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THE ROLE OF UNIVERSITIES AND RESEARCH AND DEVELOPMENT (R&D) ORGANIZATIONS AND ENTERPRISES IN THE INNOVATION CYCLE

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1. Development, growth and competitiveness are based on new ideas. Society constantly expects new ideas, inventions and commercially successful innovations from private citizens, from enterprises and large corporations and also from researchers and other persons working in scientific and technological development. All the resources available for creativity and inventiveness must be used. However, the development of an invention into a successful innovation requires significant human and financial resources and support organizations. In that way knowledge and know-how can be exploited and transformed into competitiveness, economic growth, new jobs and also welfare.

Universities and R&D organizations

2. Anyone, whether private person, researcher or research team, corporate employee or product development team, may come up with an invention. An inventor or a researcher is often alone with his invention: he needs advice, support and networks. An employee inventor may have a large organization and many specialists around him. The enterprise may also have the requisite resources to bring the invention rapidly on to the market.

3. Generally, an individual owns his invention personally, whereas an enterprise or a corporation owns an invention made by its employee if it is related to the employer's business. Local laws define ownership in detail. The ownership of the inventions of university researchers varies from country to country, but often they are the property of the university. Inventions are always made by human beings, however.

4. The role of universities and research and development organizations is crucial. Research results are important, but the number of inventions and possibilities for innovative products and methods is growing all the time. A researcher should evaluate the possibility of patenting the results of his research, and of course should do so before making the results public. In many universities and research organizations there are innovation managers, innovation centres, licensing departments or other agencies whose role it is to assist and finance the researcher in the patenting, development and marketing of inventions. The revenue from successful innovations is usually divided between the inventor, the university and the licensing organization. There is often a problem, however, when it comes to covering the cost of patenting and development work.

5. We should not forget another important task of universities, which is teaching. It is the primary source of technical and business knowledge for researchers, company employees and entrepreneurs. It seems to be increasingly important to study mathematics and natural sciences at school before entering university; in many fields inventions are based on the most recent research results and often also on the ability to combine information technology with other technology.

Innovative enterprises

6. Successful enterprises know why and how to invest in research and development that brings results. Although small and medium-sized companies often suffer from a lack of resources, know-how and an innovative environment, they do manage to produce inventions and patents. The result is reflected in new products, improved competitiveness and success. In a recent study conducted by Statistics Finland, profitability was found to be noticeably higher in firms that were active in research and development than in non-R&D firms.

7. Innovations and success in an enterprise depend greatly on the ability to develop, acquire and apply new scientific knowledge and know-how. Research and development within the enterprise, along with the current and growing expertise of its personnel, provide a basis for the propagation, development and exploitation of competitive inventions. Information and know-how become a strategic resource for the enterprise.

8. In an innovative organization, there should be:

- An innovation strategy and goals;
- Teamwork and networks;
- Creativity training;
- A positive and competitive atmosphere;
- The strength to accept mistakes and reward achievements;
- Feedback and information systems.

9. The success of an innovation may result from:

- Technical advantages, and/or
- Commercial advantages.

10. These advantages may result from:

- Novelty and inventiveness;
- Level of technology and technical features;
- Operational characteristics;
- Markets and business potential.

11. Competitive advantages can also be gained, if the innovative product is hard to:

- Build;
- Buy;
- Copy;
- Replace.

12. The importance of an invention to an enterprise can be analyzed according to the following principles:

- What are the technical features and technological level?
- Is it new and patentable?
- What and where are the markets?
- How important is the product to the enterprise and its growth, competitiveness and image?
- What kind of human and financial investment is required by the new product and its development?
- Does it fit in with the enterprise's line of production?
- What are the risks of the project?
- What are the profit expectations?
- What is the life cycle of the product?
- Are financiers interested in the new product?

13. There must naturally be a balance between goals and resources.

14. The main phases involved in developing an invention into a commercially successful innovation include:

- Evaluation;
- Patenting;
- Product development;
- Marketing;
- Commercialization.

15. All these phases require specialists and financial resources. Commercialization is the key to making the invention successful and earning revenue.

The influence of innovation activities on enterprises

16. Financial results obtained from innovations are a direct indication of the success of a business. In recent years, however, financial indicators and corporate balance sheets have begun to be supplemented by concepts such as intellectual assets and intellectual capital, and even personnel balance sheets. Intellectual capital is part of an enterprise's intangible assets. It may be quantified by calculating the difference between the enterprise's market value or acquisition price and its book value.

17. A key component of intellectual capital is so-called organizational capital. Among other things it includes:

- Intellectual property rights, such as patents and trademarks;
- Corporate culture;
- Trade secrets;
- Information systems.

18. Intellectual capital also includes human assets such as know-how, teamwork, skills and values.

19. Intellectual capital may be measured using indices such as:

- Value added per person;
- Quantity and quality of customer contacts;
- Makeover rate, or the ability to introduce new products and their share of total sales;
- Number and quality of patents.

20. The intellectual capital of an enterprise and the different types of intellectual property right often combine to add value to the product in the commercialization phase. Industrial products are often protected by multiple patents and have a registered trademark. In addition, a product may embody design characteristics, know-how that cannot be legally protected, trade secrets and the like; all of these add value. They are factors that can be classified on technical, commercial and other bases. Technical classification includes patents, new product technology and manufacturing methods, research findings, evaluation skills and testing,

whereas commercial classification includes the enterprise's name, its trademarks and copyrights and also its marketing strategies and advertising know-how. The other factors include management know-how, information technology, databases, training, customer relations, networks, quality assurance, pricing skills and security procedures.

21. Intellectual capital and its subset, intellectual property rights, between them often form the basis for corporate development, growth and international expansion. This applies to all intellectual property rights, but especially to patents and trademarks. A strong patent and a good trademark play a central role in both domestic and international trade. The trading of intellectual property rights has grown strongly worldwide, and income flows from licensed technology, trademarks and computer programs add significantly to companies' final accounts and market values.

22. Additionally, with a strong intellectual capital, the company can continuously produce new ideas and remain at the forefront of innovation.

Support for researchers and entrepreneurs

23. The role of the government in the field of inventions and R&D is essential. In Finland, for instance, the Government determines Finnish technology and innovation policy. Many organizations, such as the Foundation for Finnish Inventions, Tekes (the National Technology Agency), Sitra (the Finnish National Fund for Research and Development) and Finnvera, are active in the field of innovations or in dealings with innovative companies and provide finance for R&D, product development or investment.

24. The Foundation for Finnish Inventions, for instance, supports and helps private individuals and entrepreneurs to develop and exploit invention proposals both in Finland and internationally. The Foundation is a leader in advising, evaluating, financing, developing and marketing invention projects in different areas of technology. It serves as a link between private inventors, innovators, small and medium-sized enterprises, universities, research institutes, consumers, businesses and industry, both in Finland and in other parts of the world, whether for setting up production runs, licensing or any other means of exploiting an invention. The Foundation has also a network of innovation managers in all regions of Finland and in major universities (www.innofin.com).

25. Finnish invention activities are also promoted in the form of national and regional, or industry-specific competitions, seminars, exhibitions and awards. The most important of these is the annual INNOFINLAND project, which culminates in the presentation of INNOFINLAND awards. These are given to successful new innovative companies or inventors by the President of Finland, Mrs Tarja Halonen.

26. Although projects receive public support, most of the research and development work is carried out in private companies. Finland also has numerous technology parks and small business incubators. Many private venture capital companies finance various development phases of young companies.

Value perspectives

27. The value of an invention varies when viewed from different perspectives. These include:

- The inventor's perspective;
- The inventing enterprise's perspective;
- The licensee's perspective;
- Social, and perhaps also global economic perspectives.

28. Some objectives associated with the value of an invention or intellectual property rights are convergent, while others diverge. Those objectives may be economic in nature, such as financial gain, growth, profitability, stability and other rewards. They may also include social esteem, prestige, power, respect, reputation, international expansion and social welfare.

29. The social objectives of inventiveness, exploitation of intellectual property rights and innovation include increased economic activity, entrepreneurship, employment, tax revenue, international competitiveness and general public welfare.

30. Those values can be transformed into material benefits when the inventions are marketed.

31. New technology and inventions create many opportunities, but they cannot be successful until they have been given the form accepted and needed by the marketplace.

32. Even though an invention may be good and may have survived the patenting and product development processes, and even if the enterprise involved is dynamic and innovative, the invention will not of its own accord bring a competitive advantage or success. Only the most difficult stage in the process, marketing, can generate income – up to that point the venture has only consumed time and money, which are often considered investment rather than expenditure.

Marketing

33. The right to exploit an invention belongs to its owner. The commonest exploitation alternatives are:

- Production within an existing or new enterprise;
- Licensing;
- Partnership arrangements;
- Acquisitions;
- Subcontracting.

34. The inventor may start a company to manufacture and market his invention. If the inventor-entrepreneur exploits the invention himself, the patent need not be as strong as when the invention is licensed to someone else. It is not always wise, however, to build a company around one product, and a good inventor does not always make a good entrepreneur.

Networking, on the other hand, often produces good results by providing access to the best available innovation, financing, manufacturing and marketing expertise of individuals or smaller companies. Patents also have value as capital, which may be exchanged for equity in a newly formed company.

35. The acquisition and sale of licensing rights is one of the cornerstones of the operating strategy of manufacturing and technology firms today. In practice it involves a complex combination of technical innovation, law, economics and management. Many inventors and also companies would like to license their inventions to a company that will manufacture and market the product.

36. An invention must be viewed as a business opportunity from the start, as incremental business for the enterprise. The analysis of whether to manufacture a product is identical, regardless of whether the invention has been made in-house by an employee or offered to the enterprise by an outside inventor for exploitation. Inventions made within the enterprise may be easier, however, when suitable means of production already exist and the invention relates to existing operations. On the other hand, it is good to remember that outsiders can produce ideas for products that are just as good as, or even better than, those generated within a company. That of course presupposes that the inventions are patented and developed to a marketable state.

37. An agreement is usually reached when the deal is beneficial to all parties. According to experience of license agreements an average royalty rate, on the basis of which the inventor receives revenue, is 25 to 30 per cent of the total revenue from sales of the innovative product. Sometimes the share of revenues for the licensor may be as much as it is for the licensee. The real royalty percentages are often from two to six per cent but can range from 0.5 up to 25 per cent, depending on the field and the type of product. When the life span of a product is short, or the product is unique, the royalty may be very high. Alternatively mass production at low royalty percentages can make for a high level of real revenue.

Benefits from innovation

38. Different groups or parties can benefit from the innovation. These include the following:

a) A private inventor or researcher, if he starts a successful business or concludes a good license agreement. In many cases, however, the development costs of an invention prove higher than the revenue received;

b) An employee inventor in an enterprise or in a corporation receives usually a flat fee for a patented invention, plus possibly a bonus for a successful innovation based on sales of the product. In addition, he normally continues to receive his basic salary;

c) The corporation and its shareholders benefit from new innovative products based on sales, and often benefit also when the share price of the corporation rises;

d) Other companies which cooperate with inventors or with the innovative corporation. They include patent agents, lawyers, bookkeepers, companies in communications or transport and other manufacturing companies which use the innovative product, and / or also wholesalers and retailers;

e) Government and municipalities which receive tax revenue from inventors and innovative corporations and also fees from patenting or customs transactions;

f) Consumers, who benefit directly or indirectly or are otherwise satisfied with new innovations such as mobile phones or medicines.

Conclusions

39. Monitoring the competition environment in companies is a good source of ideas for inventions. It often gives clues or exposes problems or a hidden demand, leading to more systematic inventive and development work and consequently more market-oriented products. In inventive work, the patent is often an essential step in the production of an innovative product. However, it is no more than an expenditure item unless there is a real commitment to developing the invention and turning it into a marketable product. The patent itself is merely like a key to a door that opens on to new opportunities for successful business.

40. When research, invention and technology bring forth new opportunities, the fundamental question that has eventually to be asked is: Where are the intellectual and financial boundaries of acceptance and usability? Three factors in particular, namely need, use and reliability, become increasingly important when new ideas and goods are evaluated and produced.

41. Knowledge deriving from education and expertise is also needed if the intellectual and financial inputs are to be properly implemented. The key question is how science and research can help us to understand the world that we live in and take advantage of the opportunities offered. Time, too, has become a central factor in terms of competitiveness: the same things are invented or found simultaneously in different parts of the world, and a competitive edge has to be gained with fast product development and marketing.

42. Today’s inventions have to be on the market by tomorrow morning, otherwise others will reach it first.

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