Scoring System for Commercialization Potential Appraisal of Technologies

MAKSYM KARPASH, NAZARII TATSAKOVYCH, OLEG KARPASH
Ivano-Frankivsk National Technical University of Oil and Gas
Karpatska street, 15, Ivano-Frankivsk, 76019
Ukraine
mkarpash@nung.edu.ua, ntatsakovych@gmail.com, karpash@nung.edu.ua

Abstract

Postindustrial model of economic development states the innovations to be a pathway toward constant growth. Huge amounts of money through public and private institutions are spent for research and development. Innovation is the way how to make reverse process – create money from research (commercialize). Regardless to the chosen route for commercialization (startup, consulting, licensing) there is a constant need to select technologies without deep academic background. We have proposed scoring system which helps to assess existing technologies with consideration of quality of technical opportunity, quality of the related market opportunity and value of the commercialization perspective. Results of the case study of proposed scoring systems in the frame of HUSKROUA/1101/194 project are presented.

Key words: technology, transfer, scoring system, commercialization.

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1 Introduction

Everyday huge number of different ideas come to the mind of people but so many of those ideas, while intriguing and novel, are not quite practical because they often could not be directly applied in practice; also it is possible they don't directly address a significant market need; or they could not be implemented in a cost effective manner or they just could not be implemented at all. (Siegel et al. 1995)

Commercial potential in literature means "the possibility of commercialization of candidate technology" and/or "likelihood of a successful commercialization". The determination of commercial potential of a technology is a necessary prerequisite element for defining successful commercialization strategies. There are numerous methodologies for making such a determination.

Normally to determine the commercial potential of a technology, the strengths and weaknesses, as well as opportunities and constraints related to its commercial realization should be evaluated. Recently, several models have been developed to determine the commercial potential of a

technology. These models assess several factors that are effective on successful commercialization of the technology. However, the principle problem quantifying essential factors and calculating the overall commercial potential of the technology has remained unanswered (Kathleen 2003; Martyniuk 2002; Martino 1995)

In other words, what has not been covered yet in the previous research is a more proactive approach by which one can forecast the success rate of commercialization of the technology in the process of R&D. Such a forecasting model would enable one to figure out the best scenario for a given technology to be matched with a specific transferor and transferee. (Sohn et al. 2005)
This paper presents an approach that aids to the decision makers to select those early stage technologies who have potential of successful transfer to marketplace. For a prediction of a specific combination, we suggest a methodology based on a committee of experts. Moreover, we expect this method will become feasible for technology transfer offices at technological universities.

2 Problem of Commercialization

In simple words, commercialization means making money out of research and knowledge while research is process of making new knowledge using money. Commercialization in this study means "converting or moving "technology" into a profit making position" and technology refers to know-how, techniques, patented or otherwise proprietary processes, materials, equipment, systems, etc [Siegel et al. 1995].

Commercialization is the process of moving a technology or innovative concept from the idea stage to the marketplace. In other words; technology commercialization commonly define as the process of creating a product that is suitable for a particular market at an affordable price that fulfills the demand of the market. But more useful definition with the most coverage on our target in this article is "the process for commercialization of technology from R&D sector and laboratories to industrial companies" that is more common between experts. So emphasize in this article is on the process from "laboratories to industry" or "laboratories to market " (Balachandra et al. 1997; Ghazinoori, 2005).

The technology commercialization process is not a simple linear process, but rather is a complex process involving many actors in many capacities. The commercialization process requires skills such as: product development, market assessment, market strategies, finance, manufacturing, accounting etc. (Kathleen 2003).

There are several barriers against commercialization of a technology, which are more severe than those others. Barriers against the commercialization of a technology could arise at each stage of the idea to market process. They range from lack of information; insufficient human capabilities; political and economic barriers such as lack of capital, high transaction costs, lack of full cost pricing, and trade and policy barriers; institutional and structural barriers; lack of understanding of local needs; business limitations such as risk aversion in financial institutions; excessive and costly regulations; and inadequate environmental codes and standards. In addition, there may be also technology specific barriers. While there appears to be no shortage of barriers to technology

commercialization, discovering a method to enhance the process is a difficult task. It is widely accepted that for successful and sustainable technology commercialization, there must exist a multi-faceted enabling environment. This environment should include favorable macroeconomic conditions, the involvement of social organizations, national institutions for technology innovation, human and institutional capacities for selecting and managing technologies, national legal institutions that reduce risk and protect intellectual property rights, codes and standards research and technology development, and the means for addressing equity issues and respecting existing property rights.

The decision to commercialize a technology is often made by an organization or individual, often the developer(s) of the technology, without a complete understanding of the processes and requirements that will ensure success. (Kathleen 2003; Martyniuk 2002)
Still in modern Europe at least half of all research is being conducted at universities. This means that universities have to overtake above mentioned barriers on the commercialization pathway while researcher has only to take a decision on this issue and inform technology transfer office on this.

One way to overcome these problems is evaluation of new technology and assessing its commercial potential. Such evaluation should be initiated as early as possible. The early evaluation of new technologies allows those with more commercial potential to be further developed in ways that would enhance the chances of successful technology commercialization.
While a number of tools have been developed to address some of the individual aspects of successful technology commercialization, but more strategic and informed, comprehensive process is desirable. However the major problem consisting of the synthesis of individual aspects, quantifying them and calculating the overall commercial potential of the technology has remained unsolved (Kathleen 2003; Chifos et al 1997)

The early identification of new, emerging technologies with high commercial potential has a number of advantages. Early identification by laboratories and firms seeking to commercialize their technologies can assist them in deciding whether to continue developing a technology and expend the time and effort necessary to obtain intellectual property protection (e.g., a patent) for the technology. Early assessment can also be used to identify what types of businesses or industries may be interested in, or best suited for further developing or adopting the technology in question. In either case, early recognition of commercial potential of the technology represents an effective use of resources and may aid in increasing the number of new technologies that eventually establish a commercial presence (Martyniuk et al 2003; Chifos et al 1997).

3 Commercialization Attractiveness Appraisal Process: Scoring System

We propose the scoring system which is a combination of existing EU good practices with consideration of current Ukrainian specific legislative and commercial reality.
The score ranges from 0 to 100 (max) and demonstrates whether the technology transfer office should take the technology for commercialization with reasonable risks and possible benefits. Additionally, the scoring systems may be used by researchers themselves to see what has to be improved in their research outcomes in terms of commercialization potential.

Method requires at least 2-3 experts in general engineering (or medicine, biology if applicable) to work on the technology description made by technology transfer office staff or researchers. The following disclosure form is being proposed http://content-project.net/form/intellectual-property-disclosure-form.

The maximum score of 100 points is divided between 3 key areas – quality of technology (25 pts), quality of market opportunity (25 pts) and quality and value of commercialization perspective (50 pts).

Tables 1-3 shows the indicative scoring scheme in terms of minimum and maximum for above mentioned areas of technology assessment.

Tab. 1 Scoring scheme for "Quality of Technology"

1A - Uniqueness/ protectability of the technology	
5 (max)	*for a family of patents, granted worldwide, which covers several interlinked aspects of the technology*
0 (min)	*for a bare idea, with no evident uniqueness or protectability (first action - consider dropping idea, or at least keep a watching brief to more related ideas in future)*
1B - Readiness of technology	
5	*the technology is well proven and bug free, and a process for volume manufacture has already be proven by manufacture of significant quantities (or is trivial, as for example, with software duplication)*
0	*the technology should work in theory, but hasn't yet been tried (first action - assess how long and at what cost to improve this score)*
1C - Technical development timescale and risk	
5	*The technology is fully developed and productionised and can be taken on by a commercialisation agent with the certainty of being ready for market (subject to business development) within 6 months*
0	*The idea will need a lot of time (>10yrs), effort and resource in terms of technical development (and it is not obvious who would fund the resource) and then there is only a 10% chance of real success (implication – not a Investor-oriented opportunity, and we should not get involved in grant finding)*
1D - Academic track record	
5	*The team is the world leader in the field and acknowledged as such*
0	*The idea comes from an individual with no obvious track record or quality support (that does not mean the idea has no credibility).*
1E - Relevance of the technology to existing market demanded technology	
5	*An existing and large global market is very visibly searching for a new solution to a real problem which this invention will fulfil with no significant or time consuming further development*
0	*This might be an elegant piece of science but there is no market need, nor is it likely that there will be any market need in the foreseeable future (implication – do not pursue)*

Tab. 2 Scoring scheme for "Quality of market opportunity"

2A - Value of the market, now or within the next 5 years (i.e. the **value of the market** of the **niche** that the technology is ever capable of filling, and in whichever geographical market could be accessed, even there are no plans to do so)	
5	*the worldwide market for this product and its direct competitors is likely to be in excess of EUR 1 billion p.a.*
0	*the worldwide market is likely to be less than EUR 1 million p.a. (but this could still be a worthwhile high margin niche).*
2B - Competitive edge	
5	*the product/service is/will be several times as good as the competition in one or more customer-critical areas, and is not worse in any other areas*
0	*the product or service has no, nor likely to be developed to have, evident advantages over the competition (implication – do not pursue in any way)*

2C - Profit margin (if considering a license, score on the anticipated royalty rate)	
5	*the gross profit margin per sale is likely to be over 70% (royalty >7%)*
0	*the gross profit margin per sale is likely to be under 15% (royalty <1½%) (a margin of <15% may be still worth pursuing, but might imply that the competitive situation makes it not worth pursuing)*
2D - Customer conservatism (the direct customer for the product or service)	
5	*the customer group is very innovative and experimental, buying new products or services just to try them out*
0	*regulatory, legal, moral or religious reasons lead to new methods being rejected irrespective of their advantages, which mean there is no chance of the idea being exploited (implication – do not pursue)*
2E - Route to market and barriers to market entry	
5	*There is an obvious and an easy to access route to market for the product or service, with no industry barriers – just do it!*
0	*Every conventional and legal route to market (licence, spinout, joint venture, consultancy etc.) seems to have an insurmountable barrier to entry (which may be e.g. cost barriers, industry maturity, market stranglehold etc.) (Implication – do not pursue)*

Tab. 3 Scoring scheme for "Quality and value of commercialization perspective"

3A - Reputation to the University (note max score of **20**)	
20	*The proposal appears to provide a route to solving a current global priority problem, can be publicised as such now (or very soon if a patent application is needed), which will have the world knocking at the door offering money, and even it only fulfils part of its potential, will still provide huge reputational credit for the university*
15	*The proposal can be publicised now (or very soon if a patent application is needed) and will get useful national (and possibly international) press coverage as it seems to meet a current need or real issue, bringing in interested parties to work with us*
12	*The proposal will gain regional and possibly national coverage and get interested parties wanting to find out more as it really is a novel way of doing something*
8	*The idea is 'ok', might provide a few jobs or income, but is no more than universities are supposed to do on a day to day basis*
5	*The idea just has no interest to anyone*
0	*The idea has no reputational value; indeed, it could be misrepresented and be very negatively viewed by others and seen as something a quality University should steer well clear of (implication – **avoid,** unless and until it can be repackaged in a more acceptable way)*
3B - Potential value (EUR) to the University (assuming reasonable success) (value is the likely cash return to the university on spinout exit, or total royalty and licence fees; before shares for the academics)	
5	*EUR 3m+*
0	*<EUR 30k*
3C - Readiness of the researcher to commercialize	
5	*Researcher has a clear vision of the business model with relevant experience*
0	*No willing for any business activity*
3D - Estimated time for the University to obtain this value (for a spinout, take an optimistically realistic view) (for royalty fees which will be spread over many years, use a time period of 30% into the income stream, unless a known 'lump' indicates a different timescale)	
5	*within 12months*
0	*>10yr (this is a long time, but some ideas do have a long gestation time especially if high reputational value can be garnered now)*
3E - Expected time to exit the business (start to receive paybacks, royalties, profits etc). Patent application is the starting point.	
5	*within 6months*
0	*>5yr*
3F - Cost of Investor resources until project completion (as external expenditure plus staff time)	
5	*It will only need a day or so to successful promotion, at a cost of < EUR 1000.*
0	*We will need to support a patent for several years, buy in significant outside specialist help, and need say 1 day of staff member time per week for several years, adding up to a cost of >EUR 200k over the years*

3G - Added value	
5	*Investor involvement through the team's specialist capabilities is essential to get the idea to successful exit, and could not happen with only academic staff only*
0	*The ultimate value to Investor will not be affected in any way by our involvement as no patent protection is needed, and our business skills do not add anything*

4 Ukrainian University Case Studies

During 2011-2014 at Ivano-Frankivsk National Technical University of Oil and Gas we have collected more than 25 descriptions of the technologies developed by researchers. Only 10 of those reached more than indicative threshold of 50 pts – based on our experience we believe technologies with such rating worst for technology transfer office to consider working on them.
In order to demonstrate the capabilities of the proposed scoring system we describe the experience with 2 technologies.

Technology 1 deals with fast and low-cost determination of natural gas calorific value. In 2011 score of this technology reached 55 pts. During last years the team received several good publications, additional funding and completed field trails of the device, totally redesigned it and now score reached 72 pts in 2014. In general, technology is ready to be realized but legislative obstacles in Ukraine become the biggest barrier and authors are looking for a foreign partner.
Technology 2 deals with enhancement of oil recovery from matured fields. During 2011-2014 the research team completed only several publications and done very few attempts to improve the technology itself. In 2014 recent assessment of this technology resulted only in 62 points.

5 Conclusion

The proposed approach for assessment of commercialization potential of technologies has become a powerful tool for technology transfer office and researchers helping to assess in simple numbers whether the technology may be interesting for the market. Moreover, it showed capability to determine the aspects of technology which shall be improved for growth of commercialization potential.

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