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Xixi Wang

*Harbin Institute of Technology, Harbin, P.R. China*

Nan Zhang

*Harbin Institute of Technology, Harbin, P.R. China, andyzhang@hit.edu.cn*

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# Investment Strategies of Digital Music Copyright in Uncertain Environment

Xixi Wang<sup>1</sup> and Nan Zhang<sup>1</sup>

<sup>1</sup>Harbin Institute of Technology, Harbin, P.R. China

[andyzhang@hit.edu.cn](mailto:andyzhang@hit.edu.cn) (Nan Zhang, corresponding author)

## 1. INTRODUCTION AND RESEARCH QUESTIONS

With the progress of society and the development of information technology, people's demand for spiritual and cultural consumption is growing. More and more consumers begin to obtain news, videos, music, knowledge, and other online contents through the Internet<sup>[1]</sup>. At the same time, with the increasing depth and breadth of consumers' access to the Internet, the competition for copyright among online platforms is becoming increasingly fierce. Copyright protection policies have been strengthened, online contents copyright owners and platforms actively safeguard their legitimate rights and interests, and the investment environment for digital copyright has been rapidly improved<sup>[2]</sup>. The rapidly rising cost of copyright investment has made it the biggest operating expense for online music platforms. At the same time, more and more users are willing to pay for high-quality online contents, and rich library resources become the basis of payment and the key to user retention<sup>[3]</sup>. Copyright investment affects the revenue models and pricing strategies of the platforms to some extent. After entering the copyright period, the major online music platforms try to gain a competitive advantage by buying as many Copyrights as possible. In this situation, the investment choice of digital music copyright is extremely important for the healthy and orderly development of online music platforms. Digital assets are getting more and more attentions. Many scholars have begun to investigate portfolio strategies for digital assets<sup>[4]</sup>. Petukhina et al. assess the out-of-sample performance of eight portfolio allocation strategies relative to the naive 1/N rule applied to traditional and crypto-assets investment universe<sup>[5]</sup>. Nevertheless, there is a lack of research on digital copyright investment strategies.

Further, with the rapid development of mobile Internet in recent years and the impact of COVID-19 on the network environment, the instability of social network environment and the uncertainty of music copyright value have been greatly enhanced. For example, a negative personal event of the singer of a musical track may affect the playing effect of the music copyright. At this point, online music platforms cannot judge the future data of music tracks according to the music playing data in the previous network environment.

Therefore, this study will analyze the copyright portfolio strategy under the influence of uncertain factors. Our research questions are as follows: (1) How to rationally invest in digital music copyright for platform vendors? (2) How does the platform make decisions under different preference situations?

## 2. THEORY AND RESEARCH FRAMEWORK

Uncertain factors lead to decision-makers having nothing to rely on, and uncertainty theory provides a theoretical framework for analyzing situations. In the copyright investment process, the product we are investing in is usually new. Currently, we do not have enough historical data to determine the probability distribution, so it is incomplete for us to consider uncertain factors as random variables. The uncertainty theory is precisely a theory that uses reliability to measure the possibility of events when the sample size is small. At this point, we can determine the uncertain distribution that the variable satisfies. Therefore, in this paper, the uncertain factors in investment process are considered as uncertain variables.

In view of digital copyright investment behavior, this paper regards the uncertain factors in copyright investment as uncertain variables. In this paper, we treat the online content service provider as the decision-making party, the copyright portfolio involved in the copyright process as the background, the digital music copyright playing effect, and the cost of the decision-making party as the uncertain variables, the copyright income effect, investment cost and investment risk as the

constraints of promotion decision optimization problem, the copyright investment decision of online music platform.

To sum up, the uncertain digital music copyright investment model which considers investment returns, investment costs and investment risks (Uncertain Digital Music Copyright Investment Model, UDMCI-model):

$$\left\{ \begin{array}{l} \min \frac{V[\xi_1 x_1 + \xi_2 x_2 + \cdots + \xi_n x_n]}{E[\xi_1 x_1 + \xi_2 x_2 + \cdots + \xi_n x_n]} \\ s.t. \\ E[\xi_1 x_1 + \xi_2 x_2 + \cdots + \xi_n x_n] \geq \alpha \\ M\{c_1 x_1 + c_2 x_2 + \cdots + c_n x_n \geq Y\} \leq \beta \\ V[\xi_1 x_1 + \xi_2 x_2 + \cdots + \xi_n x_n] \leq \lambda \\ x_1 + x_2 + \cdots + x_n = 1 \\ x_i \geq 0 \\ i = 1, 2, \dots, n. \end{array} \right. \quad (1)$$

In order to facilitate the solution of model, this paper gives the equivalent form of model according to the uncertainty theory. In order to make decision makers better apply the UDMCI-model considering the constraints of benefits, costs, and risks in practice, a numerical example is used to illustrate the application of the model.

### 3. RESULTS AND MAJOR FINDINGS

Digital music copyright is a powerful tool for online music platforms to gain profits as well as the industry competitiveness. High-quality investment decisions are conducive to the sustainable development of the platform. Under the condition of limited cost expenditure, online music platform should minimize the promotion risk on the basis of satisfying the expected playback effect, so as to make the optimal investment decision reasonable. Considering the instability of the network environment and the uncertainty of the playing effect of music tracks, this paper innovatively introduces the uncertainty theory to build the digital music copyright portfolio model under the uncertain environment, which is expected to fill in the gap of investment strategy research in the field of digital music copyright.

### 4. CONTRIBUTIONS

The research results of this paper can provide a theoretical basis for the scientific decision of copyright investment in online music platforms, and have a guiding role in the rationalization of copyright investment in such platforms. The main contributions of this paper are as follows: Firstly, the uncertainty theory is applied to the research of digital music copyright for the first time. Secondly, the portfolio strategy of digital music copyright under uncertain environment is studied. Thirdly, the paper explores the influence of decision makers' investment preference on digital music copyright investment.

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