Investigations regarding the evaluation of specific intellectual property production risks within Quality Management System

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Abstract. This paper is a theoretical research concerning methods for risk assessment of specific intellectual property production risks that are identified in the product achievement stage within the Quality Management System. In order to realize this, we will start by identifying the specific intellectual property production risks and by proposing some new calculating formulas for minimalizing their negative effects. The theoretical model proposed assessment of specific intellectual property production risks, will be realized based on 3 hypothetical situations. This study intends to reduce the intellectual property risks identified in the production process of commercial societies that have an industrial profile.

1. Introduction

Within every commercial society that has an industrial profile, the application of a Quality Management System is sought together with some continuous improvements for the product’s quality without taking into consideration the intellectual property risks faced by the society after the release of the product.

Before the product is launched on the market, it has been thought, created, projected and executed based on some plans, sketches/drawings, projects that are protected against internal and external intellectual theft through different intellectual property forms of protection (such as Law number 8/1996) or by different documents, certificates, patents. After the product has been launched on the market it becomes vulnerable against its competitors, becoming a source of imitation, denigration etc. [2]

Previous national and international investigations from the management and intellectual property domains [2, 3, 4, 5, 6, 7], have approached the risk problem only from the perspective of abiding some norms, principles and an organizational structure in the industrial process. Furthermore, these investigations are handling the risk problem only from within the system and in a punctual matter.[2]

By studying the risk sources and analyzing some expertise in intellectual property right breaches [2, 3, 4, 5, 6], results that a risk category is often treated with superficiality and sometimes even neglected, namely: the specific intellectual property risk category. For this aspect we propose the identification of specific intellectual property risks in the product’s realization process within QMS.[4]
Based on this study we will suggest some calculating formulas that can be applied to the intellectual property risks with the purpose to reduce its negative effects that can spread on all industrial companies.

2. Detecting the specific intellectual property production risks within the product’s realization process

The realization processes are referring to the product’s Production Processes and are executed in the following order, according to Figure 1:

![Figure 1. Product realization processes. [4]](image)

In order to obtain optimum results, we suggest a working scheme in which we will identify the specific intellectual property production risks from the product’s realization process point of view in the exact order of their application in every industrial profile company. [4]

Identifying the specific IP production risks within the product’s realization process represents a first step in obtaining the intended results, namely reducing its negative effects.

The working scheme in which the specific intellectual property production risks will be identified from the product’s realization processes point of view is represented in Figure 2.

As it can be observed from Figure 2, the main possible intellectual property risks from the production process were identified. These risks will be noted as follows:

- **RUCP** - Risk of unfair competition in production;
- **TRUI** - Technological risk of unprotected inventions;
- **TRUD/M** - Technological risk of unprotected drawings / models;
- **RPN-S** - Risk of products non-standardization;
- **RPP** - Risk of piracy of products.
3. Theoretical model proposed assessment of specific intellectual property production risks

The intellectual property risks are influenced by the following criteria:

- AP - IP risks apparition probability;
- IRpi - IP risk impact;
- TRpi - time (moment) of detecting the apparition of IP risks.

From a mathematical point of view [2, 5], the IP risks apparition probability is of 50%. When we are talking about the impact of IP risks on commercial societies with an industrial profile, they can have values ranging between: \( IR_{pi} = \{1, \ldots, 100\} \). When the impact value is getting closer to 100, the company’s bankruptcy risk is growing.

The impact of the IP risks depends directly on their detection time - \( TR_{pi} \). The sooner the IP risks are detected, the lower their impact will be.

It has been demonstrated from previous research [2, 8] that the \( IR_{pi} \) differs based on \( TR_{pi} \).

As such, a first general formula for estimating the specific IP production risks within the production process is [4]:

\[
R_{pi} = PA \times \frac{TR_{pi}}{IR_{pi}}
\]  

Detecting the IP risks apparition time (moment) is directly proportionate with their impact. The IP risks also depend on their apparition frequency.

For this aspect we use the following annotation:

- \( FR_{pi} \) - IP risks apparition frequency

In mathematics, the IP risks frequency can be of 3 types:

a) Descending cumulated IP risk frequency, which represents the sum of all IP risks that have appeared at \( TR_{pi \min} \) moment.

\[
FR_{pi}^{D} = \sum(R_{pi}^{1} + R_{pi}^{2} + \ldots + R_{pi}^{N})TR_{pi \min}
\]
b) Ascending cumulated IP risk frequency, which represents the sum of all IP risks that have appeared until the $TR_{pi\ max}$ moment and also including it.

$$FR_{pi\ C} = \sum_{X=1}^{X_{\ max}} (R_{p1}^1 + R_{p2}^2 + \ldots + R_{pN}^N)TR_{p1\ max}$$ (3)

c) Average cumulated IP risk frequency, which represents the arithmetic sum between the ascending cumulated frequency and the descending cumulated frequency and appears in the $TR_{pi\ medium}$ moment.

$$FR_{pi\ M} = \frac{FR_{pi\ D} + FR_{pi\ C}}{2}$$ (4)

Where:
- $FR_{pi\ D}$- descending cumulated IP risk frequency;
- $FR_{pi\ C}$- ascending cumulated IP risk frequency;
- $FR_{pi\ M}$- average IP risk frequency;
- $TR_{pi\ min}$- time (moment) of detecting the IP risks in the anticipation stage;
- $TR_{pi\ max}$- time (moment) of detecting the IP risks in the whole production process;
- $TR_{pi\ medium}$- time (moment) of detecting the IP risks in the in the merchandising production process.

4. Possible hypotheses for estimating the specific intellectual property production risks based on their detection (apparition) moment

There are 3 situations for detecting the specific intellectual property risks identified in the production process (Figure 3) namely:
1. In the anticipation stage of the production process.
2. In the production process.
3. In the production merchandising process.

Figure 3. Hypothesis tests for IP risks depending on their discovery time. [4]
Hypothesis 1: Detecting the specific IP production risks in the anticipation stage of the production process.
This is the stage in which:
\[ TR_{pi} \leq 0 \Rightarrow IR_{pi} \gg 0 \Rightarrow FR_{piD} = 0 \]
The sooner the detection of the IP risk apparition is (TR\[pi min\]), the smaller their impact is on the company.
This situation offers the possibility of reducing to a minimum the IP risk.

Hypothesis 2: Detecting the specific IP production risks during the production process.
This is the stage in which:
\[ TR_{pi mediu} \geq 5 \% \Rightarrow IR_{pi} > 50\% \Rightarrow FR_{piM} \geq 50 \]
In this stage, detecting the IP risks leads to larger financial losses, with the possibility of reducing them up to 50%.

Hypothesis 3: Detecting the specific IP production risks in the merchandising stage.
This is the stage in which:
\[ TR_{pi max} \text{ aims towards } 100 \Rightarrow IR_{pi} \text{ aims towards the value of } 100 \Rightarrow FR_{piC} \text{ apparition aims towards } 100 \text{ repetitions} \Rightarrow \text{BANKRUPTCY risks grows.} \]
In this stage of detecting the specific IP production risks, the commercial society with an industrial profile records significant loses so that the impact of IP risks is up to 100%, a fact that can increase the bankruptcy risk.

In order to evaluate the specific IP production risks identified in the product’s realization process, we will consider the 3 hypothesis presented in Figure 3, as 3 possible hypothesis, each one depending on the IP risks detection time (moment).
As such, we will analyze the specific IP risks that we have identified in the production process through the 3 time hypothesis and we will see what happens with each IP risk identified in different production time moments and the way in which they are affecting the well-functioning of industrial enterprises.

Taking into consideration the fact that the specific IP production risks (noted with \( RP_{pi} \)) depend on:
- \( PA \)- IP risks apparition probability;
- \( IR_{pi} \)- IP risk intensity;
- \( FR_{pi} \)- IP risk frequency;
- \( TR_{pi} \)- time (moment) of detecting the apparition of IP risks.

We are suggesting the following calculating formula:

\[
RP_{pi} = PA \times \frac{FR_{pi} \times IR_{pi}}{TR_{pi}}
\]  (5)

Based on this formula and on the 3 risk detection hypothesis, the specific IP production risks identified in the product’s production stage will be evaluated.
For example:
In case of Risk of unfair competition in production (noted RUCP) we propose the following assumptions:

\[
RUCP = PA \times \frac{FR_{pi} \times IR_{pi}}{TR_{pi}}
\]  (6)

Hypothesis 1: Detecting RUCP in the anticipation stage of the production process.
In this stage:
\( PA = 50\% \)

\[
FR_{piD} = \sum(R_{pi}^{1} + R_{pi}^{2} + \ldots + R_{pi}^{N})TR_{pi min}
\]  (7)

\( TR_{pi min} = 0 \)
IR_{pi \ min} = 0\%

Results that:

\[ RUCP = PA \times \frac{FR_{pi}D \times IR_{pi} \ min}{TR_{pi} \ min} \] (8)

In this situation \( RUCP = 0 \Rightarrow \) detecting \( RUCP \) in the anticipation stage leads to the possibility of reducing this risk to 0.

**Hypothesis 2: Detecting \( RUCP \) in the production process time.**

In this stage:

\( PA = 50\% \)

\[ FR_{pi \ M} = \frac{FR_{pi}D + FR_{pi}C}{2} \] (9)

\( FR_{pi \ M} = 50 \)

\( TR_{pi \ medium} = 50 \)

\( IR_{pi \ medium} = 50\% \)

Results that:

\[ RUCP = PA \times \frac{FR_{pi \ M} \times IR_{pi \ medium}}{TR_{pi \ medium}} \] (10)

In this situation \( RUCP = 50 \Rightarrow \) detecting \( RUCP \) within the production process time can lead to a great loss of the enterprises capital \( \geq 50\% \).

**Hypothesis 3: Detecting \( RUCP \) in the production’s merchandising process.**

In this stage:

\( PA = 50\% \)

\[ FR_{pi \ C} = \sum_{X=1}^{X \ \ max} (R_{pi} 1 + R_{pi} 2 + ... + R_{pi} N) TR_{pi \ max} \] (11)

\( FR_{pi \ C} = 100 \)

\( TR_{pi \ max} = 100 \)

\( IR_{pi \ max} = 100\% \)

Results that:

\[ RUCP = PA \times \frac{FR_{pi \ C} \times IR_{pi \ max}}{TR_{pi \ max}} \] (12)

In this situation the \( RUCP \) impact on the company can be of \( 100\% \Rightarrow \) detecting \( RUCP \) in the merchandising stage can lead to losses of up to \( 100\% \Rightarrow \) the company’s bankruptcy risk grows considerably.

5. Conclusions

Evaluating the specific intellectual property production risks, identified in the product’s creation process from the Quality Management System can be a long and costly process as it implies the hiring of intellectual property experts that will offer personalized expertise for each detection hypothesis and that will analyze their impact on the company’s financial situation.

The present paper represents a theoretical proposal that can be improved or modified based on other factors and indicators for specific intellectual property production risks.
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