

Customizing Conventional Patent-based Financial Instruments for Financing Nanotechnology Firms: An Iranian Perspective

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Abstract— This paper attempts to provide a theoretical contribution to the area of financing nanotechnology firms by customizing conventional patent-based financial instruments in a manner to be applicable in Iranian context. For this purpose we investigated the available financial instruments in Iran and found that even though the Iranian financial instruments mostly are traditional and in essence risk averse which do not welcome new risky ventures like nanotechnology projects, there are potentials to modify those instruments as customized patent-based instruments in a manner to be used in financing nanotechnology firms. Accordingly, three new mechanisms were introduced: Jo'aalah Secured by Patent (JSP), Installment Sales Secured by Patent (ISSP) and Patent-backed Ijara Sukuk (PBIS).

Keywords—Nanotechnology Financing; Patent; Patent-based Financial Instruments

I. INTRODUCTION

Nanotechnology is the study of materials in atomic scale in order to control them. The aim of most researches in nanotechnology is to create new composition of materials or making changes in the composition of existing materials [13]. Nanotechnology have extensive applications in various sectors and indeed its applications cover a broader range of areas such as electronics, biology, genetics, aeronautics, etc. wide-ranging applications and rapid developments and advances of nanotechnology have created attractive opportunities for businesses to exploit them. One of the most significant issues in exploitation of new technologies including nanotechnology is the method of commercializing them and without doubt among the key success factors in technology commercializing process, financing is the most important one.

Since nanotechnology is an emerging technology and embraces high level of uncertainty and blurriness in its businesses, the firms operating in this sector have difficulties in attracting external finances. Traditional financial systems do not provide adequate financing for nanotechnology firms as their cash flows is not certain as the cash flows of large and well-established firms [3]. Traditional debt capital providers which normally are banks and financial institutions are obscure for financing such firms and consequently there are few financing alternatives for nanotechnology firms which mostly are at start-up level and attributed to have high

risk in essence. Therefore, financing options for these firms are typically venture capital and private equity. But not all start-ups are able to attract these sources of finance and as a result, most of them are unable to continue their business and have to be closed up at early stage.

Nevertheless, along with these restrictions, these firms have valued intangible assets that represent the knowledge of their initiatives. These intangible assets are called Patent. Current researches in financing start-up firms have put remarkable concern on the roles that patents can play in facilitating fund raising for these firms. In line with these considerations, technology-based firms are increasingly exploiting their patents portfolios as a means of accessing external sources of financing [3]. This paper aims to provide contribution in this field and attempts to analyze the roles that patents can play in financing nanotechnology firms in Iran by customizing conventional patents-based financial instruments in a manner to be applicable in Iranian context. For this purpose, we investigated the available financial instruments for financing nanotechnology firms in Iran. We found that the Iranian financial instruments predominantly are traditional and in essence risk averse which do not welcome new risky ventures. Nevertheless, we understood that there are potentials to customize the current financial instruments in a manner to be used in financing nanotechnology firms. For this purpose, we focused on patent-based financing instruments to launch modified versions of this kind of instruments that are applicable in Iranian context. Accordingly, three new mechanisms were introduced as appropriate financial instruments to finance the nanotechnology firms: Jo'aalah Secured by Patent (JSP), Installment Sales Secured by Patent (ISSP) and Patent-backed Ijara Sukuk (PBIS). The main concern of this paper is to introduce these mechanisms. We will also address some probable challenges in applying these instruments.

II. CONVENTIONAL PATENT-BASED FINANCIAL INSTRUMENTS

Patent-based financial instruments which relatively are new instruments have been established through different financial vehicles from commercial banks to specialized financial operators [14]. These instruments are not standardized but there exist three relatively well-defined types of them. These instruments are: Patent loan, Patent sale and lease back, and Patent-backed securitization [7].

A Patent Loan (PL) is a bank loan using patent as collateral and the amount of the loan depends on patent quality, main risk factors, and owner credit merit [7]. According to [7] a PL provides opportunity to raise debt capital and indeed it is the introduction of a new asset class for debt financing. PL can be used by both small and large, and well-established and start-up firms. It is more fit to technological firms like nanotechnology firms in which patents constitutes notable part of their assets. However, there are some drawbacks as mentioned by [5] and [7] connecting to usage of PLs. Using patents as collateral in loan transactions may carry higher monitoring costs and higher uncertainty for the quality of the collateral. Furthermore, patent valuation and collateral disposal in case of default is an open issue affecting the development of these financial solutions and can raise borrowing transaction costs.

Another Patent-based financial instrument is Patent Sale and Lease Back (PSLB). In this mechanism patents are used as underlying asset. In a typical PSLB, a specialized institution as lessor purchases a single or a pool of patents from a firm as lessee. The latter, subsequently, lessee lease patents back from the lessor and obtains all rights to use them in its business activities paying some interests [7]. In PSLB the lessor typically, holds the ownership of the patents until the end of the lease agreement. In this case the parties of deal may agree on a defined nominal value for repurchasing the patents by lessee. Basically, PSLB is relatively simple method and remarkably can enhance the firm's liquidity through assets sale allowing the firm to use patents in its everyday business [3]. However, according to [7] there are some limitations in relation to this financial instrument. Lack of a standard and universal patent valuation procedure which is critical to determine transaction security, likelihood of lessee default, possibility of infringement and the selection of patents for lease inclusion are the challenges addressed by [7]

The latest category of patent-based financial instruments is Patent-based Securitization (PBS). Practically, securitization is the process of pooling of different financial assets and issuing of new securities backed by those assets which can be any kind of assets that have reasonably predictable cash flows [9]. In a patent-backed securitization the underlying pooled assets are patents that possess projectable cash flows. In this case the cash flows will be generated from licensing agreements or contingent payment rights. Since this kind of patent-based financial instruments is very important in financing nanotechnology firms, we will explain it in more details later in section IV.

So far we briefly introduced three main types of patent-based financial instruments. Now we want to give details that how can we customize these instruments in a manner to be applicable to Iranian financial system. But before that we need to have an overview of Iranian financial system and instruments.

III. AN OVERVIEW OF IRANIAN FINANCIAL INSTRUMENTS

There exist some similarities and differences between Iranian financial system and the financial system of other countries, especially developed countries. The basic

differences have been resulted from the nature and structure of Iranian financial system [2]. After the Islamic revolution of 1979 in Iran, the Iranian banking system was nationalized and afterward in 1983, the Law of Usury-Free Banking (LUFB) was passed, and accordingly the banks started to put Islamic banking (Interest-free banking) into practice on March 21, 1984 [1]. In line with the new scheme of Iranian financial system, the nature of financial contracts was changed in a manner that all fixed income financial instruments (such as bonds and preferred stock) were dismissed from the financial system. Nonetheless, likewise other countries financial instruments in Iran are categorized into two categories: equity instruments and debt instruments.

Currently in Iran, common stock, venture capital and private equity are used as main equity financial instruments. The process of financing by issuing common stock in Iran has not basic differences with the conventional system which is practiced in western countries [2]. But unfortunately owing to the lack of appropriate basis and infrastructures, the industry of venture capital and private equity has been not developed sufficiently in Iran yet. However, there is limited number of institutions that provide financial facilities for high-tech and small and medium size enterprises [10].

The debt financial instruments in Iran mainly include Participation Securities (PS), Banks Financial Facilities (BFF) and Sukuk contracts. PSs which basically are interest-free bonds are issued by high-rated public companies, municipalities and banks. These securities have been replaced with conventional bond. BFFs include 13 Iranian banking contracts: Qard-al-Hasaneh Grant, Modarabah, Civil Partnership, Equity Partnership, Direct Investment, Installments Sales, Hire Purchase, Forward Deals, Jo'aalah, Mozara'ah, Mosa'ghaat, Debt Purchase and Guarantees. Sukuk contracts are Islamic version of securitization deals. Recently, the Iranian central bank has been willing to launch some kinds of sukuk in Iranian financial system. These sukuks are Ijarah, Istisna'a and Murabaha

This paper does not cover the explanation of detailed features of all of these financial instruments, since it requires focusing on the issues which may deviate us from the main concern of the paper¹. But it is necessary to mention that as we investigated the various accepts and features of these instruments; "jo'aalah", "installments sales" and "Ijarah sukuk" have more potential to be used as patent-based instruments after customization. So in the next section we will focus on these instruments.

IV. CUSTOMIZING PATENT-BASED FINANCIAL INSTRUMENTS

As mentioned earlier, we investigated the various accepts and features of the Iranian financial instruments and found that jo'aalah, Installments Sales and Ijarah Sukuk have more potential to be used as patent-based instruments. Basically, Jo'aalah is a service contract according to which one party (Ja'el) purchases another party's (Amel or contractor) services for a specified commission (Jo'al). The bank may

1 - for more information about the Iranian banking contracts see [1]

function as either Ja'el or Amel depending on the situation and the need of the customer [8]. Iranian bank normally acts as contractor (Amel) in providing required financial facilities for companies and receive profit (as Jo'al) for them. In this case bank will require a guaranty or collateral to secure the repayment of financial facilities. Installment sales constitute another type of service that a bank can provide its customers in Iran. On an installment basis, a bank can buy and resell tools, raw materials, machinery, houses, or any business inventory, thus earning a profit. The sale price of goods sold on an installment basis will be based on a cost-plus scheme [8]. In this case also the bank will demand a guaranty or collateral to secure the repayment of financial facilities.

These two types of Iranian banking contracts can be used as methods for utilizing the value of patent in financing nanotechnology firm in which the firms' patents are being used as collateral. When the jo'aalah and installments sales contracts are secured by patents as collaterals we call them "Jo'aalah Secured by Patent (JSP)" and "Installment Sales Secured by patent (ISSP)" respectively. Indeed these methods are the customized version of conventional PLs. Using JSP and ISSP nanotechnology firms operating in Iran can access to debt capital for financing their projects and obtain tools, raw materials, machinery and other required equipments.

Theoretically JSP and ISSP are simple methods that easily can be understood. But practically the firms may face with a limitation in applying them. This limitation is derived from the fact that the Iranian banks have not established a proper procedure and mechanism to use patents as collateral yet. So as first step it is necessary to define and establish a suitable procedure for making use of patents as collaterals.

The other customized financial instrument we will propose here is related to securitization. This instrument is more important and applicable for financing nanotechnology firm. So we will focus on it in more details. As mentioned previously, the most recent category of patent-based financial instruments in conventional finance is Patent-backed Securitization (PBS). Fundamentally, securitization is process by which (relatively) homogeneous, but illiquid, assets are pooled and repackaged, with security interests representing claims to the incoming cash flows and other economic benefits generated by the loan pool sold as securities to third-party investors [16]. Basically, underlying assets can be any kind of assets which possesses projectable cash flows [9]. Therefore, securitization can be applied for patents and since these kinds of assets are expected to generate royalty payments in future, thus in conventional finance, the implication of securitization for patents will be a model in which the patents will be used as underlying assets and the cash flows will be generated from licensing agreements or contingent payment rights. Furthermore, it is also possible to construct securitization on future cash flows deriving from a future revenues share associated to the commercialization of products protected by the patent [7]. The basic model of PBS process has been presented in Fig.1.

At a simple case some parties are engaged in the process of PBS: originator, SPV, investors, license users, credit enhancer, liquidity enhancer and trustee. PBS process starts from an originator who owns a single or portfolio of patents

with reasonably foreseeable cash flow. Then, the originator in the course of its business to a bankruptcy-remote sells the patents or the cash flow rights to an entity so called Special Purpose Vehicle (SPV). SPV which legally is a separated entity designs securities to be sold according to historical performance of patents and, finally, it issues securities and sales in either in the form of private placement or public offering in the capital markets. The securities are backed by the income streams of patents. During the securitization term, payments including cash-in and cash-out flows are collected by a servicing entity so called Trustee. The payments from the income of patents are collected by trustee and then disbursed to security-holders in payment of the securities. Typically other subjects are involved in a securitization: the transaction arranger, the rating agency for credit merit assignment, the placement agent to sell the security and other actors providing external credit enhancement [7].

PBS provides considerable benefits for both patent-holders (originators) and investors including: limited credit exposure, improved capital structure and credit ratings (form patent-holders perspective) and greater diversification in investment portfolio, direct participation in narrow technology niches or specific patents and investment in the patents rather than the business to get quicker liquidity (form investors perspective) [4].

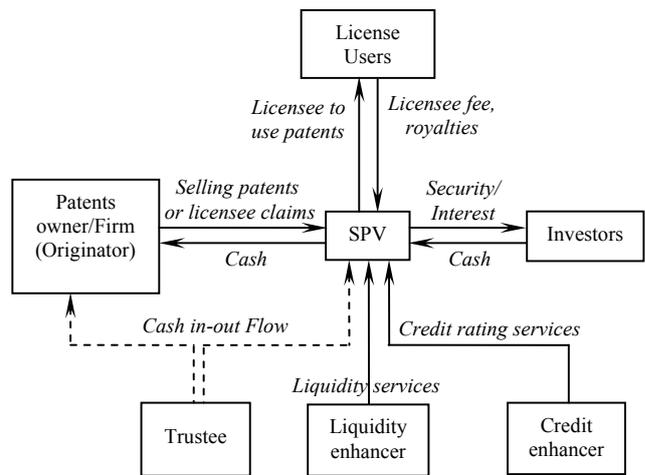


Figure 1. Basic model of PBS Adopted from [12]

Securitization as a transaction which is based on fixed income (interest) legally cannot be practiced in Iran. This is due to the especial features of Iranian financial system which mentioned earlier. Some of Islamic countries have introduced an alternative for securitization so called Sukuk [11]. In fact, sukuk is an Islamic version of securitization deals. Depending on the structure and subject of transactions sukuk has various kinds that the main versions includes: Muqaradah, Musharakah, Ijarah, Salam, Istisna'a, Murabaha [11]. Recently, the Iranian central bank has been willing to launch some kinds of sukuk in Iranian financial system.

These sukuks are Ijarah, Istisna'a and Murabaha. Explaining the nature and applications of each kind of sukuk is not the topic we are going to provide in this paper. But we have to mention that according to our analysis and assessment only Ijarah can be adopted to use for financing nanotechnology firms based on patents.

In basic form Ijarah sukuks are securities representing ownership of well defined existing and known assets tied up to a lease contract, rental of which is the return payable to sukuk holders. Payment of ijarah rentals can be unrelated to the period of taking usufruct by the lessee. It can be made before beginning of the lease period, during the period or after the period as the parties may mutually decide [17]. The process of Ijarah sukuk starts with the owner of assets as originator. The originator sells assets to the SPV at an agreed pre-determined purchase price. The SPV raises financing by issuing sukuk certificates in an amount equal to the purchase price. This is passed on to the originator (as seller). A lease agreement is signed between SPV and the originator for a fixed period of time, where the originator leases back the assets as lessee. SPV receives periodic rentals from the originator. These are distributed among the investors i.e. the sukuk holders. At maturity, or on a dissolution event, the SPV sells the patents back to the seller at a predetermined value. That value should be equal to any amounts still owed under the terms of the Ijara sukuk [17].

Using patents, Ijarah sukuk can have implication to finance nanotechnology firms which we call that "Patent-backed Ijarah Sukuk (PBIS)". In PBIS the underlying asset will be patents. The process of PBIS starts with the owner of patents as originator. Therefore, nanotechnology firm who owns a single or portfolio of patents will act as originator in PBIS. The originator identifies portfolio of its patents and sells them to the SPV then the SPV issues PBIS certificates in an amount equal to the patents purchase price. SPV sales the PBIS certificates to investors in financial markets. The funds obtained from issuing certificates passed on to the originator (as seller). A lease agreement (here we call licensing agreement) also is signed between SPV and the originator for a fixed period of time, where the SPV provides license to originator as licensee to use patents. SPV receives periodic license fee from the originator. These are distributed among the investors i.e. the sukuk holders. At the end of agreement period, the SPV sells the patents back to the seller at a predetermined value. Likewise conventional securitization, during the Sukuk term, payments including cash-in and cash-out flows are collected by trustee. Other parties also can be involved in the process of issuing Ijarah Sukuk: the transaction arranger, the rating agency for credit merit assignment, the placement agent to sell the sukuk certificates and other actors providing external credit enhancement. The basic model of PBIS presented in Fig.2.

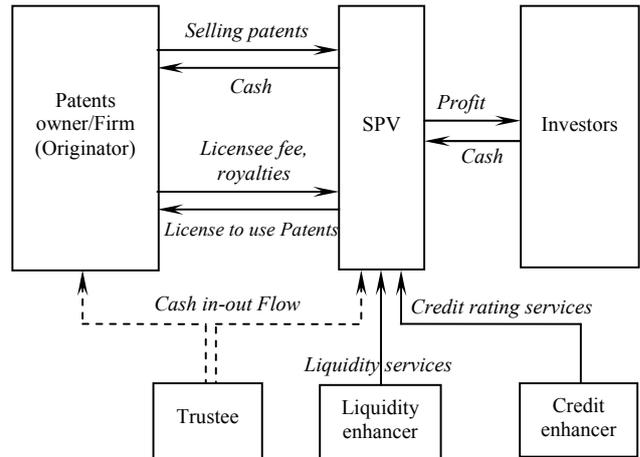


Figure 2. Basic model of PBIS

V. EPILOGUE AND CONCLUSION

Nanotechnology surprisingly has gravitated scientific and industrial societies towards itself in recent years. Iran also as a developing country has engaged actively in nanotechnology research and has a comprehensive national nanotechnology program. Despite this notable concern on nanotechnology researches, there have been little serious investigations on business and practical aspects of nanotechnology. The most important part of nanotechnology business is effective commercialization of initiatives, but the firms operating in nanotechnology industry normally face challenges in raising fund to commercialize their initiatives. The challenges are because of the fact that nanotechnology embraces high level of uncertainty and blurriness in its businesses. Furthermore, the firms operating in this industry mostly are small and medium-size firms or at start-up level and so attributed to have high level of business and market risk in essence. As a result, traditional financial systems do not provide adequate financing for nanotechnology firms and consequently there are few financing alternatives for them.

On contrary, along with this restriction, these firms have valued patents that represent the knowledge of their initiatives. If the patents are registered and protected, they are considered as valuable assets. The firms owning these patents can embed them in financing process in a way that they can break through the mentioned restriction and access to external fund for financing their operations. In this paper we explained some kind of conventional patent-based financial instruments by which nanotechnology firms can use them for fund raising. We tried to customize them in a manner to be applicable in Iranian financial system which is entirely interest-free and different from conventional system. For this reason, we looked into the available financial instruments in Iran. Accordingly we found that even though the Iranian financial instruments mostly are traditional and in essence risk averse which do not welcome new risky ventures like nanotechnology projects, there are potentials to modify those instruments as customized patent-based instruments in a manner to be used in financing

nanotechnology firms. As a result, we introduced three new mechanisms as appropriate financial instruments to finance the nanotechnology firms in Iran: Jo'aalah Secured by Patent (JSP), Installment Sales Secured by Patent (ISSP) and Patent-backed Ijara Sukuk (PBIS).

We acknowledge that however these instruments theoretically seem to be sedulous, but there may be some challenges and limitations in implementing them in real world. For example, most banks and financial institutions in developing countries like Iran have not established a proper procedure and mechanism to use patents as collateral yet. Indeed, banking systems in these countries are still ignoring intangible assets and patents in particular, when assessing companies' credit merit [6].

Another challenge with which patent-based finance is faced is relatively high cost of using these instruments. Since nanotechnology firms typically are small firms and at start-up level it does not make sense for these firms and they are not able to use patent-based deals with high costs. Lack of adequate legal framework to protect patents is another challenge for patent-based financing. Most jurisdictions still do not offer adequate legal means for financing intangible assets, including patents [15]. The other challenges is the little knowledge and understanding of borrowers and investors about patent protection and management [15]. In developing countries like Iran managers have little knowledge and information about auditing, valuing or commercializing patent based-technology. Hence investors and financiers are not able to grasp the value deriving from the borrowers' patent, and borrower firms lose the opportunity of using patents in financing their projects.

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