

# Smart Model-Driven Engineering to Improve the Music Valuation

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## Abstract

Existing mechanisms for assessing the value of music tend to focus on economic aspects and do not take into account the true impact of music on our emotions, decisions, and even our health. What's more, Collective Management Organizations lack information to accurately distribute royalties, creators lack information about how their music is being used, and policymakers lack detailed information about the social and economic value of music. For this reason, the Music360 project, driven by a European consortium, aims to create a platform that measures both the economic and non-economic value of music usage, going beyond traditional metrics. Music360 uses a model-driven approach combined with artificial intelligence techniques to assess the impact of music on concrete scenarios related to healthcare, cultural heritage and customer experience, among others. As a result, it can advocate for a fairer distribution of royalties and a better understanding of the multi-faceted value of music.

## Keywords

Music Value, Model-Driven Engineering, Property Rights, Artificial Intelligence

## 1. Introduction

The musical works played in stores, bars, restaurants and other venues contribute to business profits and customer satisfaction. This background music must pay specific royalties for its use, which are related to intellectual property rights (IPR). The valuation of background music royalties is usually based on measures that do not take into account the people who listen to the music, much less the positive or negative effects of music on people's well-being. For example, a bar pays royalties based on the square footage of the venue regardless of the number of customers listening; i.e., a bar pays the same whether 10 or 100 customers listen to the music being played.


On the other hand, various studies show the impact that music has on people's behavior[1], such as positive effects on the intention to buy certain products. Music has also been shown to have a positive effect on reducing the consumption of painkillers and the recovery time of patients in the healthcare sector [2]. However, there is a lack of mechanisms to capture and analyze the actual use of background music and its effects. With this information, venues could

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*ER2024: Companion Proceedings of the 43rd International Conference on Conceptual Modeling: ER Forum, Special Topics, Posters and Demos, October 28-31, 2024, Pittsburg, Pennsylvania, USA*

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 CEUR Workshop Proceedings (CEUR-WS.org)

configure the background playlist according to their customers' profiles, or hospitals could play specific musical works that improve patients' treatment.

This paper presents a model-driven approach that integrates novel AI and data science solutions to address the challenge of capturing and representing the economic and non-economic aspects of music valuation. This approach is part of the European Music360 project [3], which aims to develop a platform that provides information about the use and value of background music to stakeholders in the music ecosystem.

The rest of the paper is organized as follows. Section 2 presents a brief background and analysis of related work. Section 3 presents the main elements of the proposed model-driven approach. Finally, Section 4 presents our main conclusions, ongoing work, and expected impact.

## 2. Background and Related Work

Background music, including recordings and live performances, collects the 28% of royalties for artists, more than streaming, which collects 21%[4]. These royalties are usually collected by Collective Management Organizations (CMOs), which act on behalf of the rights owners (artists, lyricists, songwriters and composers) in a country and distribute the money collected to those rights owners[5].

However, there are some problems with the current criterion for distributing the money collected to eligible right-holders[6], which considers using reference data such as the top twenty radio stations in a country. This can result in local artists whose music is played in local restaurants, bars and shops, but not on the radio, receiving no royalties.

In addition, different contexts and areas of application can vary the actual value of the music played, for example, improving the patient's well-being[7], or the behavior of customers in different places[8].

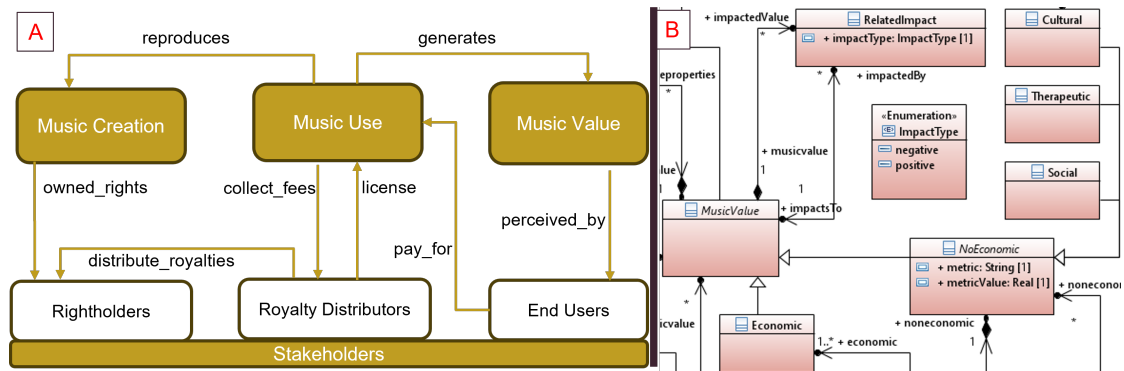
It is therefore necessary to develop a method that improves the valuation of music in order to generate a "fair remuneration" for the use of music. In the context of the European project Music360 <sup>1</sup>, we propose that it is possible to define a common conceptual model of the different elements that determine the real value of music for different stakeholders and venues. This conceptual model can be implemented using model-driven engineering techniques [9, 10], which consider the specification of a concrete metamodel and ontological definitions [11].

Moreover, most of the existing approaches related to measuring different dimension of music value, such as social or cultural music effect, lack supporting technology to share the obtained results [12]. The existing implementations related to sharing music usage information are mainly focused on economic aspects for royalty payment [13]. However, these approaches are not fully adopted and there are still various data exchange issues that need to be resolved manually[14].

The use of a model-driven engineering approach will formalize common concepts around music value, as well as facilitate the interoperability of information between the different actors in the music value chain. Furthermore, the proposed approach will allow researchers to leverage existing information on economic and non-economic music value, and share the generated knowledge with the community to improve music value assessment.

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<sup>1</sup><https://music-360.eu/>



**Figure 1:** A: Core elements of the Music360 conceptual model. B: Metamodel excerpt for the music value characterization.

### 3. Music360 Model-Driven Approach

The Music360 conceptual model is intended to provide a framework for understanding, quantifying, and analyzing music value in a comprehensive and consistent manner. Figure 1 - Part A shows the core elements associated with the Music360 Conceptual Model, which are described below:

- **Value Dimensions.** There are two main value dimensions: the economic (or monetary) dimension, which is mainly related to financial measures of collecting and paying music royalties; and the non-economic dimension, which is divided into three main value types: Social Value, Cultural Value, and Therapeutic Value.
- **Stakeholders.** Entities that play different roles in the music value chain, which goes from the music work creation to the music use. In general terms, these stakeholders can be classified in right holders, royalty distributors, and end-users (venues or people).
- **Music Creation.** It defines the concepts related to music works that include compositions, recordings, and live performances, indicating the artists involved in the creation. These artists are the right-owners that normally benefit of the music royalty distribution. However, the music rights can be also transferred to third parties.
- **Music Use.** It considers the play of the music works in different venues, adding the necessary metadata to generate richer analysis of the music effect, such as temporal and geographical information, music tempo, lyrics language, music genre, venue type, etc.
- **Rights and license management.** Represented by different relationships in Figure 1. It is closely related to the economic valuation of music use. It indicates the beneficiaries of the royalties from the use of music (right holders) and the different schemes in which the use of music can be licensed.

Figure 1 - Part B also shows a small section of the Music360 metamodel<sup>2</sup> that supports the proposed conceptual model. This excerpt shows that the music value is specialized in economic and non-economic values. The different instances of music value can influence each other

<sup>2</sup>Music360 metamodel is based on the OMG MOF standard v2.5.1

positively or negatively, e.g. a piece of music that generates positive cultural engagement in a local celebration may have a negative effect in another context.

Moreover, the non-economic values are also divided into cultural, social and therapeutic values. This division corresponds to the application domain of various living labs [15], which are real-life scenarios where controlled experiments are performed to measure the value of music. These living labs include retail stores, hospitals, bars, hotels, and local festivals. Capturing the use and value of music in real scenarios presents different technical challenges in order to be able to instantiate the conceptual model proposed. For instance, how to determinate the music effectively played and the time played in case of live performances. Thus, the proposed conceptual model and the implemented metamodel will be used to drive the implementation of artificial intelligence (AI) and data science techniques [16]. In particular, to formalize the set of common concepts that must be supported for the analysis tools in different contexts, as well as the interoperability of large amounts of heterogeneous and distributed data that must be ingested and interpreted. Some of the technologies we are considering for this purpose are the following: 1) special devices that recognize the music played and mark it with a music fingerprint[17]; 2) machine learning algorithms that analyse patterns from the living labs performed to measure music impact on different venues; 3) specific approaches for characterize the European music ecosystem and generate architectural definitions that consider business and technical dimensions [18]; 4) quality assurance proposal for quality of models and data involved [19, 20]. These novel approaches are part of the Music360 digital platform.

## 4. Conclusions and Expected Impacts

Overall, the Music360 project aims to create a fair and sustainable European music ecosystem that benefits all stakeholders involved in the creation, distribution, and use of music. It is expected that the implementation of the music360 platform, supported by the proposed model-driven approach, will enable interoperability among different stakeholders, standardize data management across the music value chain, facilitate data collection in live music and public venues, enable real-time analytics for streaming and social networks, and facilitate evidence-based decisions about new business opportunities for stakeholders, among other benefits. These results will be made possible by the interdisciplinary collaboration of computer science, marketing, and social science research teams, together with the support of various CMOs and companies related to the creation and use of music. The project aims to make the final versions of all generated software available to society with an open source license if no dependencies exist <sup>3</sup>. In this way, music organizations and creators would have accurate information about the distribution of royalties and the use of music, policymakers would have details about the social and economic value of music, and researchers would be able to generate new studies and share knowledge about the impact of music in different areas.

## Acknowledgments

Work partially funded by Horizon Europe RIA programme Music360 grant No 101094872.

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<sup>3</sup>The first version of the music360 platform is expected to be available in October 2025.

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