the differences in actual practice?

 9.22

USP: Wording

USP:

- Sentence #1

  For (target customer)
  who (statement of the need or opportunity),
  the (product/service name) is a (product/service category)
  that (statement of benefit).

- Sentence #2

  Unlike (primary competitive alternative),
  our product (statement of primary differentiation).

Value Proposition:

a statement of how customer value can be created (by your NTBF) – usually one or two values (9.8) dominate

- Compelling reason to purchase
- Provides profit margin
- Quantify these benefits (money/time saved; less repair, etc.)

 Ref. Dorf & Byers, p. 250 9.23

Binding Customers

Customers: *find them, attract them* (they also may find you, how?), *bind them*

- Build customer loyalty (↔ customer intimacy)
  - Quality, consistency, favorable price/value ratio
  - Reliability
  - Value added services
- Note: To eliminate 1 negative experience requires 6-8 positive experiences of the same kind
- Customized offerings
- The "manifold" ("one-stop-shop") approach
- "Mosaic" (process chain) offerings (→ "solutions")
- Switching costs (reverse customers' bargaining power)

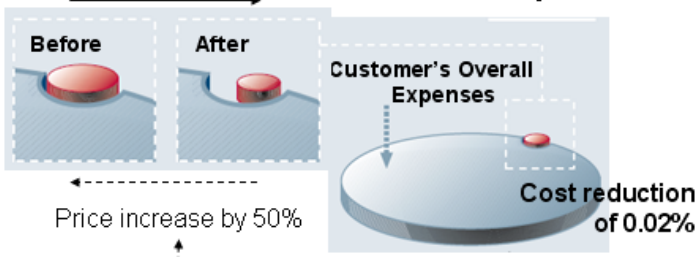
 Ref. Runge, p. 26, 27, 781 9.24

Benefits:
Supplier Customer and Perspectives

Customer's Economics

Supplier Perspective:
Cost reduction by 50%

Customer Perspective:



Price increase by 50%

Potential Price-Insensitivity

Price Elasticity

 9.25

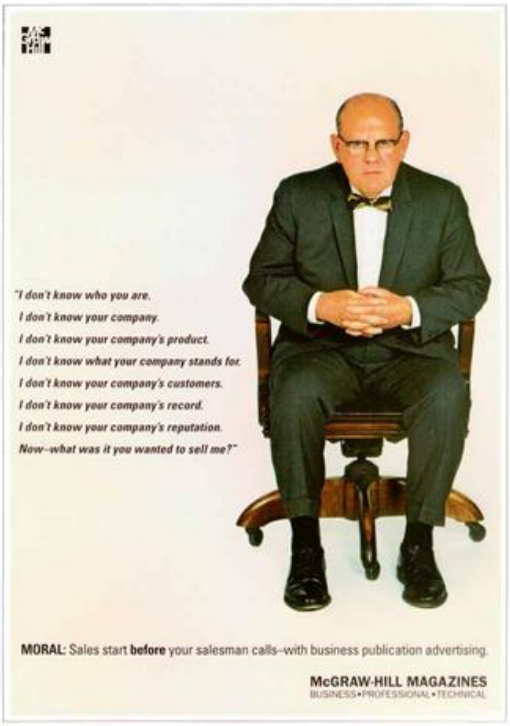
Selling: The Extended View

- **The key lesson for the entrepreneur: *learning how to sell* (hard job!)**
- **Selling is not something that you do only when seeking money for a product or an investment: You sell all through life.**
  - Negotiating with your parents for a bigger allowance, trying to convince your children to eat their vegetables
  - Going for a job interview
  - Getting anywhere in the corporate world would involve selling (yourself, your idea, your project, your vision) to peers and managers
- **Persuade people to give you what you want!**
  - Persuade (financial) people to give you the money you need to launch your startup
- **In a startup, everyone quickly learns that *survival depends on the company's ability to sell its offerings (products, services)*. No matter how unusual or wonderful your products, the stark reality remains that you are always competing with someone else.**
- **The only way to succeed in the long term is to make your customers successful, after all. You can always *win by helping others win*.**
- **Advantageous *"soft" skills*: Presentation Skills, Negotiation Skills**

 9.26

Selling –
"The Man in the Chair"

- *Sales start before entering the sales negotiations*
- Get messages to perspective or existing customers or to bind the customers
- The power of *advertisements* (in the media; created ca. 50 years ago); today: also role of the *firm's Web site.*
- Advertising in technical journal or magazine in terms or technical articles or interviews (Q&A) still very important



(cf. also slide 4.24)

Ref. Runge, p. 351; Figure II.26

Place - Distribution Channels

- How does your offering reach the customer?
- Distribution: making your product available to potential users is particularly important for *consumer-facing startups*.
- Can you do it yourself?
- Will you (have to) look for marketing/sales and distribution agreements? (often used by NTBF)
- Do you have a Web site?
  Can you use the Web for selling?
- When deciding how to distribute your product, think of the *traditional distribution model as a starting point*.
  Its three levels: *the producer, wholesaler and the retailer*.
- The primary alternative distribution channel is *direct distribution*. This is e.g. the model of Dell Computer.

Pricing – Market Value

"Price is what you pay, value is what you get" (Warren Buffet)

- Demand in markets may be "*price-sensitive*" or "*price-insensitive*" (e.g. military)
- Value is a relationship and a context that is important: "valuable to whom" and "important for what purpose" (cf. Slide 9.8)
- For NTBF: Unique needs of industrial/technical customers
- Pricing for NTBF: How much do customers value the products, services, and (associated) intangibles that the vendor provides?
- Pricing concepts comprise owner (the proprietor's point-of-view), market value, tax value and fair value (equitable to both parties).
- A *well chosen price* should
  - achieve the financial goals of the firm (e.g. profitability)
  - fit the realities of the marketplace (will customers buy at that price?)
  - support a product's *positioning* and be consistent with the other variables in the *marketing mix*
- Approaches to pricing:
  - *Market-based* (reference to comparable transactions, competitive offerings),
  - *Cost-based* (relying on some relationship between cost (of sales) and value is, in principle, easy to use),
  - Based on *estimates of future economic benefits* (for instance, extrapolate capitalization of historically comparable profits; needs to consider the operating environment of the asset carefully to determine the potential for market revenue)

 Ref. Runge, p. 682, 683 9.29

Disruptive ("Radical") Innovation (1)

Disruptive innovation – the entre(intra)preneur's dream!

- Disruptive innovation ("*new-to-the-world*") means in *market value created*, not in technology!
- Disruptive ("Radical") Innovation:
  - The power to *change customer expectations* (and *excitement*) (new-to-the world *performance* features, *perception of novelty* and *market adoption*)
  - Changing the basis for competition ("*game change*")
  - The power to *change industry economics* ("breakthrough") or *generate new industries* ("industry genesis")
- Disruptive technologies are *typically commercialized first in emerging or insignificant ("special") markets.*

  Emerging technologies (leading to disruptive innovations) usually take root in markets that are *perceived to be not large enough* to satisfy the growth needs of large firms.
- Challenge for evaluators: experience base lies primarily in established lines of business and/or technology

 Ref. Runge, p. 714, 716 9.30

Disruptive ("Radical") Innovation (2)

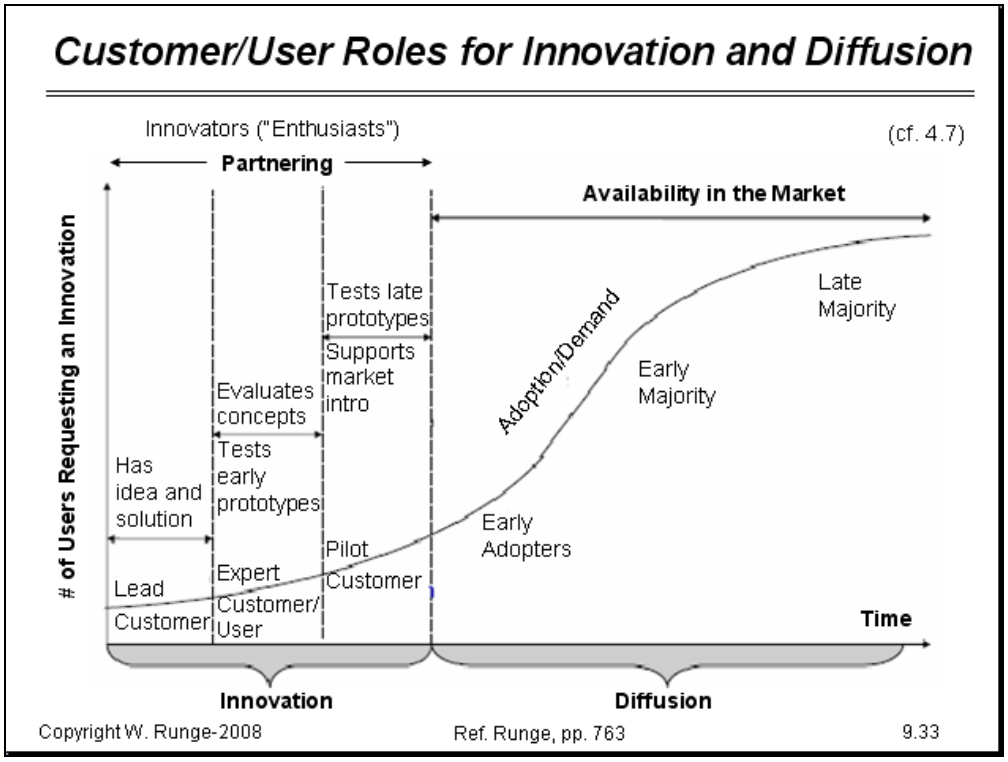
- For disruptive innovations *markets may not exist at all* and *there are almost no ways to lift related uncertainty and assess risk*.
- There are *few generic approaches* to discontinuous or disruptive innovation where related market information will exist:
  - *Adding a new, widely demanded performance feature to a product with otherwise identical properties to products already on the market* is associated with data of the existing market, at least (e.g. nanotechnology, biobased chemistry)
  - For *cost reduction innovations of 30% or more* by a process or change of raw materials or intermediates, from history and familiarity with the market it is *likely that industrial customers will switch*
  - Researchers *know from the beginning that they are addressing large markets* and do not feel compelled to answer the market size question by detailed figures when they are on their way to pursue a *Holy Grail* (a great and unsolved challenge in science or industry)

 Ref. Runge, p. 714, 717, 782 9.31

Disruptive ("Radical") Innovation (3)

- Contrary to some expectations, *market size* is not necessarily a good early focus in guiding ideas for new offerings.
- *Initial markets are just starting points* that can lead to much greater value that may be gained from *later applications that were completely unknown at the early stage* (cf. steam engine, Internet).
- Customer and market research are needed, but do help little for (discontinuous and) disruptive innovation!
- For disruptive innovations *early market learning is the responsibility of the innovator/entrepreneur (and/or the related innovation teams)*: in seek for applications talk to customers and experts, be imaginative.
- Pricing for disruptive innovations is extremely difficult.
- To target disruptive technologies: as their related products are often first commercialized in emerging or insignificant markets, *for innovative ideas* spend some time on the fringe - of technology, politics, life style!

 9.32


Customer/User Roles for Innovation and Diffusion
Innovators ("Enthusiasts")
(cf. 4.7)
Partnering
Availability in the Market
# of Users Requesting an Innovation
Tests late prototypes
Supports market intro
Evaluates concepts
Tests early prototypes
Has idea and solution
Adoption/Demand
Late Majority
Early Majority
Early Adopters
Pilot Customer
Expert Customer/ User
Lead Customer
Time
Innovation
Diffusion
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