Evaluation of Organizational Intellectual Property Management Decision Structure using Organizational Risk Analyzer (ORA)

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Abstract-The optimal exploitation of intellectual property (IP) as a strategy requires effective IP management structure. Many organizations have developed and implemented Intellectual Property Management System (IPMS). However the issue remains the problem of evaluating the effectiveness of the organizations IP management mechanism. The evaluation enables the benchmarking of the performance of the organizations IP management structure and provides the basis and information for possible re-engineering of such management architecture. The simplicity of the balanced scorecard does not allow it to factor in the complex interaction that exists in the organization which impact on effective IP management. This paper proposes the Organizational Risk Analyzer for the evaluation of the performance of IP management structure. The ORA metrics (ORA measures) is presented to indicate how its evaluation enables the assessment of the efficiency of an organizations IP management decision structure.

KEYWORDS: IPM, decision structure, organization structure, ORA, decision structure evaluation.

I. INTRODUCTION

Within the context of the knowledge economy intellectual property has become an important measure of corporate value. The structure(s) and processes utilized for its management impact greatly on the ability of a firm to leverage on the enormous benefit of IP and effective IP management structure or organizational design is vital to advance to and support the higher and more sophisticated level of IP strategy with reference to the pyramid of IP management. Structural adaptation can be objectively made if an organization can properly evaluate the effectiveness of its IP management decision structure. This paper proposes the Organizational Risk Analyzer to carry out such evaluation. The ORA is shown (on the basis of the meta-matrix) to factor in the complex interaction that influence IP management decision making.

I. INTELLECTUAL PROPERTY

Intellectual property (IP) describes ideas, inventions, technologies, artworks, music and literature, all of which are intangible when created, but becomes valuable in the tangible form as products or service [1].
IP includes all the sensible and intangible property a firm has, including contextual information and digital assets that are the result of the innovation process [2]. This definition of IP is instructed in figure (taken from [2]).
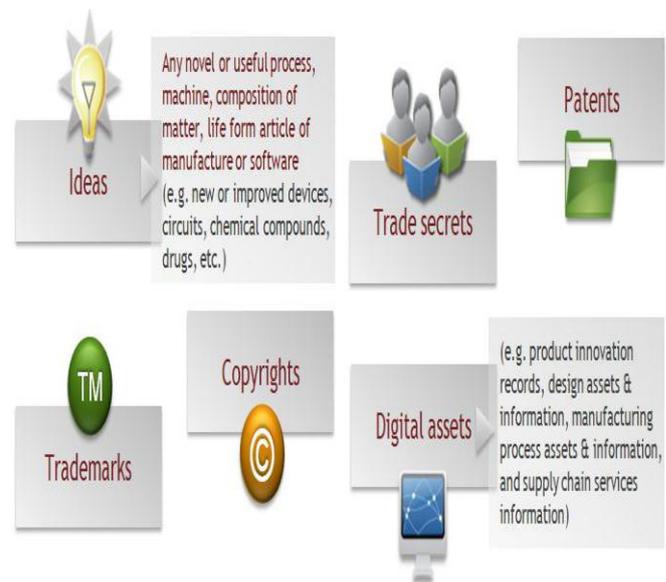
Figure 1: Definition of IP

IP is a crucial contributor to the emergency and evolution of the knowledge economy and generates monopoly position in return for providing payoff to innovation [1]. Intellectual property management (IPM) approach aims at generation of IP, protection, and converging the same into the market and increasing revenue. IP is a very important element of an organization. Patents, trademarks, trade secrets etc are assets that increase the value of a company. These assets are a special category of business assets which are named intangibles [3]. But where do the intangible assets stand in an enterprise? How is it related to IP? The intangible assets and IP can be understood only in the enterprise context, where they are created, used and produced the most of their value. Every enterprise small or large is compounded by three basic elements [4];

1. Monetary assets
2. Tangible assets
3. Intangible assets

Enterprising = monetary assets + tangible assets + intangible assets.

The reference [6] defined intellectual capital (IC) as a knowledge that can be converted to value. [6] also determined that IC has two main components: human capital (ideas we have in our heads) and intellectual assets (ideas that have been codified in same manner). Within intellectual assets, there is a subset of ideas that can be legally protected, called intellectual property (IP). (see figure 2 taken from [3]);
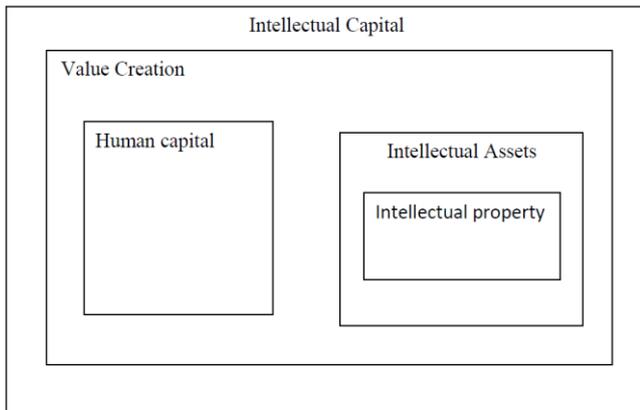

Figure 2: Intellectual property within the context of intellectual capital

Intellectual property are intellectual assets which are protected by law. The aim of management is "to produce" intellectual property [3].

II. The value hierarchy of IP management

The reference [3] structure the value Hierarchy, which is a pyramid with five levels. Each level represents a different expectation that the company has about the contribution that its IP function should be making to the corporate goals. Like building blocks, each higher level relies on the foundation of the lower levels and contribution to the shareholder value (see figure 3).
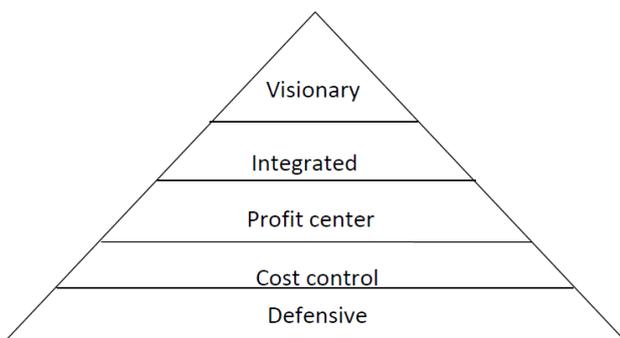

Figure 3. The value hierarchy of IP management (the pyramid of IP management) [3].

2.1. Defensive level

When a corporation owns an intellectual asset, it can prevent competitions from using the asset. At this level companies use their IP for defensive purposes only and view IP as a legal asset. Their goals are use to protect their own innovations, to ensure that they don't infringe the IP of others. The cons in fitting fees, enforcement and other legal expenses can be high.

2.2. Cost control level

Companies at this level still have a defensive approach, but how focus on finding ways to obtain protection while simultaneously reducing the costs of creating and maintaining their IP portfolios.

2.3. Profit center level

Companies of this level turn their attention to more proactive strategies that can generate a great amount of additional revenues while further contriving to trim costs. Passing from the previous levels of activity to this one requires a major change in a company's attitude and even its organization. It's management processes, decision structure and mechanism i.e its organizational structure. Effectively making such changes in its management structure requires the means to qualitatively and quantitatively evaluate its structures and processes that impacts on it decisions. Such systemic evaluation requires the framework that optimally considers the structure and dynamics of modern organization.

2.4. Integrated level

In this level, the IP function serves the organization as a whole. Here the company's business units have grasped the power of using IP for a range of business roles. IP use for business becomes integrated across all of the company's business activity.

2.5. Visionary

At this level of IP management sophistication companies take a long-brim view of the company's role in business and in its industry. They seek to use the company's IP to create more strategic value. Though it should not be inferred from this pyramid that the highest level of sophistication equates to the "best" level of IP management, every company can improve their position in the pyramid. This would require changes as pointed out earlier (see rotes under the integrated level of the pyramid). Since effective organizational changes has to be evaluation driven, it should require sophisticated evaluation procedure for an effective IP management decision stricture. (i.e management structure and processes) to be put in place and integrated into the organizations IP management systems. Each level of the pyramid serves as a building block for levels above it.

III. Intellectual Property Administration and Intellectual Property Management

IP management is an important set of concepts, methods and processes created to fit intellectual property (IP) of the firm with defined objectives and business strategy [3]. IP administration and IP management are often confused but they differ from each other. As illustrated in figure 4, while IP administration mainly deals with the IP asset itself(the acquisition, preservation and all legal aspects), the central is the integration of IP innovation strategies and business models. [3]. To put it simply, IP administration strives to enable the usage of the legal and economic functions of IP:

- The protection of an invention (patents, to exclusively identify and protect the commercial source of a product or service (trademarks)
- To block competition (IP rights)
- And to enable inventory stocks, licenses.

Those functions may have an economic effect for example, they prevent a competitor from offering similar functionality in its products. It is the task and responsibility of IP managers to appropriate those functions and the economic consequences for the benefit of the company; in other words to make sure that the company actually can cash in on IP and its effects.

As a rule, the economic benefit of the company is a cash flow (of some sort). Therefore, the target figures of IP management are key operational figures such as rate of return, profitability and turn over [4].
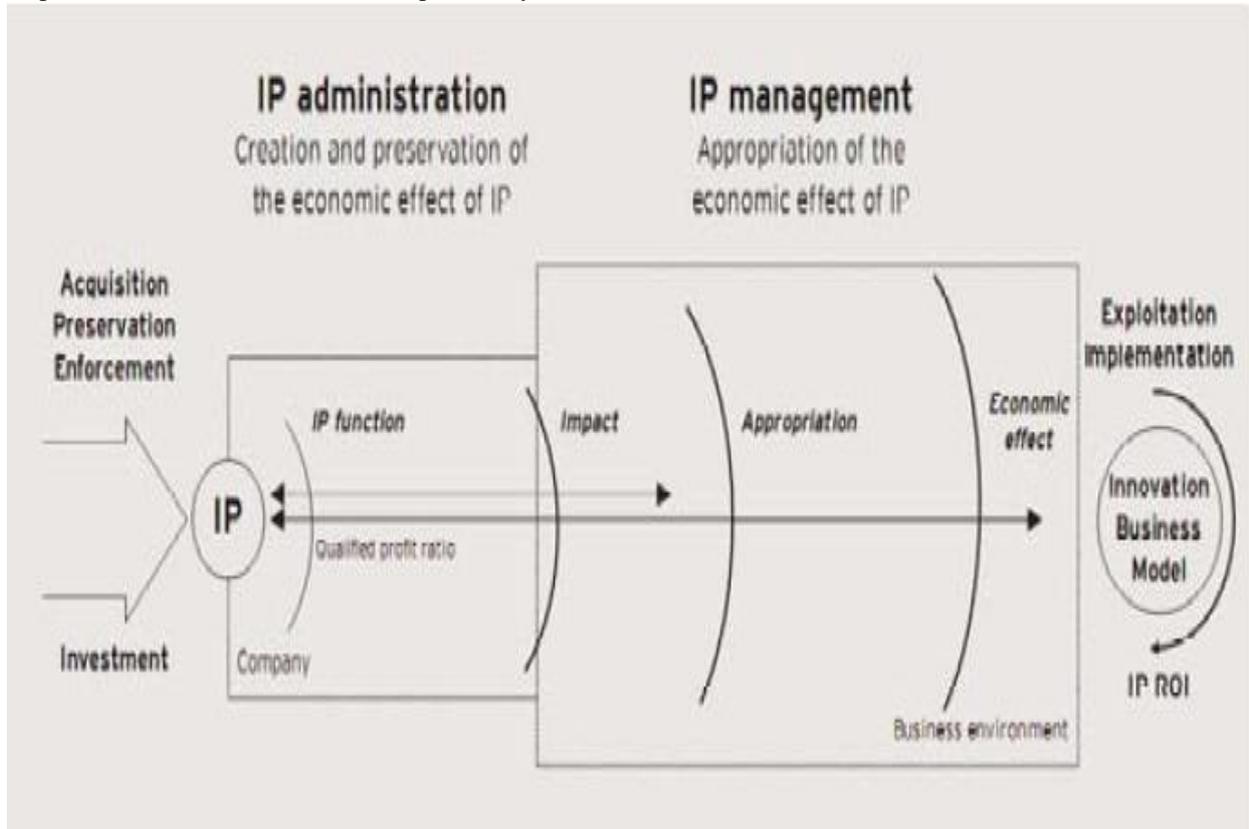

Figure 4: The difference between IP administration and IP management (source [5])

Today, even technology start-ups and spin-off companies have started commercializing innovations and existing technologies [5]. However, successful commercialization of innovation requires that the know-how in question be used in conjunction with other capabilities or assets [6]. Companies gain advantage by taking a proactive, multi-disciplinary approach to managing the complete body of IP – ideas, digital assets, patents, filling, internal invention disclosures, trade secrets etc. all of which are critical to growth and competition in an ever changing business environment. Organisations have developed Intellctual Property Management System (IPSM) to some extent cater for their needs, and ensure availability of information and database for strategic decision making. However, there exist the problem of measuring and evaluating the mpact of any decision architecture put in place for intellctual property management. There is need for a framworkthat facilitaes the qualitative and quantitative evaluation of the impact,

efficacy and efficiently of the IPM decision structure the organization. The evaluation framework should enable the evaluation of the IPM model, processes, methods and concepts adopted by the organization. The evaluation method has to be such that it considers intellectual property structural as a Team sport, it not only factors in all the five components of an effects organization and design as depicted in the wheel in figure 6, but also the alignment of the five components to one another in evaluating IPM decision structure.

3.1. IP management and strategy is a team sport

Protecting, managing, leveraging and commercializing IP is a team sport that refines key players from corporate, Legal, Research of Development (R&D), Engineering, Technology, Manufacturing, and construers [2]. Figure 5 depicts this concept.

Figure 5: An effective IP team helps ensure that IP development and needs align with business strategy.

For example, when creating an innovative new product or technology, marketing and R&D teams determine key performance or functional requirements that must be met. Development teams focus on designing the right product or technology to meet those requirements and they must either mine existing IP for quick time to market or create a strategy for protecting the innovation with a smart IP strategy.

The team sport view of IP management and strategy facilitates both the design of effective decision structure and the design of workable model required to evaluate the performance of such decision structure. The team view of IP management decision processes is not without a sound classical theoretical basis. In their formulation of "team theory" authors in [7] postulated that each member of a group of actors has some (possibly null) initial information about the world and some (possibly null) ability to control certain actions in the world. A team also has some shared payoff function that determines, for a given state of the world, the value team members attach to the results of the different possible actions. Since in general, this team members who most take actions do not posses all the relevant information about the world, there must be some information structure that determines how members perceive and commutate information and there must also be some decision structure that determines how members decide what actions to take based on the information they receive. The goal of an organizational designer may be thought of as choosing an information structure and a decision structure that maximizes the net payoff to the team members, i.e, the gross payoff less the cost of commutating and deciding.

The actors in this Team view of IP management and strategy can be thought of as decision making units as a collection of one or more people and associated mechanisms that act, from an organizational perspective as a single actor.

IV. organization structure and IP management performance evaluation

Effective organizational design considers five, interrelated components as illustrated in the wheel, figure 6.

Figure 6. source: Bain and company organizational toolkit and Bridgespan analysis.

1. **Leadership**
   - Clear vision and prentices
   - Cohesive leadership team
2. **Decision making and structure**
   - Clear roles and accountabilities for decisions
   - Organizational structure (decision structure) that supports objectives
3. **People**
   - Organizational and individual talent necessary for success
   - Performance measures and incentives aligned to objectives.
4. **Work processes and systems**
   - Superior execution of programmatic work processes.
   - Effective and efficient support processes and systems.
5. **Culture**
   - High performance values and behaviors
   - Capacity to change.

Principles of effective organizational structure or design [8];

➤ Consider all five components of the "wheel"
➤ Align the five components to one another
➤ Align strategy and organization to one another.

Organization structure (decision structure) have two components [9] groupings and linking of activities;

Grouping: - how individuals, jobs, functions or activities are differentiated and aggregated

- optimizes information flow within the group but typically creates barners with other groups.

Linking:

➤ Mechanisms of integration used to coordinate and store intimation across groups.
➤ Enable leadership to provide guidance and direction across the organization.

5.1. How the components of these organization structure maps into the proposed evaluation model.

The grouping maps into the organizational risk analyzer (ORA) network mode. The linking maps into ORA edges. It can be deducted from [8] that the organizational structure can be formally represented in terms of messages (lines in the ORA Network model) and decisions (node in the ORA network model). The ORA is discussed in section organizational structure provides the framework within which various coordination and control mechanism can be brought to bear on IP management processes. Such mechanism are in fact types of information processing systems that should be used to continually improve the decision making performance towards the effective management of IP.

This one of the primary determinant of effective IPM decision marking system can be seen in terms of the continual evaluation of its effectiveness among other things as it relates to the resolution of uncertainty with the IPM environment.

5.2. Evaluating performance of IPM structure and processes

Given the understanding that IP is a core element of a successful organization it becomes vital to be able to evaluate the IPM decision apparatus of a form. This evaluation gives managers the possibility to reflect the consequences of decision made based on current IPM process and structures and hence pare the way for new, better informed decisions mechanism. The balanced scorecard is a well known management scorecard [10]. The balanced scorecard has mostly been used in managing and controlling the holistic performance of organizations. Scorecards have also been used in the analysis and management of intellectual property rights assets [11]. From a decision-making science-point of view, the basic form of a scorecard is a rather simple multiple criteria decision analysis (MCDA) tool, an elementary non-weighted scoring system that uses a numerical scale in ranking. The elementary nature of the scorecard makes it non suitable in the evaluation of complex decision that the scorecard have

to undergo some changes if it must be used for decision support that uses estimate of future values as a base.
Due to this limitation, the scorecard cannot factor in the effect of the complex interactions of the elements of the "wheel" or the complex interaction of the actors based on the perspective of the "team theory" views of organizational decision structure.

Hence an evaluation model that factors in such complex interaction that characterizes the IPM environment is necessary. The Organizational Risk Analyzer (ORA) models an organizational structure as a set of interconnected networks connecting different organizational entities. This makes it able to factor in the effect of the interconnected elements of the "wheel" and the interactions of actions in the team sport view of the IPM environment. This ensures its suitability for the evaluation of the IPM decision systems efficiency.

V.   Organization Risk Analyzer (ORA)

ORA is a network analysis tool that detects risks or vulnerability of an organization design/decision structure. The design/decision structure of an organization is the relationship among its personnel, knowledge, resources and tasks entities. These entities and relationships are represented by a collection of networks called META-MATRIX. ORA analyzes the meta-matrix using measures and read and writes network data in multiple formats to make it interoperable with existing network analysis software.

The modeling of organizations as network and the development of measures to examine their decision structure is well developed. Even a cursory analysis of the literature reveals a wide variety of measures of assessing organizational risk and vulnerability [13][14][15]

5.1. The Organization as Meta-Matrix

The main unit of input in ORA is the organization. An organization can be modeled and characterized as a set of interlocked networks connecting entities such as people, knowledge resources, tasks and groups. These interlocked network can be represented using the meta-matrix conceptual framework [16][17], presented in table 1.

Table 1: Meta-Matrix for Organizational Design.

	People	Knowledge	Resources	Tasks
People	Interaction network	Knowledge network	Resource network	Assignment network
Knowledge		Information network	Resources skill needs network	Task skill needs network
Resources			Substitutes and coordinated resources network	Task resources needs network
Tasks				Task precedence network

A variety of networks exist within and among organizations. Meta-matrix can be understood to be the networks connecting the four key corporate entities-agents, knowledge, resources, and tasks (see table 1). Various aspects of organization can be characterized in terms of these networks. For example, structure (such as the authority structure or the communication structure) is defined in terms of the interaction network connecting people to people. Culture can be defined in terms of the knowledge network- the connections of people to knowledge. And so on. The mathematical description of the ORA Network model is beyond the scope of this paper. Some of the ORA metrics are: Access index knowledge base, cognitive load, communication congruent loads, Resources congruence, actual workload, communication, and personnel cost. For the definition of these measures, including their mathematical expressions, see the organization risk Analyser Technical report.

5.2. Evaluating IPM decision Structure using ORA

For the evaluation, the ORA takes as input the IPM structure and processes of the company (i.e the firms organizational structure for IPM) as a meta-metrix. Based on this and with reference to the meta-metrix conceptual framework, the following can be referenced and referred specified: IPM interaction network, IPM knowledge network, IPM resource network and IPM task network. The IPM decision system of the organization is optimized if these networks are engineered such that the identified vulnerabilities of concern to the organization are minimized. Inputing the IPM structure of the company into the ORA network model, the ORA metrics for the IPM performance of the company are evaluated. For such evaluation entities (human management or machines) responsible for taking IP management decisions are mapped into "Nodes" while relationships existing between the nodes are mapped into "Edges" in the ORA network model.(refer to the organization Risk Analyzer Technical Report). To improve performance of the IP management decision structure (i.e the organization structure for IP management), the communication congruent, resource congruent must be maximized, and the variation in actual workload must be minimized. On the other hand, to improve adaptability the variation in cognitive load should be minimized. Hence, optimizing an IPM meta-matrix for performance or for adaptability requires optimization with criteria created as a sum or a product of the ORA metrics. The evaluation of the ORA metrics associated with IPM decisions structure enables organization to benchmark decision performance. This enables the firm to validate the efficacy of adopted IPM architecture.

VI.   CONCLUSION

IP is a valuable and strategic asset of great companies. Effective IP management structure is required for the organization to effectively appropriate its intellectual capital for its optimal benefits. However to be able to leverage on this, there has to be an effective measures to evaluate the performance of such decisions structure. Due to its capability to model the complex interaction of the different elements of an organization, the ORA was proposed as the right tool for this kind of evaluation. With reference to the organizational structure view, the decision framework can be represented in terms of messages (links of the MATA-MATRIX) and decisions (nodes of the MATA-MATRIX). The evaluation of the ORA metrics for the IPM structure of an organization enables the firm to a certain the impact of their IPM structure. Based on this evaluation, the company can understand weaknesses in its decision structure. The ORA evaluation provides the data that helps the firm to objectively make modifications to its IP management structures and processes.

REFERENCES

1. Karuna Jaint and Varadana Sharma "Intellectual property management system: An organizational perspective" Journal of intellectual property weights vol. 11 Sept. 2006 Pp 330-332.
2. Joe Dury "protecting and managing your intellectual property" View point Calypso 2013, www.kalpso.com.
3. Miresi, Cela, "intellectual property management and strategy in business   Mediterranean journal of social sciences MCSER publishing, Roma-Haly, Vol. 4 No. 11 Oct. 2013.
4. Parr, R., and Smith. G. (2005), "Intellectual property: valuation, Exploitation,and infringement Damages, income approach-qualifying the economic benefits, John Wiley and Sons, Inc. Pp. 206.
5. Wurzer, J.A., D; Giammarino P. (2009) IP management: SMEs, smaller IP owners seek better management and relirms:
6. Davis, J., and Harrison, S.(2001) Evison in the boardroom: "How leading Companies realize value from their intellectual assets, John Wiley and sons, New York, pp 1-36.
7. Marschork. J. and Radner, R. Economic theory of Teams. New Haven, Conn: Yoke university press, 1972.
8. The Brigespan Group "Designing an effective organization structure "Jan 2009
9. Peter this "strategic organization design: An integrated approach" Mercer   Delta consulting (2000): Interview with peter this, equinox organizational consisting, Bridgespan analysis.
10. Sechneidermom, A. (2006). "The first Balanced Score Card". Uttp://www.schneidermom.com/concepts/the-first-balance-csorecard/BSC-INTRO-AND-CONTANTS.htm.
11. Edvinsson, L. (1997): Developing intellectual capital at Scandia: Long Range Planning, 30(3): 366-373.
12. Mikael Collan fuzzy or linguistic input scorecard for IPR evaluation "journal of Applied Operational Research (2013) 5(1), 22-29.
13. Ashwork, M. and Kath Lean M. (2003) "Critical Human capital, working paper" Asos Carnefisn Mellon, Pittsburgh PA.
14. Borgath, S.P. (2003) "The key Ployer problem. Dyromic society network modeling and Analysis workshop summary and papers.
15. Brass, D. (1984) "A structural analysis of individual influence in an organization. Admini.sci.Ourat. 26 331-348.
16. Carley, Kathleen M. (2002) "Smart Agents and organization of the future" the Hand book of new media. Edited by Lech Lievroon and Sonia liveigstrme. Ch 12 pp. 206-220.
17. Carley, Change and Learning within organization in Dynamics of organization: computational modeling and organizational themes Edith by Aless and Lomi and Erk R. Lerken, M.T press./AAA 11 press/live Oke, Ch. 1. Pp 63-92.

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