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On the way to creativity: engineers as intrapreneurs in organizations

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Abstract

Organizations often hide creativity and talent. This paper describes how to make engineers active in the field of intrapreneurship within large firms where they often are employed in R&D. This development is seen, in Europe at least, most desirable by the companies today. Technology has an extensive impact on the society and economy nowadays and it is important to study how technological innovations appear and who are behind them. Entrepreneurship and organizational intrapreneurship are, in many cases, the basis of technological innovations and firm renewal. Engineers are the professional workforces that have a special role in companies that produce and develop innovations and promote an intrapreneurial spirit. Since the world of high tech companies needs the cooperation of many experts, engineers must be able to work well together with other fields of expertise such as marketing, research and development. Innovations today often ask not only for unique technical knowledge but also social knowledge to make these innovations meaningful. Social innovation parallels technical innovation as well. In this paper we explore the origins of the intrapreneuring capacity of any firm, concentrating on three issues: what is an intrapreneur and engineer-intrapreneur in particular (literature survey), and how organizational arrangements and leadership can support its upcoming

Key words: Intrapreneurship, innovations, culture

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1   Introduction

Organizations often hide creativity and talent. This paper describes how to make engineers active in the field of intrapreneurship within large firms where they often are employed in R&D. This development is seen, in Europe at least, most desirable by the companies today. Technology has an extensive impact on the society and economy nowadays and it is important to study how technological innovations appear and who are behind them. Entrepreneurship and organizational intrapreneurship are, in many cases, the basis of technological innovations and firm renewal. Engineers are the professional workforces that have a special role in companies that produce and develop innovations and promote an intrapreneurial spirit. Since the world of high-tech companies needs the cooperation of many experts, engineers must be able to work well together with other fields of expertise such as marketing, research and development. Innovations today often ask not only for unique technical knowledge but also social knowledge to make these innovations meaningful. Social innovation parallels technical innovation as well. In this paper we explore the origins of the intrapreneuring capacity of any firm, concentrating on three issues: what is an intrapreneur and engineer-intrapreneur in particular (literature survey), and how organizational arrangements and leadership can support its upcoming

Firstly, what is an intrapreneur? How do intrapreneurs differ from other workforce, and why are they so highly appreciated in any organization? Moreover, we will emphasize the intrapreneuring process and the many competencies needed in this process and elaborate on how intrapreneurs feature in these. As a core individual initiative, opportunities seeking, visionary and flexibility are emphasized, but there are also social skills such as teamwork and network building that are extremely important in innovation projects. In promoting technological innovations one often has to work in the world of 'becoming' and on the borders of several fields of expertise. In this respect a variety of professional cultures is important, such as the difference between engineering and marketing. Mutual interaction happens between many levels. How do engineers perceive intrapreneurship in their organization? As

the Dutch evidence from 156 companies show, in micro companies the engineers see the intrapreneurship conditions more favourable than in larger firms; they see their freedoms better incorporated in the company's culture of the company, if it spends more on R&D (Veenker et al., 2004a, 2004b).

Secondly, what kind of cultural, managerial and organizational support is required? Here we discuss the special conditions in companies that champion intrapreneurial talent and spirit. Intrapreneurship is a complex, mutually interrelated process between many actors and many units within and outside of the company that need support. Organizational climate and management that fosters intense working relations between the people, that elicits people's innovation capacity, tolerates risk, and supports personal growth and development are all important. Therefore, high investment in leadership and social development is needed. Our Dutch study (see Veenker et al., 2004a, 2004b) shows here that interest of the top management for intrapreneurship of engineers has a significant impact.

Thirdly, what are the educational and work related consequences for practical intrapreneurship tool development? University education focussing on the provision of expertise and competence in both technological and marketing knowledge is a key since innovations often get started at the borders of knowledge instead of within one expertise area. Intrapreneurial careers and even starting up own firms should serve an alternative to other professional careers in all levels of education. On the company level even the physical working conditions should be supportive for intrapreneurship, because they can encourage as well as hinder it. Resource availability, reward systems and organizational arrangement that help to create individual intrapreneurship and intrapreneurial co operation are all facilitators as well. The senior management should also give its visible support to and show commitment in organizational renewal.

In sum, intrapreneurship should be a permanent effort of every organization and particularly in those that innovate and renew. At the company level, intrapreneurship should be supported by the organizational culture and give a good basis for individual innovation advancement, good teamwork and fruitful knowledge development in the company. Engineers and other professionals should foster innovation, continuous revitalization and development in any company. In sum a technological intrapreneur should therefore be able to exploit the R&D potential of ideas into marketable technical products and services, identify the necessary resources and present this as a

compelling business case to his/her top management. If both university education and the working environment create favourable leaning conditions for such intrapreneur, technological intrapreneurship will nourish.

2 Intrapreneurship and engineering

Intrapreneurship is a topic with a high attraction to many managers in companies of any size nowadays. In the last two decades intrapreneurship is more and more recognized as an important element in organizational development. Already the early years of the 1980s researchers discovered the importance of entrepreneurship and its role in organizational renewal, innovation, and the creation of new businesses (Antoncic & Hisrich, 2001; Hornsby et al., 2002; Pinchot, 1985). It became a subject of interest because of its effect on revitalization and performance of the firm (Draeger-Ernst, 2003; Kuratko et al., 1990). Many studies focused on the organizational factors that influence intrapreneurship (Hornsby et al., 2002; Pinchot, 1985), and on the effect of intrapreneurship on company performance (Lumpkin & Dess, 1996; Zahra & Gravis, 2000), and on the characteristics of individuals in the organization (Fayolle, 2004; Howell & Higgins, 1990a, 1990b).

The topic of intrapreneurship is of specific importance in contexts where engineers work: most engineers will remain employees and never become entrepreneurs, but their managerial responsibility will increase and requires them to act entrepreneurial. Thus, there is relevance of this topic also from a career point of view (Paffen, 1998). As shown in from an organisation's point of view intrapreneurship has important advantages and could impact (Hornsby et al., 2002).

Table 1: Advantages of intrapreneurship from an organization's point of view (based on Hornsby et al., 2002)

- *Profit*: some companies want to increase their profits via intrapreneurship.
- *Strategic renewal*: intrapreneurship can bring new insights, new approaches for reaching customers and markets.
- *International success*: via intrapreneurship companies can try to attain international success.
- *Technological innovation*: the objective of intrapreneurship can be the stimulation of innovation.
- *Knowledge about future revenue streams*: companies can learn about (extra) revenue streams in the (near) future via intrapreneurship.

Intrapreneurship is a topic both important for the company and for the individual employee him/herself. Traditionally, the studies of intrapreneurship are multidisciplinary using several sources (Cunningham & Lischeron, 1991) that are often located within the studies of entrepreneurship. Indeed, intrapreneurship is a special type of entrepreneurship. A brief overview of the domain of entrepreneurship research helps to increase the understanding of intrapreneurship. There are for instance studies on entrepreneurship that come from a classical perspective, stemming from micro-economics and focusing on the entrepreneur as an innovator who is seeking for niches; representative of this category is Schumpeter (1934). Psychological research comes with the emphasis of personal features of the entrepreneur, such as McClelland's (1961) studies on achievement motivation, management research with the study of the firm level, the study of the leadership capabilities of the entrepreneur, the study of the successful entrepreneurs and intrapreneurs inside big firms. Even if some approaches are remote from intrapreneurship described earlier here, they show the relevance of intrapreneurship context, like the company level, as well as the multidisciplinary nature of it by all (Aaltio, 2002).

2.1 What is intrapreneurship?

The concept of intrapreneurship may appear straightforward, but researchers use different definitions and names for the entrepreneurship phenomenon within existing organizations. Terms such as Intrapreneurship (amongst others, Pinchot, 1985), Corporate Entrepreneurship (amongst others, Burgelman, 1983, 1984), and Corporate Venturing (MacMillan *et al.*, 1986) have all been used to describe the same phenomenon. The broad and widely used definition of intrapreneurship is entrepreneurship within existing organizations. A more specific and widely accepted definition of entrepreneurship in this sense is 'the process of uncovering and developing an opportunity to create value through innovation and seizing that opportunity without regard to either resources or the location of the entrepreneur' (Antoncic & Hisrich, 2001). In intrapreneurship the location and the resources are specified as belonging to the existing organisation. To narrow down our context to technological entrepreneurship – defined by Zahra & Hayton (2004) as the creation of new firms by independent entrepreneurs and corporations to exploit technological discovery – limits, in our opinion, corporate entrepreneurship too much as it excludes

the creation of new business units in the existing organisation and excludes the specificity of intrapreneurship. In engineering and R&D settings intrapreneurship is entrepreneurial R&D engineers and scientists who start up new ventures to create new business opportunities through the exploitation of new technology within an existing organisation; the exploitation of new technology by the existing organization and via a new firms is corporate entrepreneurship (see Menzel, forthcoming). Our focus is on the first.

In accordance with this definition a lot of research is carried out in the context of innovation, organizational factors, organizational renewal and the creation of new businesses. Research mainly focused on large corporations and researchers used intrapreneurship definitions that excluded smaller companies (Antoncic & Hisrich, 2001). Organizations with different backgrounds and size may use intrapreneurship in a different way. A second characteristic of earlier research is that most research is anecdotal and testimonial in nature. Because of this hardly any research is done into the basic characteristics of companies such as size and sector. Even though these factors are challenging, managers have to respond to them in a creative and innovative way (Hornsby et al., 2002).

The concept of intrapreneurship is a complex one; there are many descriptions and conceptualisations that have been made over the years. In accordance with Maes' model (2004) of the intrapreneurship construct we consider the following constituents as the relevant elements of the intrapreneurship construct..
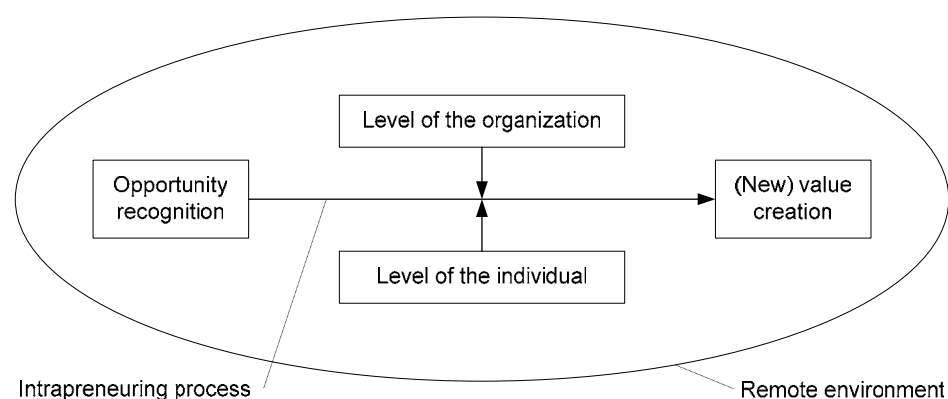

Figure 1: The intrapreneuring process – from the idea to the creation of (new) value (based on Maes, 2004; Menzel, forthcoming)

The intrapreneuring process operates at the heart of the intrapreneurship construct and executes through the ongoing interaction of two main process layers: the organization (close environment, in the case of independent entrepreneurship this level is the same as the level of the individual) and the individual (a single intrapreneur or a group of intrapreneurs). The process starts with idea/opportunity recognition and results in (new) value creation. The remote environment (cultural context, industry, markets, etc.) serves as a general setting for the organization in general, and for intrapreneurship in particular. The process is often, after the stage of idea/opportunity recognition, divided in the stages of "preparation for exploitation" and "exploitation" that lead to the creation of value, in fact each of the stages adds value to the process. The exploitation of the opportunity takes place in the context of the company, in the scope of a R&D project or as a new business unit that create value for the organization it is part of.

The major role of the individual in this process is well recognized (Fry, 1987; Howell & Higgins, 1990a, 1990b; Leifer *et al.*, 2000; Pinchot, 1985). As Pinchot & Pellman (1999) put it, 'innovations just do not happen unless someone takes on the intrapreneurial role'. Indeed, it is obvious that there will be no innovation without the individual involved. As the history of truly independent entrepreneurship and (radical) technical innovation shows, the organization does not necessarily need it, but the individual takes on a central role in the innovation process. This is clearly exemplified by Elisha Graves Otis, the founder and namesake of the Otis Elevator Co., who invented the safety brake for elevators and literally started the elevator industry in 1853. His invention, which advanced to a truly radical innovation – in the sense of the typology of innovativeness by Garcia & Calantone, (2002) – enabled buildings to climb ever skyward and giving shape to our cities. Today, the Otis Elevator Company is world's largest manufacturer of elevators, escalators, moving walks and other horizontal transportation systems (see Goodwin, 2001). As this example and other work show, independent entrepreneur engineers are crucial when in comes to technical and especially radical innovation (Fayolle *et al.*, 2005; Ulijn & Fayolle, 2004). So who is the entrepreneur engineer who works as an employee within an existing company?

2.2 Who is the technology intrapreneur?

Intrapreneurs are defined as entrepreneurs within existing organizations and closely resemble individual entrepreneurs (Pinchot & Pellman, 1999). They come up with new ideas, take full advantage of opportunities and turn them into profitable new realities, push for change and develop creative responses in the organization. However, the profile of an intrapreneur seems to lie beyond the one of an entrepreneur. Entrepreneurial persons do not have to be appointed and designated as leaders; anyone who behaves with entrepreneurial spirit within an existing organization – at any level and in any function – can be an intrapreneur. Indeed, there is no clear-cut profile that could help to identify them, but many intrapreneurs do share similar personality traits as, for instance, described by Davis (1999) or Hitt *et al.* (2002).

Especially, in the case of engineering and technical innovation the presence of entrepreneurial minded technologists is of importance (Menzel, forthcoming). Engineers take up a strong position in innovation activities since they contribute to an important role in the creation, development and generation of new (technical) knowledge technologies. Their technical expertise and skills are an important source for new technical ideas that might turn into new opportunities. The demands on intrapreneurs, as outlined by Cohen (2002), underscore the potential intrapreneur-engineers' contribution to corporate R&D and innovation activities. 'One great source of opportunities arises from knowing customers and their needs well; another is a clear understanding of the industry value chain and the organization's place in it. Considerable entrepreneurship inside organizations is driven by people who have deep knowledge of a critical technology and sufficient market knowledge to judge potential demand'.

This is also supported by recent case study research realized in the highly innovative German automotive supplier industry by Menzel (forthcoming) who describes an innovation process within a large multinational corporation (MNC) in the automotive supplier industry that has led to a "really new" innovation as defined by Garcia & Calantone (Garcia & Calantone, 2002). This innovation is about an electro-hydraulic transmission control unit used in cars which integrates formerly separated mechanical, hydraulic and electronic components into one module. As the study underpins, the realization of this innovation required to a great extent qualities that are distinct

characteristics of the intrapreneuring process, such as exploration of new and unknown paths at the very beginning of the process, generation of new knowledge and integration of existent technologies spread over various business divisions and departments of the company during exploitations phases, and finally new value creation by opening up a new and extremely growing market which have led and leads to the realization of significant profits for the MNC. Moreover, along the whole intrapreneuring process participants, that is, both R&D management and workers showed courage and persistence to achieve a earlier stated vision/goal, had the capacity to deal with risks of both a technical and an economical nature, and were able to work in teams, to cooperate across department and division borders, and, perhaps most important, included a lead customer already in the early phases of the intrapreneuring process. As this case shows, an important factor of a successful innovation process has been the participants with their specific skills, competences and attitudes. Neither all involved were true intrapreneurs, nor one single intrapreneur alone showed responsible for the innovation, but a "good mix" of those having an entrepreneurial mind-set and those, who could not be labelled as intrapreneurs at all, collaborated in a finally successful way.

In this connection the question arises how differences of the professional culture level show up on the individual level of the intrapreneuring process that, of course, involve various professions. Engineers are not all the same; it seems that there are significant differences between, for instance, R&D, application and production engineers, or between mechanical, electronic and software engineers (see also Fayolle, 1999). So, what makes the engineer intrapreneur distinct from a professional culture view point (referring to the individual level of intrapreneuring) and how is this related to the corporate culture (referring to the organizational level of intrapreneuring). This is discussed in the following section.

2.3   *From individuals to context: intrapreneurial organization culture features*

Intrapreneurship occurs at the level of the organizational members. There is no intrapreneurship without action, effort and achievement that comes from the individuals themselves. However, the individuals have their professional backgrounds, and the surrounding cultural circumstances give either give them support or even hinder the emerging of intrapreneurship. However, the cultural and

social context of such actions is relevant. Studies often capture features related to individuals, whereas relational understanding brings the individual intrapreneur into the context (Vesala, 1996). Networks, social capital, mutual trust, and cultural aspects all have impact on the becoming and being an intrapreneur (Groen, 2005). An approach that combines the micro-level – the individuals for their own sake – and the macro-level – individuals in the organizational context – is necessary. To put this more broadly, the creation of culture within a working community (a company) can also be illustrated by the explanatory force to the role of the organizational system, very often the organization as a system is contrasted with intrapreneurship as an action, as a black-and-white design (Aaltio, 2005).

The organization exerts control over social relationships, for example by organizational structures, by the division of duties or by physical nearness or distance. The organization is a framework for reference for its members. Some studies (Lumpkin & Dess, 1996) focus on the organization for intrapreneurship, risk-taking and competition abilities, innovativeness, independence, clear objectives and reinforcement. All these are organizational practices that support the cultural framework for intrapreneurship. Also leadership has a specific importance in the early development of organizational culture. Managers structure the collectively experienced world by providing it with meanings (Smircich & Morgan, 1982). When a company is set up, it is the founder who determines the culture through his/her personality and setting the operating principles (Bloor & Dawson, 1994; Schein, 2004). The role of values in the development of organizational strategies is considered important.

Culture, the special world of meanings shared by a community, evolves as a dialectic process through interaction between leaders and their followers. The opportunity for leadership arises when there are people who are prepared to give up the possibility of defining their own reality all by themselves (Smircich & Morgan, 1982). The role of an individual in the creation of culture is above regarded as being both passive and active. In Cohen's (2002) approach, all cultural creation and change involve politics and power. In his view 'man' is two-dimensional: both a subject exercising power as well as a passive object of power. There is no way to avoid the interaction between the power structures working within organizational frames. Intrapreneurial culture is

nourished by leadership that gives meaning to the work done, and further, it promotes good interaction between the leaders and the led.

In developing an intrapreneurial organization culture both the intrapreneurial individuals and the organizational contexts are relevant. Key persons in the organization are the managers in all levels, but also the mutual interaction processes between colleagues. A culture being supportive of intrapreneurship contains organizational practices conducive of innovation and initiative. Intrapreneurship in an organization can be stimulated via its culture that emphasizes the experience that work is meaningful and motivating. What kind of organizational culture triggers intrapreneurship in engineers? Close relationships with clients and continuous feedback give engineers space for innovations. If the leadership-followership relations are favourable, initiatives can fly further in the organization and stimulate intrapreneurship. The ideals, values, norms and traditions of the culture can highly elicit individual intrapreneurial actions. Successful innovations are often based on intensive co-operation and teamwork.

The process of intrapreneurship takes place in a complex, mutually interrelated social environment, where highly competent individuals and the organizational framework should converge. Thus, it is important to study this process of convergence and mutual social interaction. Intrapreneurship is given space via its culture and, reciprocally, it also influences the culture. It is obvious that the different backgrounds and professional cultures of individuals involved are important. For instance good co-operation between the marketers and engineers is usually needed, in particular in an environment where engineering and technical expertise must meet business and market knowledge. This way, different levels of culture, such as national, professional and corporate culture and their interaction, might the pathway to effective technology intrapreneurship. How to foster it more in practice?

3   Fostering technology intrapreneurship

As the general, given condition of intrapreneurship, the organizational arrangement needs to encourage engineers to act as intrapreneurs and, therefore, to provide a continuous stream of opportunities to try, to experience and to learn for change, renewal and innovation. As long as the aspiring intrapreneur experiences opportunities of self-determination, has freedom to make decisions, can take action

and to exercise influence in his role, her/his strive for autonomy can be satisfied through a self-imposed project. In the following sections we highlight the aspects of an organization's setting, environment as well as the importance of leadership in the promotion and support of engineers to commit themselves to take intrapreneurial action.

3.1 *A physical environment built for intrapreneurial action and co-operation*

Promoting intrapreneurship begins with considering the physical environment of the organization. The environment should be able to compensate for and create new ways of physical nearness, and stimulate mutual co-operation that goes beyond time and space. An example of this is Microsoft where corporate headquarters resemble a college campus with high social integration and dynamics (Higgins, 1995a, 1995b). Also the perceived work environment influences the level of creativity and innovation in organizations (Amabile, 1993; Chandler *et al.*, 2000). In general it may support innovation and mutual co-operation by giving opportunities to work, create and innovate in networks.

According to Sherwood (2002) innovative organizations pay high attention to their employees' working environment in many ways: the appreciation of natural light, a temperature controlled environment, appropriate and up-to-date technology. Management of innovative work also takes benefit from the fact that the people require privacy, and quiet – often solitary – spaces where they can work and be able to concentrate without interruption. In addition to good environment of work, communal spaces where meetings and workshops can be held are needed. Since innovative output is also spontaneous and happens by chance interaction, environments should be designed to make accidental meetings happen: 'to design an environment that encourages people to interact with each other, and maximizing the likelihood of having different people meeting one another by chance is an important design issue for every entrepreneurial company' (Sherwood, 2002). The role of email communication should not be overemphasized, but informal meeting places in staff restaurants should be promoted and be hubs in organizations and seduce people to be innovative over a meal.

3.2 Organizational structures are designed to support intrapreneurship

Reduction of organizational hierarchy and bureaucracy is so important to promote intrapreneurship. It is necessary to eliminate organizational structures that obscure personal responsibility and homogenize individual actions (Robinson, 2001). However, bureaucracy is not only hampering: rules can trigger creative action which could nicely exemplified by 3M. Interestingly, Art Fry, who invented the Post-it notes and made it an intrapreneurial success, states that 'bureaucracy represents accumulated know-how, which will really test you before the product is released' (Anonymous, 1998). He regards bureaucracy as a necessary pre-market test, which will help the intrapreneur to identify major product defects and errors in time. Following this argumentation, bureaucracy can also be seen as an organizational safeguard and should thus not be weakened too much. For this reason, organizations should challenge bureaucratic structures, but bearing in mind, that bureaucracy can have positive implications.

Communication structure comes together with the organizational structure. As stated by Honig (2001), organizations attempting to promote intrapreneurship should consider organizational learning tools applicable to their particular environment. Hence, corporate communication structures need to be capable of adapting to those environments as well. Ravasi & Turati (2005) support this statement and add that entrepreneurial learning usually is affected by constraints as, for instance, scarcity of money, time or attention. The studies mentioned propose several tools to improve corporate communication and to generate creativity necessary for intrapreneurial action, such as grapevines for intrapreneurs, idea competitions and innovation fairs (Klein, 2002; Klein & Specht, 2002), cross-functional innovation teams and decentralized communication structures. The main objective of all these tools should be to optimise knowledge sharing and idea generation within the organization and across disciplinary borders, since intrapreneurship is based upon good ideas and the knowledge how to implement them.

3.3 What can top management do for intrapreneurship?

As discussed before, the top management's role and interest for innovation and intrapreneurship is important as Trompenaars & Hampden-Turner (2001) elaborate in their HAIRL model. This is based upon the ideal profile of Shell top managers,

characterized by (in a decreasing order of importance): Helicopter view, Analysis skill, Imagination and Creativity, Reality sense, Leadership. Senior management has an important role in determining whether or not the organization supports intrapreneurship – largely because they have the power to make things happen, or to block things they do not like. In order to be successful, intrapreneurs need to think differently; they need to find uncommon solutions. The research we report in this chapter shows that this a major factor for the facilitation of intrapreneurship. Challenging the status quo is an essential element of intrapreneurship and because intrapreneurs will not have the power to do so alone, they need support either by senior management.

In order to encourage engineers to take initiative as intrapreneurs, it is top management's task to communicate and fill with life the organization's goals, strategy, and task which should be based on clear commitment to intrapreneurship initiatives. Setting goals for innovators and intrapreneurs to achieve is a never-ending task for top management, and their action must reflect their words: 'You cannot just talk the talk; you have got to walk the talk' (Nicholson, 1998). In order to leave the people free to innovate, they must use the goals and values of the organization to guide behaviour – not rules, procedures or reward and punishment (Frohman, 1998). Furthermore, listening is a big part of the top manager's job of encouraging intrapreneurs. 'Pay attention to every idea, no matter how unlikely, because today's loser might become tomorrow's winner' (Nicholson, 1998). The leaders should constantly walk around asking questions, 'looking under the rocks', doing what is unexpected (Frohman, 1998). Also, a participative style of leadership should be lived, enabling employees to take part in communication and decision making processes. While the goals are set at the top, they should not be forced top-down: they should be discussed, deliberated and changed, based on feedback from people at all levels (Frohman, 1998).

3.4   Who are the intrapreneurs' advocates?

Besides senior management in general there are other types of top and middle managers important for fostering intrapreneurship. In an organization, in which intrapreneurship flourishes, we think especially of three relevant promoting actors whose primary responsibility is to be a positive advocate of the intrapreneur's idea

(Anfuso, 1999; Hauschildt & Kirchmann, 2001; Klein, 2002; Klein & Specht, 2002): the promoter who supports the idea of the intrapreneur and communicate it to the upper highs in the organization; the sponsor who directly recognizes the commercial value of these ideas; and the protector or gate-keeper who monitors the process of implementation of the ideas. Such key stakeholders can support the intrapreneur with their broad experience in conducting projects, corporate politics and professional knowledge. Their main task should thus be coaching the intrapreneur. They do not necessarily need to be the direct superiors, but they should be as high as possible in the corporate hierarchy, so they can support the intrapreneur by assigning necessary resources to his project. This could either be realized by assigning resources from their own budget or by utilizing their contacts and authority among other executives. Their acceptance by colleagues and their power due to a hierarchical position could also be advantageous when defending or protecting the intrapreneur's project against criticism. Hence, it is important for the intrapreneur to develop a network of top and middle managers that are willing to support the intrapreneurial idea.

3.5   *Resource availability and allocation enhance intrapreneurship*

Intrapreneurship cannot be created from a vacuum. Individual talent and potential are highly relevant resources of the company. Even if the intrapreneur's qualification and the corporate communication channels do support intrapreneurial thinking and action, still resources for this action need to be provided somehow. One classical approach, as pursued by companies like 3M (Klein, 2002; Klein & Specht, 2002) or Wella, is the concept of organizational slack (see Lindenau & Friz, 2004). The idea behind is to allocate a certain ratio of employees' working time for innovative projects, which can be chosen by employees themselves. Examples for those time ratios are 15% (3M) or 20% (Wella) of total working time. This evidently needs supportive recruitment efforts and good resource allocation. As mentioned above, manpower should be provided on a voluntary base. With the precondition of organizational slack, the intrapreneur only needs to compete with other intrapreneurs for the available slack time of his colleagues. In addition to time, capital needs to be placed at the intrapreneur's disposal. In this respect, Pinchot (1985) coins the expression of "patient money", that is, a credible promise of the organization to invest capital into a project without withdrawing it after some initial losses.

Again, organizational practices are of key relevance in the development of an intrapreneurial organization. Van de Ven & Polley (1992) add an interesting proposal concerning the funding of new ventures. Planning of a venture should be separated from its funding. Intrapreneurs do not have to develop plans for funding (certainly not from the beginning), but to develop innovative and realistic plans. Also, they point out the importance of an optimal turnover of personnel. On the one hand, a low turnover secures remaining of vital knowledge within a project group and decreases additional workload due to advising new colleagues to their tasks; on the other, a high turnover can bring more new ideas and impulses into the team. It is a known fact that only a small number of ideas will become successful products. Generating ideas is important, but turning the ideas into a business proposition is a different matter. Intrapreneurs are particularly those employees who are able to see the opportunity, identify the necessary resources and present to the management a compelling business case. Of course intrapreneurs are "diluting" knowledge over more initiatives, but a company that does not innovate will not survive in the future. New ideas need to be explored on their potential for new business; such activities motivate employees and rather than dilute it cumulate knowledge.

4   New, interaction-based methods of intrapreneurship teaching and training

Organizations need to encourage engineers to act as intrapreneurs and, therefore, provide on the organizational level of intrapreneurship room manoeuvre and a continuous stream of opportunities to learn and (pre-)experience the importance of intrapreneurship for change, renewal and technical innovation. However, not every corporate engineer will have what it takes to become an intrapreneur. Employees may lack motivation, inspiration and drive and may not be ready to think for themselves, make choices or take risks to the extent required for intrapreneurship (Coulson-Thomas, 1999). Especially engineers seem to lack skills to become intrapreneurs (Menzel, forthcoming). This also means that not every employee will become an intrapreneur in the end. Only some or even a few of them might have the potential to become intrapreneurs and should, thus, be taught and trained in this direction.

Nevertheless, potential intrapreneurs should be identified early in their careers even those of them who might lack some of the distinct characteristics and capabilities of an intrapreneur in the beginning. These so-called "would-be intrapreneurs" need to be

addressed by intrapreneurship programs and trainings. Although innate predispositions may play some role, entrepreneurs are mostly made rather than born (Block & MacMillan, 1993; MacMillan et al., 1986; Pinchot & Pellman, 1999). This holds also true for intrapreneurs, although they vary considerably in their capabilities, which can be improved significantly through training and experience. How are we going to develop in some concrete teaching examples personal skills, such as creativity, innovativeness, proactiveness, team spirit, and so on and skills to convert those into realistic intrapreneurial action? And what are the best training methods to do so?

The training rigor theory by Black *et al.* (Black *et al.*, 1999) seems to gain support from the ideas by Mintzberg & Gosling (2002) on management education in general: Think first, interact and do later. The management education classroom can be a place where managers reflect thoughtfully on their experience beyond the classic professor student interaction. A new mindset for intrapreneurship is developing: from reflection, collaboration and analysis to action involving a diversity of stakeholders. These is not a jump in the dark as the American style of learning by doing, or learn from your mistakes, or a French/Latin teaching ex cathedra, but a combination of teaching and training. This new educational paradigm would not only be an interaction between professors and students, but also in the case of intrapreneurship development include other stakeholders or partners, such as financial, legal, technological and marketing experts apart from entrepreneurs telling not only about their successes, but also about their failures without any reluctance.

How to profit from these teaching possibilities for a more effective intrapreneurship education and training? A promising attempt is the so-called *Intrapreneuring Game* (see Menzel, forthcoming; Verhoeff *et al.*, 2005) that addresses both students and employees in engineering and R&D settings to learn and experience in an interactive setting what intrapreneurship is all about. Based on a scenario presented to the participants, this game simulates an intrapreneuring process in a large multinational corporation, where a true engineer-intrapreneur has a revolutionary idea of a new product. In the simulated meeting with other relevant actors in the company (for instance, the Business Unit, R&D and Marketing Manager) the engineer-intrapreneur aims to convince the others of her/his idea in order to acquire resources for the further development and implementation of the (radical) innovation project. This, however, is

not an easy affair in a large, established organization that rather is meant for incremental than radical innovation, where short-term focus prevails over long-term orientation to the future, and where participants are rather uncertainty averse than risk-aware. The underlying logic or conflict of this simulation is based on the high degree of newness of the product idea (new to the company in terms of knowledge/technology, risk, time, financial resources, etc. involved) that fully contrasts what the organization is meant for.

Table 2: The basic conflict simulated in the Intrapreneuring Game (see Menzel, forthcoming)

The intrapreneur's orientation	The organization's orienation
• Higher degree of newness, radical innovation • Exploration of unknown resources and pathways • Higher level uncertainty acceptance • Long-term orientation, persistence • Need for flexibility and room to manoeuvre	• Lower degree of newness, incremental innovation • Exploitation of existing resources and pathways • Lower level of uncertainty acceptance • Short-term orientation, quick returns • Planning and formalisation of activities

Theory first, application later, or telling, doing, and showing as proposed by Lempereur (2004) in line with what Kurt Lewin has said: 'There is nothing more practical than a good theory!' In teaching engineering students to become more intrapreneurial, leaning by doing and learning from your mistakes might be more effective, as Black et al. (1999) suggest. Doing, showing and telling as a strong sensitization concept might have more effect: Just jump in at the deep end of every-day's business practice or sink and swim. In the mere case of entrepreneurial business plan negotiation Ulijn *et al.* (2004) evaluated how engineering students gain insight and skills in such a critical stage of their possible high-tech start-up. The simulations of such real-world scenarios are action-oriented and have a direct impact on the behaviour of the students: DO, SHOW and TELL means that the teacher post hoc drew implications. The conclusion of their study is that for future use of the role-play, the order TELL, DO and SHOW (as used by Lempereur, 2004) might be equally effective. Simulation of real life scenarios permits studying critical incidents and the reaction of individual stakeholders, processes such as negotiation, decision making,

technical and social innovation, and interaction between individuals and between individuals and the organization.

There are very specific implications for training and educating engineers as future intrapreneurs. With regard to methods: scenario-based simulations of both the task execution of the intrapreneur and his/her organization itself would be much more effective than listening to even the wise lessons of professors, trainers, consultants, or even by so-called "gurus", who do not assume the daily responsibility of company operations. Intrapreneurship is action-driven: Please do not talk too much about it, but do it! Simulations and role-plays help people to prepare, for instance, for negotiations which are part of such technology intrapreneurship development process in large R&D departments of MNCs.

5   Conclusion for businesses

What should organizations do to foster intrapreneurship of engineers? Technical innovation needs social innovation (Verhoeff, 2005; Verhoeff et al., 2005). In sum, the above presented empirical evidence of 156 Dutch firms show what physical environment for intrapreneurial action and cooperation to provide the organizational structure supportive of intrapreneurship with clear goals, strategies and tasks (Veenker et al., 2004a, 2004b). Top management should encourage successful intrapreneurship by making human and financial resources available and allocated, such as rewarding engineers for intrapreneurial action, irrespective of a possible failure under the slogan: *Never a shot, always a miss*.

As commercial and social visions are more and more important in technical product and service development, they do also in engineering training. This commercial/social/technical interaction evidently stimulates cooperation between various actors and a natural kind of working towards common goals. Although the topics of entrepreneurship and intrapreneurship can be taught in a theoretical manner, for engineering students this is not the desired approach: All engineering students should be exposed to intrapreneurship both in theory and in practice and be able to develop an idea into a compelling business case, preferably for a real opportunity, not an artificial one. Engineering students must be trained to work in multidisciplinary teams and to bring out knowledge and experiences from the others in the team and

come up with new ideas, new solutions, and new combinations, that, when working in a company mean innovation.

Companies internationalize rapidly since for many high-tech products and services there are no local, regional, or national markets. Employees in those companies are more and more exposed to different national and business cultures. Situations that simulate such conditions can be accomplished in bringing teams of international (Socrates) students together and work on joint projects. Engineers move within ten years after their graduation to management positions, but already during their initial studies they need to be made aware of how innovation can be stimulated through intrapreneurship. The intrapreneurial engineer should know how to orchestrate the physical environment and the management structure to foster and elicit new business development.

Earlier in this contribution four organizational factors were identified as important for intrapreneurship. One of those, cooperation between colleagues, is an important one with regard to education. Engineers ought to be able to work together with their colleagues in a team. Education ought to prepare them for this. Therefore we offer some current teaching and business practices to address those issues, such as team work and negotiation in Germany, The Netherlands and Finland. The aim of a future more general European study would be to simulate, for instance, the intrapreneurial negotiation process within real-world firms both as a learning, a research and an educational tool. This way a reliable data gathering in The Netherlands, Germany, France and other countries is possible leading to a practical assessment tool to make engineers active as entre- and intrapreneurs (Verhoeff *et al.*, 2005).

In sum, a technological intrapreneur should be able to exploit the R&D potential of ideas into marketable technical products and services, identify the necessary resources and present this as a compelling business case to his/her top management. The working environment, organizational arrangements and ways of management and leadership create favourable learning conditions for such an intrapreneur and for technological intrapreneurship.

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