Glossary

Note: Words in *italics* refer to other definitions in this list.

**Academic**: member of the scientific staff of a university. Also used for scientists and technologists working for other *know-how institutes*.

**Accelerator**: see *incubator*.

**Angels**: see *business angels*.

**Appellation system** (in the context of this book): from the French *appellation d’origine contrôlée* – certified name of the origin (of wines). Using a hierarchy of names, the *appellation* statement indicates the quality of the wine as assessed by independent experts.

**Applied science**: the use of existing theory to develop original new technology, adding applied knowledge without developing new theories in the domain of *pure science*. Also called technological development.

**Basic or fundamental research**: the search for new scientific discoveries using mainly purely scientific methods. Only the scientific disciplines are defined; the direction is indicated but without specific objectives or applications. Mainly used in enterprises.

**Business angels** (or, for short, *angels*; synonym for informal investors): individual investors who, alone or together with other angels, invest in young enterprises at the *development phase* or *start-up phase*. Such investments are usually high risk. Angels not only provide money, they also coach the founders or *CEO* of the enterprise and they make their networks available to the starter. In this way, they create a win–win relationship with the investment while they reduce the risk. Angels usually invest only in companies in product or service areas in which they have experience. Informal investment leads to a form of private equity (as does venture capital and other investments that are realised outside stock exchanges).

**Business plan**: a plan for a new venture describing the business model, the products and/or services to be delivered, the expected client base, details of the development activities needed, the production facilities, the organisation and staffing of the enterprise together with a forecast of the
financial development and investment funds required at certain stages. The preparation of a business plan forces the founders to agree what they want to do and to consider all aspects of the new venture. The business plan should demonstrate the economic viability of the new venture and, as such, it is an important communication tool with investors and other stakeholders.

**Cambridge Phenomenon**: the emergence and creation of a high-tech industry in the rural area around Cambridge since about 1970 and in connection with the University of Cambridge.

**Carried value** or **carry**: the value of an investment at the moment of exit, less the original investment which is increased by the hurdle rate.

**Cascade model** of education in entrepreneurship: see funnel model.

**CEO**: chief executive officer, the president or managing director of a company, the highest-ranking person in the executive management. In companies set up by technostarters, one of the founders is often the CEO but this is not necessarily so.

**CFO**: chief financial officer, the director or board member in an enterprise responsible for finance and administration.

**Chancellor**: head of the first generation university and still the head in some universities today (for instance in the UK, where the chancellor is the formal head of the university and the vice-chancellor is the acting head). In some countries the rector is head of the university whilst in others countries the president, usually a non-academic, heads a board of management.

**Collaboration and the commercialisation of know-how**: relatively new activities of universities regarded as of equal importance to the traditional tasks of research and education. Collaboration refers to cooperation in R&D, on a commercial basis or not, with industry or other partners. See also commercialisation of know-how.

**Commercial spinouts of scientific projects**: one of the ways in which a university can commercialise know-how. In this case, the primary aim of the research is to advance science, and commercialisation is an often unintended spinout. Technostarters who use their thesis project as the base of their enterprise fall into this category.

**Commercialisation of know-how** (also named valorisation of know-how): the way in which a know-how institute transfers knowledge to the market, either via existing companies or via new enterprises. Commercialisation implies that the institute receives a reward; in the case of valorisation this may or
may not be the case. We often use the term commercialisation as short for *collaboration and the commercialisation of know-how*.

**Consilience**: the unity of knowledge; literally the ‘bringing together’ of knowledge of different disciplines; unified learning; the idea that there are no distinct border lines between the various scientific disciplines; the idea also that these disciplines converge towards a common result. The opposite is reductionism, the fragmentation of, and specialisation in science. See also transdisciplinary research and development.

**Corporate culture** (or just *culture*): the attitudes and informal aspects that govern the behaviour of those working in the firm. Norms and values guide behaviour and habits. The culture is often formed from the personal and business norms and values of the entrepreneur who started the firm. The culture is reinforced by the selection of personnel who should ‘fit’ the culture, and by ‘stories’ (the myths and sagas of the firm, the heroes and the failures) that people tell each other. Through culture the people working in the firm distinguish themselves from those working in other firms. *Structure* is the formal element that supplements culture in creating attitudes of people in a firm.

**Course**: the total of all the activities to be carried out in order to obtain a Bachelor’s or master degree; hence the terms Bachelor’s or undergraduate course and Master’s or graduate course. Other courses are doctoral courses to assist those who work on a doctorate degree and post-experience courses, aimed at participants with a completed university education and practical experience. Typical day courses take 1–4 years to complete. Also: a series of *lectures* on a specific subject.

**Cross-faculty teams**: teams consisting of members from different faculties and often from different universities and increasingly including non-university members as well. Forerunners of *university institutes*.

**Deal-making** (or *closing of a deal*): reaching an agreement between investors and the *founders* of a (new) venture. This may include an agreement about the distribution of the *carry*. *Venture capital* firms use the term deal flow to describe the number of deals they have closed and their size.

**Dean** (in the context of this book): head of a *faculty* of a university. This is often a job that is rotated between the professors of the faculty and then it is typically taken for a period of four years. Increasingly, universities are appointing non-academic managers as deans.

**Decline phase**: phase in the life of a product or service in which the market becomes smaller as the product becomes substituted by a new product,
based on superior technology, or when it simply becomes obsolete (men’s hats for instance). See *product life cycle* and *mature phase*.

**Deductive learning:** learning in which the laws of a discipline are explained after which they can be used to solve problems. The opposite is *inductive learning*.

**Design or pre-seed phase of an enterprise:** phase in which the product and/or concept of the enterprise are being developed. To be followed by the *development phase*. See Figure 6.1.

**Development:** applying existing science and technology to solve a problem without adding to the domains of *pure science* and *technology*. Also: the search for improvements to existing products and processes with the aim of improving the quality–cost ratio. Both the target and the road are well defined. Although often viewed otherwise, development work has mainly a defensive nature as it can easily be copied by competitors and does not lead to lasting competitive advantage.

**Development or seed phase:** phase of an enterprise in which the product and/or concept of a new enterprise, as designed in the preceding phase (*design phase*), is developed into a prototype. To be followed by the *start-up phase*. See Figure 6.1.

**Disruptive innovation:** an *innovation* that substantially changes social practices, the way we work and live (examples: the steam engine, electricity, telephone, mobile phone, email).

**Elite** (in the context of this book): selected, highly talented students and academics.

**Embedded research:** a construction whereby a team of researchers from an industrial firm co-locate with researchers of the university. This is usually a form of *pre-competitive research*. See Figure 8.2.

**Entrepreneurs:** we prefer the definition: ‘dreamers who do, who take hands-on responsibility for creating new business. The entrepreneur may be the creator or inventor but it is always the dreamer who figures out how to turn an idea into a profitable reality’ (G. Pinchot, *Intrapreneuring: Why You Don’t Have to Leave the Corporation to Become an Entrepreneur*, Harper & Row, New York, 1985).

**Executive directors** (or **executive managers**): managers who lead the enterprise on a full-time basis (or almost full-time). The opposite is *non-executive directors*.

**Exit:** the moment an investment is sold or cancelled.
**Exploratory research:** the search for entirely new products or processes, or superior new technologies that can substitute existing technologies by the process of technological substitution. In industrial exploratory research, the technology domain and the business objectives are defined but they can be adjusted depending on the emerging results of the research. In other words, there is a well-defined technological and business target but the road towards it is uncertain. Exploratory research stems from offensive strategies; the work is optimistic in nature.

**Facilities:** departments in a university responsible for all non-academic activities.

**Faculty** (in the context of this book): a group of academics who pursue the same branch of science or technology.

**First flow of finance:** money allocated to universities by the government department for science and education as a basic fee to cover costs of education and ‘free research’. This is usually a lump sum and a form of input financing. See also second, third and fourth flow of finance.

**First generation R&D:** see technology-push R&D.

**First generation university** (also called medieval or scholastic university): the term denotes universities from their origins in the twelfth century until the Renaissance when the first transition period set in.

**Founder:** the (techno)starter(s) who create(s) a new enterprise. One of the founders is often the CEO but this is not necessarily so, or only so for a short period.

**Fourth flow of finance:** money received by universities as endowments. Endowments can be given for a specific project or they can be given as a general supplement to the university’s funds. They can or cannot carry an obligation, for instance to name a building after the donator. See also first, second and third flow of finance.

**Fourth generation R&D management:** see open innovation.

**Fund:** used in this book as an Investment Fund for Starters (IFS).

**Fund Management Company** (FMC): company that manages the investments of a Fund.

**Fundamental research:** see basic research.

**Funnel model:** a model for an educational programme in entrepreneurship which includes a number of stages in which the entrepreneurial intent increases after each stage while the number of students decreases. The
principle is that, from all students that enter the university, eventually only
the real entrepreneurs are left at the end of the process, while the ‘dropouts’
have had a comprehensive or more serious introduction to entrepreneur-
ship and management in general. Also called the cascade model.

**Graduate course:** educational activities for those who already have a
Bachelor’s degree and leading to a Master’s degree.

**Graduation:** The award of a Bachelor’s degree.

**Grande école:** French for ‘great school’ meaning *elite* universities with a role
comparable to that of *university colleges*. An example is the Ecole
Nationale d’ Administration (ENA, a post-graduate college).

**Growth phase:** phase of a new enterprise that follows the *start-up phase*. In
the growth phase the business activities are growing fast. To be followed by
the *mature phase*. See Figure 6.1.

**Humboldt university:** see second generation university.

**Hurdle rate** (or *hurdle*): percentage by which an investment is cumulatively
increased in order to calculate the *carried value*.

**Incapability to change:** fundamental attitude against any changes of people
involved in change processes. No matter how many good reasons for
change are given or how many guarantees against personal setbacks, the
worker or manager will resist or sabotage the changes. See also *inclination
to change* and *willingness to change*.

**Inclination to change:** active, anticipatory and self-adjusting attitude of
people involved in change processes. This term can be defined as the per-
ceptible endeavour to be constantly examining one’s own performance and
that of one’s department, and adapting it to meet the demands emanating
from the dynamics of the company’s ‘environment’ or from changed ambi-
tions of the organisation. See also *incapability to change* and *willingness to change*.

**Incubator:** building in which *start-ups* can develop their enterprise under
guidance. The conditions of renting space in an incubator are usually very
favourable and below market rates. Depending on the situation, the incu-
bator offers services from administrative services to professional coaching
and technological support. If such services are widely available, the incu-
bator can also be called an accelerator, but there is no common use of these
terms. Residence time in an incubator or accelerator is usually limited.
After this time has expired, the young enterprise may move to a *shared
accommodation* facility.
**Inductive learning**: learning to apply the rules of a discipline by carrying out practical exercises, rather than by having the rules explained or by consciously deducing the rules.

**Informal investors**: see *business angels*.

**Innovation**: the successful introduction of something new; successful as shown by acceptance in the market or other use. An innovation is often based on an *invention*. If the innovation substantially changes social practices it is called *disruptive innovation*.

**Inside-the-box innovation**: incremental innovation aimed at the improvement of what already exists using established technology. Inside-the-box innovation creates new value propositions for customers. See also *outside-the-box innovation* and *substitutive innovation*.

**Interactive research**: the cooperation between *spinouts* or *technostarters* in their early stages, and the university. It is often an informal, non-structured cooperation with Master’s degree students having a placement in the firm and academics offering unpaid advice, walking in, walking out.

**Interdisciplinary R&D**: research and development activities comprising various and integrated scientific, technological and/or design disciplines. See also *monodisciplinary R&D*, *multidisciplinary R&D* and *transdisciplinary R&D*.

**Intrapreneur**: combination of ‘internal’ and ‘entrepreneur’, meaning a manager of a distinctive unit of a larger enterprise who is profit-responsible and has a wide authority to take decisions, approaching a real *entrepreneur*. Often used in large enterprises to create flexibility and a quick response to the market.

**Intrinsic quality factors** (of a university): factors such as vision and strategy, organisational structure and culture, quality and attitudes of staff and students, possession of land, buildings and funds which to a large degree define the university and which cannot be changed easily.

**Introductory phase**: very early stage in the development of an enterprise in which the founders basically play with ideas. Once a subject for the enterprise has been chosen, the *design phase* begins.

**Invention**: a new (hitherto unknown) device, process or algorithm that has been demonstrated to work. Not all inventions are based on scientific work; many are ideas developed by trial and error. An invention may come from a technical idea, an observation of a need or problem for which a solution can be found, or from combinations of these. When an invention has been put to use, it becomes an *innovation*.
Investment Fund for Starters (IFS): in the context of this book, a fund in which investors put money in order to invest in technostarters and university spinouts.

IPO (initial public offering): shares of the company are offered to shareholders via a stock exchange for the first time.

IPR (intellectual property rights): general term for rights of ownership of original creative material. Patents, trademarks and copyrights are examples of IPR.

Know-how: see technology.

Know-how carousel (also called know-how hub): the synergistic combination of traditional academic research and education, R&D institutes of enterprises, independent (often specialised) R&D centres, facilities for technostarters, financiers of many kinds and professional services of many kinds (accountants, management consultants, marketing consultants, intellectual property specialists and so on) that collaborate in the creation and exploitation of know-how, preferably on the grounds of the university or near it. A know-how carousel is internationally regarded as a front-runner in knowledge creation in specific fields; a centre no researcher and no enterprise, active in the field, can ignore. In other words, it is a place where ‘things are happening’, where you have to be if you want to be in the front line of developments, whether you are an existing enterprise, a technostarter, an academic or a student.

Know-how hub: see know-how carousel.

Know-how infrastructure (or innovation infrastructure) of a nation or region: the way technology and market needs diffuse in a network of various participants, with each participant playing a vital role. These models have been elaborated into the concept of a national (or regional) innovation system (NIS) by which the innovation capabilities of a nation or region can be analysed, monitored and subsequently improved.

Know-how institute: organisation that creates new knowledge such as a university, a private R&D institute or department, an academy of science and other public or private institutes.

Lecture: element of an academic course. A typical lecture can take between one hour and one day.

Lingua franca (in the context of this book): language used on a large scale by people with different mother tongues. In the Middle Ages Latin was used as the lingua franca of Europe, and Chinese in South and East Asia. Today,
English is the lingua franca all over the world, in academic as well as business life.

**Mandatory course**: course that all students following a certain programme are required to take. The US name is required course.

**Matchmaking**: bringing investors (often *business angels*) and *start-ups* together in order to assess possibilities for participation.

**Mature phase**: phase of an enterprise in which it has become an established company. Follows the *growth phase*. In the mature phase, an enterprise usually starts developing other products or services but it can also do this earlier. See Figure 6.1. According to the theory of the *product life cycle*, the mature phase is followed by the *decline phase* in which the product or service is being substituted by a product based on new technology, or the product simply becomes obsolete. Note that it may take centuries before the decline phase sets in.

**Monodisciplinary R&D**: research and development activities based on only one scientific, technological or design discipline. See also *multidisciplinary R&D*, *interdisciplinary R&D* and *transdisciplinary R&D*.

**Multidisciplinary R&D**: research and development activities based on two or more scientific, technological or design disciplines working together in a complementary way. See also *monodisciplinary R&D*, *interdisciplinary R&D* and *transdisciplinary R&D*.

**National Innovation System (NIS)**: see *know-how infrastructure*.

**Nationes**: institutions comprised of students and academics from the same region in the *first generation university*. They live on in an informal way in certain students’ associations.

**New technology-based firm (NTBF)**: newly created enterprise that is based on new science or technology or new applications of science and technology. There are two kinds of NTBFs: university spinouts (known as *spinouts*) and *technostarters*. In our terminology this is identical to *start-ups*.

**Non-executive directors**: part-time members of the board of management of an enterprise who have a supervising and advising role to the *executive directors*.

**NTBF**: see new technology-based firm.

**Open Innovation**: method of managing innovation by making the *R&D* department a profit centre rather than a cost or service centre. Open
innovation suggests sharing knowledge with other parties. The concept of *fourth generation R&D management* broadly covers open innovation.

**Outside-the-box innovation**: the employment of new technology to cover new markets. Outside-the-box innovation creates new business. It is a form of diversification. See also *inside-the-box innovation* and *substitutive innovation*.

**Participation**: in the context of this book, buying or having shares in a company. As in: ‘We participate for 20 per cent in company X’, meaning that we own 20 per cent of the shares of company X.

**Patent**: Copyright to an invention; exclusive right (monopoly) to use an invention, nowadays a temporary monopoly. See IPR.

**Post-experience course**: educational activities following a certain amount of work experience (typically varying from two to ten years). Post-experience courses may have a certain level of prior education as an entrance requirement (for example Bachelor’s or Master’s level) or not.

**Postgraduate course**: educational activities immediately following the award of a Master’s degree.

**Potential for change**: the extent, at the beginning of a change process, to which there is trust and order in the organisation, thereby allowing it to enter successfully into a change process. If the potential for change is small, it is better to improve it before going into the change process directly.

**Pre-competitive research**: one of the ways in which a university can commercialise *know-how*, usually for large enterprises. This type of research often has an explorative nature and focuses on the development of basic technologies that are to be turned into applications by the sponsors themselves. The research is limited in scope, in the sense that it allows the participants to use the basic research to develop competing applications. The client can be a single sponsor or a group of companies and possibly other institutions, often organised as a foundation. The subject of the research is decided by the sponsors and the university researchers together. The collaboration can have the form of *embedded research* (one client only) or simply be a research project. The latter may or may not incorporate cooperation by researchers from the sponsoring organisation; if they are involved, each researcher works from his own location. See Figure 8.2.

**Private equity (PE)**: capital that is directly invested in enterprises or start-ups, that is, without the involvement of stock exchanges. *Business angels* and *venture capital funds* are examples of private equity. The term ‘private equity funds’ is also used for investments that can take substantial enterprises out of the stock market (buyout capital).
Product life cycle: model that describes the various phases in the life of a product or service. Usually four phases are defined: the start-up phase (or pioneering phase), the growth phase, the mature phase and the decline phase. The start-up phase is preceded by the design phase and the development phase, which are usually not included in the product life cycle concept. See Figure 6.1.

Professional support (in the context of this book): specialised advice to technostarters and university start-ups on topics such as marketing and market research, intellectual property rights, finance, administration and reporting, quality management, logistics, procurement and others.

Programme (in the sense of educational programme): all courses a faculty or university provides.

Pure science: widening scientific knowledge by new descriptions of phenomena and forming and testing fundamentally new theories.

R&D: research and development.

Rector (or rector magnificus): highest academic in a university, in the second generation university often also the head of the university but not always so (see chancellor). In the first generation university the rector was not always the highest academic, the function then being merely symbolic but highly respected.

Reductionism: see consilience.

Required course: US term for mandatory course.

Research-on-demand: one of the ways in which a university can commercialise know-how. The objectives and terms of reference of the research are well defined. The client pays for the research, in full or in part, and concludes a contract with the university similar to a contract with an engineering bureau. Research-on-demand can be requested by corporations, small and medium-sized enterprises (SMEs), consortia of companies, governments or government agencies (for example NASA in the US), branch organisations, other research organisations and perhaps other clients.

Right of first refusal: right of a supplier of goods or services to offer a contract to the buyer. Only if, after a certain period of time, no agreement has been reached, can the buyer contact other suppliers. In the context of this book: right of an Investment Fund for Starters that is linked to a university to offer investment to a university spinout.

Second flow of finance: money received by a university to carry out research with specific objectives. This finance is usually provided by the state.
through independent foundations that invite competing proposals for the research to be carried out and weighing them by peer review. The second flow of finance is a form of output financing. See also first, third and fourth flow of finance.

Second generation university (also called Humboldt university): science-based universities with a research objective (and education in its slip stream) that started after Napoleonic times in Germany and rapidly took over the other models in the nineteenth century. Lasted until, in the 1960s, the second transition period set in. The second generation university is the substitute for the first generation university and the first transition period. In this book we speculate that it will eventually be taken over by the third generation university.

Serendipity: the effect by which one accidentally discovers something fortunate, especially while looking for something else entirely. The word derives from an old Persian fairy tale and was coined by Horace Walpole on 28 January 1754 in a letter he wrote to his friend Horace Mann, an Englishman then living in Florence (not the famed American educator). The letter read:

I once read a silly fairy tale, called The Three Princes of Serendip. As their highnesses travelled, they were always making discoveries, by accidents and sagacity, of things which they were not in quest of: for instance, one of them discovered that a mule blind of the right eye had travelled the same road lately, because the grass was eaten only on the left side, where it was worse than on the right – now do you understand serendipity? One of the most remarkable instances of this accidental sagacity (for you must observe that no discovery of a thing you are looking for, comes under this description) was of my Lord Shaftsbury, who happening to dine at Lord Chancellor Clarendon’s, found out the marriage of the Duke of York and Mrs. Hyde, by the respect with which her mother treated her at table. (Wikipedia)

Shared accommodation: facilities in what is usually called a science park or technology park, where relatively young enterprises (not necessarily starters) can rent accommodation at a commercial price. Many young enterprises move from an incubator to shared accommodation, where they can stay, in principle, as long as they wish.

SMEs: small and medium-sized enterprises.

Spinout (short for university spinout): new technology-based firm in which the university owns the know-how (or shares the ownership with the sponsor of the research that led to the know-how). Spinouts can be the result of initiatives by the researchers or of a systematic identification process by the university. See also technostarters. In our terminology, spinouts are a sub-category of start-ups.
**Standardisation:** the development, implementation and successful acceptance of common rules for performing specific tasks.

**Start-up:** new company created by an individual or group of individuals. In this book: equivalent to *new technology-based firms*, that is, *spinouts* and *technostarters*.

**Start-up phase:** phase of a new enterprise, after the *development phase*, in which production and commercialisation begin. To be followed by the *growth phase*. See Figure 6.1.

**Strategy-driven technology management:** a way of managing *R&D* in which R&D is synchronised with corporate and business unit or divisional strategy. Also named third generation R&D.

**Structure:** the totality of formal arrangements within the company that divide and coordinate the work of all those working for and associated with the firm. Structure comprises the definition of the tasks of individuals, groups and departments, their mutual relationships and their communication, coordination and supervision. Organisational schemes, responsibilities and formal competences of the departments and individuals, reporting systems and formats, in short all elements that can be written down and that can subsequently be enforced are part of the structure. Structure is commonly divided into corporate governance and internal governance. Corporate governance is that part of the structure that deals with the responsibilities and competences of the executive directors (board of management in Europe), the non-executive directors (supervisory council) and the shareholders and possibly other stakeholders as well as the mutual relations between these groups and individuals. Internal governance relates to the responsibilities of executive directors vis-à-vis the internal organisation and the division of the workers of the company into groups and departments and their arrangement. Both subdivisions of structure are relevant to innovation. *Corporate Culture* is the non-formal element that supplements structure in creating attitudes of people in a firm.

**Subject** (in the sense of education): element of a *course*. A subject is made up of *lectures*, tutorials, practical work and other elements. The time required for a typical subject can vary from one week to half a year of study.

**Substitutive innovation:** innovation aimed at the substitution of old technologies by new ones with a significantly higher quality–cost ratio. The market remains more or less the same. See also *inside-the-box innovation* and *outside-the-box innovation*.

**Synchronised education:** synchronised technological education, entrepreneurial education and the development of the enterprise of *technostarters*.
Technical sciences: equivalent to technology.

Technician: person skilled in the technique of a particular art or craft. This does not include scientific knowledge of the art or craft. See also technology.

Technological escalation: the development of the quality–cost indicator of a new technology as a function of time. This usually follows an S-shaped curve, meaning that initially the indicator grows exponentially but turns into decelerating growth after a point of inflexion.

Technological proliferation: the process by which existing technology is applied to different uses.

Technological stretch: the incremental improvement of existing technology.

Technological substitution (or technological succession): the use of new technology to replace old and inferior technology in existing applications.

Technological succession: see technological substitution. Also: the range of technological substitutions in an application.

Technological surprise: the creation of a totally new technology that is used to satisfy an as yet undiscovered or unknown need.

Technology: has two meanings:

- A body of knowledge, synonym for know-how, as in: ‘Shell is leading in LPG technology’.
- The totality of applied sciences. It tries to understand phenomena and to design processes with the aim of doing something with this knowledge, by putting it to practical use. Its opposite, pure science, aims at understanding natural phenomena for their own sake, la science pour la science, to know why.

Technology-push R&D: way of managing R&D by which much initiative is left to the researchers, creating an almost academic atmosphere in corporate R&D laboratories. Also named first generation R&D management.

Technopreneurs: the Indonesian word for technostarters and young enterprises.

Technostarters: students or academics who want to establish their own science or technology-based firm. Technostarters own the know-how on which the new enterprise is based. They are the shareholders and they often form the management of the company. A subcategory of start-ups. See also spinouts.
Transdisciplinary R&D: research and development activities focused on a solution that involves scientists, engineers and designers from many disciplines, where the disciplines are no longer one-to-one related to individuals. Predecessors are monodisciplinary R&D, multidisciplinary R&D and interdisciplinary R&D. See also consilience.

Third flow of finance: money earned by a university from commercial contracts. This concerns a form of output financing. See also first, second and fourth flow of finance.

Third generation university or 3GU: speculative model described in this book of the university as it is going to be. The third generation university is characterised the centre of a know-how hub, with an emphasis on transdisciplinary R&D, collaboration with enterprises and other external partners and an active policy for the creation of spinouts and technostarters.

Third Generation R&D management: see strategy-driven technology management.

Third university objective: the exploitation or commercialisation of the university’s know-how and collaboration with industry and other partners in creating know-how.

Type 1 universities: mainly teaching institutes, often but not always on the level of higher professional education. In that case they are strictly speaking not universities but higher professional schools. Some provide for sound scientific education. The research activities of these universities are limited or not present at all. Type 1 universities are unlikely to have systematic collaboration with industry or facilities for technostarters. They may migrate to Type 2 universities.

Type 2 universities: Type 2 universities have an average scientific base. In practice this means they will have some outstanding scientists while the average level of science is medium. Education is linked to their research efforts. These are ‘true’ universities, not higher professional schools that are only universities in name. They may migrate to Type 3 or Type 4 universities.

Type 3 universities: Type 2 universities that in addition are active in collaboration with industry and other partners, in the commercialisation of know-how and while having extensive educational and operational facilities for technostarters. Type 3 universities may migrate to Type 4 or Type 5 universities; the route is usually towards Type 4 universities.

Type 4 universities: universities that create cutting-edge science or technology and that provide excellent education. The older universities of this type
are the ones that collect the Nobel Prizes. Type 4 universities are inherently unstable, as they have to migrate to Type 5 universities in order to maintain their scientific front position.

**Type 5 universities:** Type 4 universities that in addition are active in collaboration with industry and other partners, in the commercialisation of know-how and while having extensive educational and operational facilities for technostarters. Type 5 universities are the leading universities in this world and there are only a few.

**Undergraduate course:** educational activities leading to the Bachelor’s degree.

**University colleges** (Latin: domus scholarium): set up as accommodation for poor students in the early Middle Ages, the university colleges developed into elite groups of academics and students who shared accommodation while the students received extra tuition. This model still exists, for example in Oxford and Cambridge. While most academics and students are housed outside the colleges, students receive tuition from academics in the college. Such colleges can have considerable funds from endowments and with these, they play a stimulating role. The role of the colleges is complementary to the ‘normal’ faculty organisation; colleges do not award diplomas. In the EU there is a trend to organise courses for selected, highly intelligent students (and ask extra fees for this) and the name ‘university college’ is sometimes adopted for such activities. The French have created so-called grandes écoles as separate academic institutions to the universities where selected students receive premium education.

**University institutes:** main organisational element of the third generation university. Organisations that are part of a university and report directly to the board of management that carry out transdisciplinary R&D on focused subjects. They consist of specialists from different faculties, often from different universities or from industry and independent R&D organisations. They are the institutionalised version of cross-faculty teams.

**Valley of Death:** the stage in the development of a young enterprise when financing by founders, friends and family is no longer sufficient while it is still too early to use venture capital funding or the use of bank loans. The Valley of Death can be overcome by business angels or university funds.

**Valorisation of know-how:** see commercialisation of know-how.

**Venture capital:** a form of private equity for investment in the later early stages of new enterprises. Venture capital often follows business angel financing. Venture capital firms handle larger sums than angels, while
offering less or no coaching. Venture capital is still considered high risk. Like angels, venture capital firms are temporary investors. Venture capital is usually replaced by an *IPO* or money from an investment fund.

**Willingness to change:** attitude of people involved in change processes of willingness to go along with changes that arise from the demands made on the organisation by the dynamics of the ‘environment’ or by changed ambitions. This term is closely related to passive willingness, not objecting and being prepared to do something if someone else takes the initiative. See also: *incapability to change* and *inclination to change*. 