Quantitative Model of Tacit Knowledge Estimation for Pharmaceutical Industry

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It is generally agreed that successful firms need to utilize all of their assets properly in order to gain a competitive advantage. However, little attention has been paid in business to proper utilization of tacit knowledge, a subset of intangible assets, because no specialized attempt has been made to quantify it. Once a value has been assigned to an asset, it is more easily utilized in the proper way. This paper analyzes the use of tacit knowledge in pharmaceutical industry, presents a graphical model of tacit knowledge, and finally presents and uses a simplified mathematical model that could be useful in quantifying tacit knowledge. The mathematical model was applied in the empirical study of multi-billion dollar acquisition of Genentech by Hoffman La-Roche AG. The model gives a good estimation of the value of the tacit knowledge contained in the firm, which is an important contribution to the field of finance. The quantification of tacit knowledge could be extremely beneficial for managers of pharmaceutical firms who have extremely high levels of tacit knowledge in the form of knowledge workers. By quantifying tacit knowledge, managers can get a better understanding of the real value of their firm or of the value of a firm that may be a target for acquisition.

Keywords: *tacit knowledge, implicit learning, practical intelligence, practical experience, subconscious knowledge, know-how, finance, intangible assets, pharmaceutical industry, biotechnology.*

Introduction

A critical challenge for the most firms regardless of their age, size or industry is how to achieve and sustain a competitive advantage (Ndlela *et al.*, 2000). These entities are supposed to utilize all kept assets – material and non material alike. Nowadays, non material assets play a crucial role in business activity (Sung *et al.*, 2000). Since utilization of material assets has been studied extensively over the last one hundred years and is explicitly taught in business education, nearly all successful firms correctly utilize their material assets. The fundamental asset that may or may not be properly utilized is knowledge; especially tacit knowledge (Mohan & Venkatraman., 2001; Alavi & Leidner, 2001; Brockman & Anthony, 1998).

This is of key importance in pharmaceutical and biotechnology sector, where tacit knowledge of scientific personnel is fundamental to the survival of the firm. The reason for a specific focus on the biomedical sector is due in main part to its complete dependence on continual high cost R&D operations (with typical expenditures of several billion dollars per year), and the exceptionally competitive nature of the industry. For example, the information technology industry could use this model as well, but it may not be as crucial to the survival of a firm as in the biomedical sector, but it still may be useful. Since the business of developing innovative medical compounds, equipment and techniques relies on scientific research, these firms have an uncommonly high number of personnel who have doctorates, medical degrees, and even professorships at research universities (Zucker *et al.*, 2002). This sort of expertise comes at a price, with the research and development budgets of the major pharmaceutical companies exceeding several billion dollars per year. Much of that money is used to retain key personnel, who have a high degree of knowledge (Congressional Budget Office, 2006). This knowledge can be separated into explicit knowledge or tacit knowledge. While explicit knowledge can be easily transferred consciously, tacit knowledge cannot be transferred easily due to its nature of being a more subconscious form of knowledge (Nonaka, 1991, 1994).

Tacit knowledge is a relatively new concept. It is also called practical intelligence, and acquiring tacit knowledge is often referred to as implicit learning or non-formal learning (Sternberg, 1996; Sternberg *et al.*, 1993; Polanyi 1964, 1966). Tacit knowledge is best described colloquially as "know-how" (Sternberg *et al.*, 2000). The original concept of tacit knowledge was alluded to in 1904 by Spearman who noticed that people who had a high general factor for intelligence (g-factor) could acquire tacit knowledge more easily, (Spearman, 1904). Unfortunately, it wasn't until 1966 that Michael Polanyi published a more comprehensive theoretical framework describing tacit knowledge. Tacit knowledge can be distinguished from explicit knowledge in three major areas. Firstly, tacit knowledge is intuitive and unarticulated knowledge that cannot be communicated to someone else directly.

Secondly, tacit knowledge can only be acquired through practical experience and, thirdly, tacit knowledge cannot be aggregated and stored in the same way as explicit knowledge (Polanyi, 1964, 1966; Kogut & Zander, 1993). For example, the explicit knowledge of how to manufacture a new pharmaceutical compound may be written up in a protocol and stored on a computer hard drive. However, only a trained chemist with the proper years of experience would be able to create that protocol or use that protocol to manufacture the drug. The protocol cannot give the knowledge of how to use the described techniques or the laboratory equipment in the proper way.

The majority of work on tacit knowledge has been done in the field of psychology. The main focus of the psychological approach is to define further tacit knowledge (Eraut, 2000; Gertler , 2003). From the business perspective, work on tacit knowledge has been focused on how firms use tacit knowledge to gain a competitive advantage or how managers use tacit knowledge in their decision making processes. For example, Spender analyzed three different strategic ways to use tacit knowledge to gain a competitive advantage (Spender, 1993), while Shawn Berman and his colleagues went so far as to use basketball teams from the National Basketball Association and use them as a surrogate for firms in the competitive business environment. They then analyzed the performance of various teams, and correlated the team performance with their level of shared experience in order to find what "often lies at the core of sustainable competitive advantage" (Berman *et al.*, 2002). How managers use tacit knowledge in strategic decision making has been examined from the perspective of the amount of industry specific experience they have (Brockmann & Simmonds, 1997), as well as the speed and usefulness of managerial decisions (Isenberg, 1984, 1986; Gioia & Ford, 1986; Bourgeois & Eisenhardt, 1988; Judge & Miller, 1991).

There are very few articles pertaining to tacit knowledge in the field of business finance at all. There has been work done to quantify intangible assets, but there has been no attempt at trying to quantify or measure tacit knowledge; which is a subset of intangible assets and goodwill. Richard Hall identified tacit knowledge as "know-how" and listed it as one of nine types of intangible resources. This "know-how" or competency was consistently ranked as the third most important type of intangible asset by managers across all fields of business interest (Hall, 1993). Most papers written to date seem to acknowledge the great importance of tacit knowledge (Wagner & Sternberg, 1985, 1987; Wagner, 1987; Sternberg, 1997, 2002; Hsieh *et al.*, 2007), but no one has attempted to measure tacit knowledge. The purpose of this research is to present a quantifiable model of tacit knowledge. With a quantifiable model, managers will be able to utilize more properly all of their resources, and academic researchers will be able to make more accurate models of utility theory. If tacit knowledge can be quantified, than further research can show how it might be optimized. Optimizing the utilization of assets is a key tenet of economic research, whether they are tangible assets like plant, property and equipment, or a subset of intangible assets such as tacit knowledge.

The aim of this study is to present a model of tacit knowledge that may be quantified in order to provide managers with a tool to estimate better the value of a firm with high tacit knowledge. It was expected that a model could be developed that could estimate better the value of tacit knowledge. This paper has three main tasks. The first task is to point out the importance of tacit knowledge. The second is to elaborate a model − a triangle showing the interaction of efficiency, capital and tacit knowledge. The third is to make a first attempt at defining a simple mathematical model in order to quantify tacit knowledge.

Importance of Tacit Knowledge in Biomedical Sector

Pharmaceutical firms frequently rely on partnerships with biotechnology firms as a primary source for scientific discoveries crucial for the development of new drugs. Because of their lack of focus on the basic scientific research, it is often difficult for managers of pharmaceutical firms to gain a tactical understanding of this type of research. Conversely, the exclusive focus on research by biotech firms enables their managers to have a deeper tacit understanding of specific types of basic scientific research. Difficulty in effective transfer of the knowledge regarding scientific discoveries made by biotech firms to pharmaceutical firms is due in large part to the contrast in scientific paradigms emphasized by each type of firm. The potential benefits associated with a successful alliance between biotech and pharmaceutical firms are substantial. Drugs produced by pharma-biotech alliances are 30 % more likely to succeed in winning Food and Drug Administration (FDA) approval than those developed by a single company. In addition, nearly a third of new pharmaceutical products are now developed through alliances, compared to only 7 % a decade ago (Hess & Evangelista, 2003). In addition, the largest pharma-biotech deals have steadily increased in size in recent years, from SmithKline Beecham's $125 million deal with Human Genome Sciences in 1993 to the $1.3 billion collaboration between Bayer and CuraGen in 2001 (Hess & Evangelista, 2003). Porter argued that industry improves and sustains its competitiveness via every well-organized activity and infrastructure in the value system. Every element in the knowledge cluster plays a particular role and creates specific value to it (Porter, 1996).

There has also been a similar arrangement developing between the pharmaceutical industry and research universities. The main benefit of collaboration with major research universities is the amount of tacit knowledge in basic scientific research. Pharmaceutical and biotech firms can gain a competitive advantage by using a basic scientific concept developed at the university level, and then to develop that concept into a marketable product. The firms often employ what are called "star scientists" (scientists who have written highly influential papers) at a high salary in order to obtain the tacit knowledge of that star scientist (Zucker *et al.*, 2002). Studies have shown that 90 % of the top ten biotech firms had a research scientist from one of the top 112 research universities listed on the prospectus of their Initial Public Offering (IPO) or were listed as a core collaborator. The same study also shows

that firms with 10 or more collaborative articles between the firms' scientists and scientists at research universities had significantly more patents, products in development and more products in marketplace (Zucker *et al.*, 2002). Therefore, these firms are gaining a measurable competitive advantage by tapping into the tacit knowledge held by scientists at research universities. Lately, there has been a spate of large pharmaceutical companies buying very large biotechnology companies. For example, Genentech was the world's largest biotechnology company and is considered the founder of the entire biotechnology industry, but they were purchased in their entirety by F. Hoffmann-La Roche AG on March 26, 2009 for approximately $46,8 billion (GenNews, 2008). The main factor in making this purchase was to incorporate the tacit knowledge of Genentech into Hoffmann-La Roche AG.

Quantifiable Model of Tacit Knowledge

Now that the importance of tacit knowledge has been established, it must be modeled and quantified. The purchase of Genentech for $46.8 billion effectively transferred the physical capital such as plant, property and equipment to Hoffman-La Roche, but the real value for Hoffman-La Roche was in the non-material assets and especially in the tacit knowledge. Unfortunately, it cannot be said that this particular purchase was a good deal or a bad deal for Hoffman-La Roche quantitatively, because there is no model of quantifying the value of tacit knowledge. It would be very useful to be able to put a value on tacit knowledge in the same way a concrete value is assigned to tangible assets such as machinery, for example.

Model of efficiency combining financial results, capital and tacit knowledge
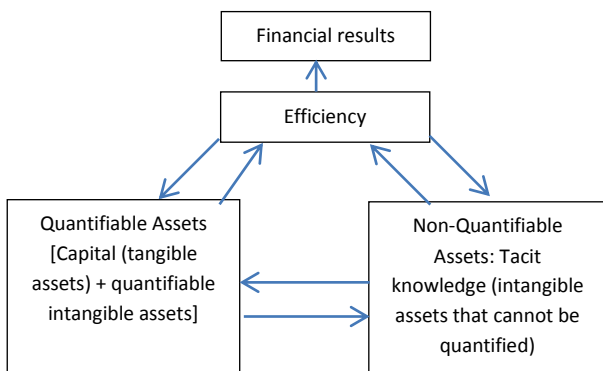
Figure 1. Triangular model of efficiency. Efficient organization must utilize all its assets both quantifiable and non-quantifiable in order to be efficient.
*Source: own data*

Generally, there are two factors fostering efficiency at pharmaceutical companies – quantifiable assets and non-quantifiable assets. Capital plus intangible assets that can be assigned a value on the one hand, and tacit knowledge (intangible assets that cannot be assigned a value) on the other hand. Capital itself includes all material assets existing at the company. Quantifiable intangible assets

include explicit knowledge such as patents and technology, as well as secret knowledge, brand names, trademarks, etc. All of these assets can be assigned either a precise or a rough value. This leaves non-quantifiable intangible assets as tacit knowledge. It is a subset of all assets of knowledge (explicit knowledge, secret knowledge, etc.). However, with these other forms of knowledge, it is possible to at least approximate their value, but with tacit knowledge no value can be assigned.

Tacit knowledge is knowledge of how to do something. So, the knowledge of how to market effectively a new pharmaceutical, or the knowledge of how to market effectively the brand image of the company is included as tacit knowledge, but the actual brand name or name of a particular drug would not be tacit knowledge because it is already something measurable. For the pharmaceutical industry, tacit knowledge as an asset is mainly stored in the "know-how" of the scientific staff to manufacture new and useful drugs, in the marketing staff who use their know-how of market forces and the business sector to bring those new drugs to the market place, and in the management staff who use their organizational and managerial skills to keep the company not only profitable, but at the cutting edge. Since pharmaceutical industry is so competitive in recent years, a company who falls behind is very likely to be taken over by one of its rivals. Therefore, proper management of tacit knowledge is a key for the survival of pharmaceutical firm.

The balance sheet does show both Goodwill and Intangible Assets. However, it would be a mistake to believe that tacit knowledge is simply the addition of these two balance sheet items. Tacit knowledge includes a part of goodwill, but not all, as well as a part of intangible assets, but not all. Tacit knowledge includes the chance that know-how of one of the knowledge workers will pay off in a top-selling product, which is a part of intangible assets. However, intangible assets such as licensing fees would not be considered tacit knowledge. Tacit knowledge includes the ability of marketing and management staff to increase the value of the company's image, but does not include the value of the brand image. Both of those would be included in Goodwill on the balance sheet. There may also be a value in tacit knowledge that is not currently recorded on the balance sheet because it has been overlooked in generally accepted accounting practices.

Model of tacit knowledge taken from the balance sheet
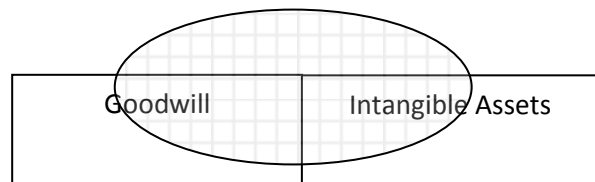
Figure 2. Shaded area represents tacit knowledge. Tacit knowledge is included on the balance sheet of publicly traded companies, but only indirectly as a subset of both Goodwill and Intangible Assets. There may also be a value in tacit knowledge that is not currently recorded on the balance sheet that is not reflected in accounting
Source: own data

Mathematical Model of Tacit Knowledge

Since graphical models have been presented, the next step is to define tacit knowledge mathematically. Figure 2 shows tacit knowledge as being a part of both Goodwill and Intangible Assets; therefore, one would expect that tacit knowledge cannot exceed the sum of Goodwill plus Intangible Assets as shown in equation one.

1) Tacit knowledge < Goodwill + Intangible Assets;

However, it is quite likely that calculated tacit knowledge will exceed the sum of Goodwill and intangible assets since there is a value inherit in tacit knowledge that is not quantified and listed on the balance sheet. This is described in equation 2.

2) Tacit knowledge < Goodwill + Intangible Assets + Undefined Value;

Figure 1 shows that efficiency is equal to quantifiable plus non-quantifiable assets as shown in equation three.

3) Efficiency = quantifiable assets + non-quantifiable assets;

Equation three makes sense because any firm is a combination of assets, and "know-how" of how to use those assets. It is the "know-how" that causes difficulty in measurement. If quantifiable assets are divided into capital plus quantifiable intangible assets we will have equation four.

4) Efficiency = Capital + quantifiable intangible assets + non-quantifiable assets;

If operating income is allowed to be a proxy for efficiency, property, plant and equipment to be a proxy for capital and we remember that non-quantifiable assets are tacit knowledge by definition we will have equation five.

5) Operating Income = PPE + quantifiable intangible assets + Tacit Knowledge;

After rearranging, there is equation six, a mathematical model for obtaining the value of tacit knowledge.

6) Tacit Knowledge = PPE + quantifiable intangible assets - Operating Income.

Case Study

As mentioned previously in the mathematical section, tacit knowledge may exceed Goodwill and Intangible Assets due to the fact that there is no concept found in accounting for listing tacit knowledge on the balance sheet. Therefore tacit knowledge may be seriously underestimated. This is why managers at Hoffmann-La Roche AG felt that it was worthwhile to spend an additional $46,8 billion to close the acquisition of Genentech in 2008, even though the outlay of such an expenditure could never be justified based upon data from the balance sheet and income statement alone. Unfortunately for the management of Hoffmann-La Roche AG, they were forced to guess the potential value of Genentech, because they did not have a formula to ascertain the value of the tacit knowledge that they were trying to attain. It should be possible for managers of a pharmaceutical firm who are trying to value a potential candidate for merger to use equation six and get a reasonable estimate of the value of the tacit knowledge of a firm for a given year. Then the management could use

that value to extrapolate ten years or so into the future (adjusting for present value), sum those values together and have a clearer picture of what they should offer above and beyond what is indicated by the financial statements.

In regards to the acquisition of Genentech, equation 6 can be used. From the Genentech financial statements of 2008 (all numbers are in billions):

operating income = 5431;

Plant, property & equipment = 5404;

Quantifiable intangible assets = goodwill + other intangible assets = 1590 + 1008 = 2598.

Putting these numbers into equation 6 gives:

TK = PPE + QIA − Operating income = PPE + goodwill + other intangible assets − operating income;

TK = 5404 + (1590 + 1008) − 5431 = 2571 This is the approximate value of tacit knowledge in 2008.

Since tacit knowledge does not depreciate, it is possible to discount this value for the next ten years using the standard formula for present value and the interest rate of the one-year treasury bond; which was approximately 2,5 % in 2008. The values can then be summed. In this example:

$$PV = \sum_{n=0}^{n=10} \frac{C}{(1+i)^n} = \sum_{n=0}^{n=10} \frac{2571}{(1+.025)^n} = 25070$$

Therefore, the value of the tacit knowledge over 10 years discounted at 2,5 % is $25,070 billion. Hoffman La-Roche AG also purchased the total assets of Genentech as well. So as not to count tacit knowledge twice, the tacit knowledge for 2008 is subtracted from the total assets for 2008. This number is then added to the cumulative 10 year tacit knowledge to give an estimation of the value for Genentech. In this example:

(2008) Total assets − (2008) tacit knowledge = 21787 − 2571 = 19216 (quantifiable assets)

Quantifiable assets + 10-year cumulative Tacit knowledge = 19216 + 25070 = 44,286 (2008 Genentech value).

In financial year 2008, Hoffman La-Roche completed their purchase of Genentech by spending $46.8 billion to finalize the acquisition. Hoffman La-Roche managers had originally offered $43,7 billion, but settled the deal at $46,8 billion. The $43,7 billion value arrived at by management of Hoffman La-Roche is about 1,4% less than the calculated value of Genentech. Since highly experienced managers have good intuition about the value of the firm they are bidding for, it is not surprising that the calculated estimations are in line with the real world offer that was made (Genentech, 2008; GenNews, 2008). By these calculations, the original offer of $43,7 billion was a reasonable offer for the acquisition of Genentech. However, the purchase of Genentech for $46,8 billion was 5,6 % higher than the value of the firm. Therefore, Hoffman La-Roche may have overpaid in this acquisition.

Discussion

In the case study above, the discounting of tacit knowledge for 10 years may seem arbitrary, but 5 years seems too short, while 15 years seems too long. The number of years should be decided upon by managers who would need to tailor the formula to their specific situation.

A similar tailoring of the interest rate could be achieved by the management as well. Using the one-year treasury bill as the basis for an interest rate is quite conservative. If managers feel that another project might bring them a higher yield, they could substitute that rate instead. Furthermore, this formula works as estimation due to the fact that goodwill and intangible assets are used as a proxy for quantifiable intangible assets. A small amount of tacit knowledge is already accounted for in those two balance sheet entries. If managers have more details about the make-up of goodwill and intangible assets, they may be able to separate the quantifiable from the non-quantifiable intangible assets and make the above calculations more precise.

One of the simplifications used in this article is the exclusion of income brought in by the financial operations of a firm. Mainly, income from investments can be easily calculated and reported on the financial statements, but there is a certain amount of tacit knowledge involved in the "know-how" of the chief financial officer and his staff of how to invest properly the assets of the firm. This portion of tacit knowledge was excluded in this analysis for the sake of simplifying the model and making it more clear, but it should be taken into consideration. Due to this simplification, calculated tacit knowledge may be slightly lower than it is in reality, depending on the amount of investment done by a firm.

The use of operating income as a proxy for efficiency was done to keep efficiency tied as close as possible to revenue. Since efficiency is a measure of how well a firm uses its resources, revenue alone was not used since it does not account for the resources used in attaining the revenue. Therefore, moving down the income statement, gross profit would perhaps be the next logical proxy, but gross profit does not take into account the expenditures laid out for operating expenses such as research and development and marketing expenses. Therefore, the next logical proxy would be operating income (or loss) which works well because it does not count R&D and marketing expenses used to generate income; yet it is not influenced by accounting for other forms of income, interest, or taxes. The use of operating income as a proxy for efficiency works best since it does not include the expenses used in generating revenue, yet it is not influenced by standard accounting practices. For instance, using net income as a proxy may give a false impression since net income includes interest, taxes, extraordinary items and the like. The use of Property Plant and Equipment as a proxy for capital is reasonable since the main aim is to evaluate the quantifiable tangible assets. This proxy excludes things such as long term investments or other financial assets, which could be listed as quantifiable intangible assets.

It is far more difficult to evaluate quantifiable intangible assets. Since quantifiable and non-quantifiable intangible assets are not listed separately on balance sheets, but are instead mainly grouped as goodwill and intangible assets, it is at the discretion of the firm or academic researcher with more information to value intangible assets such as the value of the brand or trademark, or value of confidential information for instance. However, for those who have access to the value of the quantifiable intangible assets of a particular firm, the equations and models presented in this article will be of great benefit when attempting to ascertain the value of tacit knowledge found in any particular company.

Conclusions

Since no other effort to quantify the subset of intangible assets known as tacit knowledge has been attempted, this work contributes to the literature by beginning to fill this gap. Therefore, it is prudent to offer first a simple model that can be further developed. In attempting to quantify tacit knowledge we may have somewhat oversimplified the model. However, it is necessary to begin with a simple model and build on that model later. The main purpose of quantifying tacit knowledge is to provide managers with a better way of evaluating the tacit knowledge within a firm so that they may better utilize that very important asset. The more efficient utilization of assets will in turn lead to a better operating efficiency and increased financial results. Furthermore, if academic researchers are able to quantify tacit knowledge better, they will be able to make more accurate models of subjects such as utility theory, for instance. This article has demonstrated the importance of tacit knowledge, provided the graphical model of tacit knowledge and gave an attempt at a mathematical model for quantifying tacit knowledge.

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Kiekybinis numanomų žinių vertinimo modelis farmacijos pramonėje

Santrauka

Pagrindinė problema, kuri keliama šiame straipsnyje yra tai, kad niekada anksčiau nebuvo bandoma išmatuoti ar kitaip išreikšti skaičiais *numanomas žinias*. *Numanomos žinios* yra „mokslinė/techninė informacija" apie tai, kaip praktiškai atlikti užduotį. Jos labai skiriasi nuo tokių žinių, kurios gali būti pateiktos raštu vadovėliuose, žurnalų straipsniuose ar protokoluose. *Numanomos žinios* paprastai „*neišreikštos žodžiais žinios"*. Jos gali būti perteiktos tik per praktinę patirtį. Farmacinių kompanijų (kaip ir daugelio kitų, technologijomis grįstų kompanijų), didžiausia vertybė yra aukštos kvalifikacijos personalo *numanomos žinios*. Vadovai gali tik numatyti, kokius praktinius gebėjimus darbuotojai turi. Pavyzdžiui, įmonių susijungimo ar įsigijimo atveju, abi derybų šalys gali tik spėlioti, kokia yra tikroji nagrinėjamos įmonės (įmonių) vertė, nes nėra būdo kaip apskaičiuoti kompanijos *numanomų žinių* vertę. Įmonių *numanomų žinių* įvertinimo ir išreiškimo skaičiais tikslas yra padėti vadovams nustatyti šio svarbaus turto vertę, o tada geriau jį panaudoti, nes efektyvus turto panaudojimas gerokai padidins finansinius rezultatus.

Numanomos žinios yra iš dalies nauja tyrinėjimo sritis. Dauguma psichologijos temomis rašytų straipsnių dažniausiai siekia nustatyti, kas yra *numanomos žinios*. Verslo straipsniuose pagrindinis dėmesys sutelkiamas į tai, kaip *numanomos žinios* yra panaudojamos siekiant įgyti konkurencinį pranašumą arba vadovams priimant sprendimus. Nei vienas tyrėjų nebandė *numanomų žinių* įvertinti ir išreikšti skaičiais, todėl šiame straipsnyje pateikiamas išeities taškas tolesniems tyrimams. Šiame straipsnyje keliami trys uždaviniai. Pirma – parodyti *numanomų žinių svarbą*. Antra – išplėtoti modelį-trikampį, rodantį efektyvumo, kapitalo ir *numanomų žinių* tarpusavio sąveiką. Trečia – atlikti pirmąjį bandymą siekiant apibrėžti paprastą matematinį modelį bei įvertinti ir išreikšti skaičiais *numanomas žinias*.

Norėdamos įgyti konkurencinį pranašumą, farmacijos kompanijos didina savo *numanomas žinias* bendradarbiaudamos su biotechnologijos kompanijomis, jas įsigydamos, arba bendradarbiaudamos su tyrimų universitetais. Pastaruoju metu įvyko daug susijungimų ir įsigijimų, kai labai dideli farmacijos koncernai nupirko labai dideles biotechnologijų kompanijas, o sandorių sumos siekė multi-milijardus dolerių. Devyniasdešimt proc. geriausių sektoriaus įmonių bendradarbiauja su geriausiais universitetais taip statistiškai didindamos patentų bei gaminių rinkoje kiekį. Perkančios įmonės moka milijardus dolerių už *numanomas žinias*, nes jos yra stambių įmonių įsigijimo tikslas. Todėl, remiantis *naudingumo teorija*, galima teigti, kad *numanomų žinių* vertė yra labai svarbi. Antroje tyrimo dalyje parodoma, kaip efektyvumas, kapitalas ir *numanomos žinios* sąveikauja tarpusavy. Galima teigti, kad efektyvumas yra tinkamas panaudojant visą materialų ir nematerialų turtą. Materialusis turtas yra kapitalas. Nematerialusis turtas toliau yra dalinamas į kiekybiškai nustatomą turtą ir turtą, kurio kiekybiškai įvertinti negalima. Kapitalas ir kiekybiškai įvertinamas nematerialusis turtas gali būti pateikti kartu, tačiau prieš tai paliekant kiekybiškai neįvertinamą nematerialų turtą, t. y. *numanomas žinias*. Geranoriškumas ir nematerialusis turtas yra įvardinami visų farmacijos pramonės kompanijų balanso lentelėse. Šiuo straipsniu siekiama, kad numanomos žinios taptų tų dviejų, balanso lentelės punktų, poaibiu. Tačiau panašu, kad egzistuoja *numanomų žinių* nenustatyta pridėtinė vertė, kuri nėra apskaičiuota. Finansinio turto pajamos buvo išbrauktos siekiant paprastumo. Trečioje tyrimo dalyje siūlomas elementarus matematinis modelis, kuris, kaip mes tikimės, gali būti toliau plėtojamas tolesniuose tyrimuose. Kokybiškai neįvertinamas nematerialusis turtas yra įmonės *numanomos žinios* einamais metais. Jei einamosios pajamos susijusios su efektyvumu, o nuosavybė, gamykla ir įranga susijusi su kapitalu, tai kiekybiškai ir kokybiškai neįvertinamą nematerialųjį turtą (*numanomas žinias*) įmanoma izoliuoti. Tada reikia tiesiog pakeisti formulę ir gauti bent jau apytiksliai *numanomų žinių* vertę. Matematinis modelis yra gana nesudėtingas bandant supaprastinti mąstymo procesą, todėl tikimasi, kad tolesniuose tyrimuose bus remiamasi pirmuoju bandymu, kuriuo siekiama įvertinti ir išreikšti skaičiais *numanomas žinias*.

Raktažodžiai*: numanomos žinios, numanomas mokymasis, praktinė informacija, praktinė patirtis, pasąmonės žinios, mokslinė/techninė informacija, finansai, nematerialusis turtas, farmacijos pramonė, biotechnologija.*

The article has been reviewed.