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SIMULATION MODEL STRUCTURE OF BUSINESS PROCESSES FOR A PRODUCT BASED ON AURALIZATION TECHNOLOGY

Within the framework of the Auralization of acoustic heritage sites using Augmented and Virtual Reality (AURA) project, the task was to develop the business models for potential products that would use the developed auralized 3D model. Accordingly, the purpose of the article is to analyze typical business models for the specified products with an auralized 3D model, which can further be adapted to each specific use case (marketing scenario).

In the most general terms, a business model is a method of doing business that allows a company to sustain itself, i.e. generate income and revenue. Therefore, the development of a business model is relevant to calculate the possible income or expenses of a future product.

The article analyzes existing business models and determines which ones are most suitable for the task at hand. It is proposed to use the following business models: "Canvas", "Barter" and "Joint Ownership".

The "Canvas" business model is described by the following structure: consumer segment, value proposition, sales channels, customer relationships, product revenues, key resources, key activities, key partners, and cost structure. In addition, this business model proposes the E-commerce, Affiliations, and Additional Opportunities business processes.

The "Barter" business model is based on the use of a social media platform to promote products and services. And in the Shared Ownership business model, investors do not buy the entire asset, but only a part of it. For these business models, the Barter and Shared Ownership business processes are presented.

Based on the business processes the structure of the simulation model was proposed. The study can be extended and adapted to other products. In further research, scenario modeling will be conducted using system dynamics approaches.

Keywords: business model, business process, simulation model, auralized 3D model.

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СТРУКТУРА ІМІТАЦІЙНОЇ МОДЕЛІ БІЗНЕС ПРОЦЕСІВ ДЛЯ ПРОДУКТУ НА ОСНОВІ ТЕХНОЛОГІЇ АУРАЛІЗАЦІЇ

В межах проекту Auralisation of acoustic heritage sites using Augmented and Virtual Reality (AURA) була поставлена задача розробити бізнес-моделі для потенційних продуктів, що будуть використовувати розроблену аураалізовану 3D модель. Відповідно, метою статті проаналізувати типові бізнес-моделі для зазначених продуктів за допомогою аурализованої 3D-моделі, які надалі можуть бути адаптовані до кожного конкретного випадку використання (маркетингового сценарію).

В найзагальнішому визначенні бізнес-модель – це метод здійснення бізнесу, завдяки якому компанія може забезпечити себе, тобто згенерувати дохід, виручку. Тому розробка бізнес-моделей є актуальною, для прорахування можливих доходів чи видатків майбутнього продукту.

У статті проаналізовано існуючі бізнес-моделі та визначено, які найбільше підходять для поставленої задачі. Зоерема, запропоновано використати наступні бізнес-моделі: "Канва", "Бартер" та "Спільна власність".

Бізнес-модель "Канва" описується структурою: споживчий сегмент, ціннісна пропозиція, канали збуту, взаємовідносини з клієнтами, доходи продукту, ключові ресурси, ключові види діяльності, ключові партнери, структура витрат. Також, у даній бізнес-моделі запропоновано бізнес-процес "E-commerce", "Афілювання" та "Додаткові можливості".

При бізнес-модель "Бартер" основую є використання платформи соціальних мереж для просування продуктів і

послуг. А при бізнес-моделі "Спільна власність" інвестори купують не весь актив в цілому, а лише його частку. Для даних бізнес-моделей представлено бізнес-процес "Бартер" та "Спільна власність". На основі бізнес-процесів запропоновано структуру імітаційної моделі. Результати дослідження можна розширити та адаптувати для інших продуктів.
Ключові слова: бізнес-модель, бізнес-процес, імітаційна модель, ауралізована 3D модель..

Introduction

Auralisation – the technique of creating virtual soundscapes in 3D models to provide the same immersive sound experience as the music performed in the real venue. AURA will explore exciting new opportunities that auralisation opens up for music performing arts and their traditional and new audiences.

Auralization technology is closely related to both Augmented and Virtual Reality, but goes in hand with 3D modeling and focuses on sound reproduction. The essence of the technology is to model and reproduce sound depending on the environment and the location of the listener in it.

Prospects for the use of any technology directly depend on how much it will be in demand by users. Therefore, one of the goals of the project "AURA - Auralisation of Acoustic Heritage Sites Using Augmented and Virtual Reality" [1] is to investigate the potential of using auralized 3D models of concert halls in VR and AR, as well as to understand the possibilities of promotion for different target audiences of the product.

During the research, the following groups of potential users were prioritized:

- experts (theaters, designers, musicians, singers, conductors, actors, general expert public, etc.)
- technicians (architectural designers, engineering and architecture students)
- promoters of cultural events (performing organizer, venue holders, public authorities and their culture policy representatives, marketing agencies)

During the marketing research, 21 demonstrative experiences of use succeeded, which are the subject of a separate publication. The purpose of this article is to analyze typical business models for the specified products with an auralized 3D model, which can further be adapted to each specific use case (marketing scenario).

Although business models are fundamentally linked to technological innovations, its design is essentially separated from technology. A business model can be defined as a system that solves the problem of identifying customers in the process of interacting with their needs and satisfactions, taking into account the monetisation of value [2]. Therefore, a number of researchers, in particular Osterwalder, A., & Pigneur, Y [3] and Demil & Lecocq [4], have proposed the concept of a business model as part of a traditional competitive advantage strategy. At the same time, innovative technologies themselves will affect the capabilities of business models [5]. In this regard, the design of business models for a product with an auralised 3D model is actual. Because it will enable a potential developer to determine possible revenues and expenses.

Let us review related References. Reference [6] proposes a new scenario-based predictive approach that allows assessing and predicting the future behavior of business processes based on system dynamics. Reference [7] focuses on the development of a validation technique for business process that result in a detailed report on the partner's process compatibility assessment.

Bocken et al [8], Gassmann et al [9] and Remane et al [10] consider the classification of business models, using a theoretical and template approach. Based on the analysis of these References, for a product that uses an auralised 3D model, it is reasonable to select the following three business models "Canvas"[3], "Barter" and "Joint Ownership" [9]. Hence, we adapted those models for a product that uses an auralised 3D model, illustrated the adaptation process using the Thinging Machine technology [11], and developed a correspond structure of a business process simulation model, that described below.

Business Models of Product with the Auralised 3d Model

Business model 1 "Canvas"

Despite the emergence of several alternatives, the Kanva business model [3] remains perhaps the most widely used [12, 13]. It is structurally divided into nine blocks [14]: Customer segments, Value proposition, Sales channels, Customer relations, Product revenues (revenue streams), Key resources, Key activities, Key partners, Cost structure.

We have refined each structural block of the Kanva business model in relation to a product that uses an auralised 3D model (Table 1). Taking into account the monetisation aspect, it is advisable to consider blocks 3 and 5 in more detail.

Block 3 shows how users of a product that uses an auralised 3D model receive information about value propositions. In particular, an auralised 3D model can promote its capabilities as a product through online channels (website, social media Facebook, Instagram, Telegram, etc.), forums, fairs, advertising, etc.

As an example of a sales channel, it is advisable to consider the use of the E-commerce business process [15], where traditional goods or services are delivered through Internet channels with reduced overheads, which is relevant for an auralised 3D model. The functionalities that can be implemented by e-commerce systems for a product using an auralised 3D model include the following:

- issuing and selling tickets for performances (orders are stored in a single database),
- self-registration of listeners,
- work with loyalty programmes,
- receiving feedback from listeners.

Table 1

Canvas business model for a product that uses an auralised 3D model

8	Key partners	7	Key activities	2	Value *proposition*	4	Customer relations	1	*Consumer segment*
	Ministry of Social and Cultural Affairs; Local self-government bodies; Artists and music experts; Enterprises of the tourism industry; Enterprises, institutions and organisations in the social and cultural sector.		Developing a product using an auralised 3D model; Bringing to market; Software support; Research and development and project activities.		Increasing the creativity of musical and theatrical performances; Promotion of cultural events; Modelling the acoustics of concert halls/		A product that uses an auralised 3D model; Advertising; CRM systems.		Different types of classical music listeners.
		6	**Key resources**			**3**	**Sales channels**		
			Human capital; Material and technical base; Financial resources.				Online advertising; Forums and fairs.		
9	**Costs.**					**5**	**Product revenues**		
	Labour costs; Costs of providing services; Expenses for marketing services;						Government allocations;		
	Software maintenance costs; Costs of developing a product using an auralised 3D model; Social security costs; Expenditure on items, equipment and inventory;						Monetisation channels;		
	Expenditure on research and development; Utility and energy costs; Debt service costs; Capital expenditure; External and internal borrowing costs; Payments to shareholders.						Investments.		

For example, let us illustrate the E-commerce business process for a product that uses an auralised 3D model (Fig. 1).
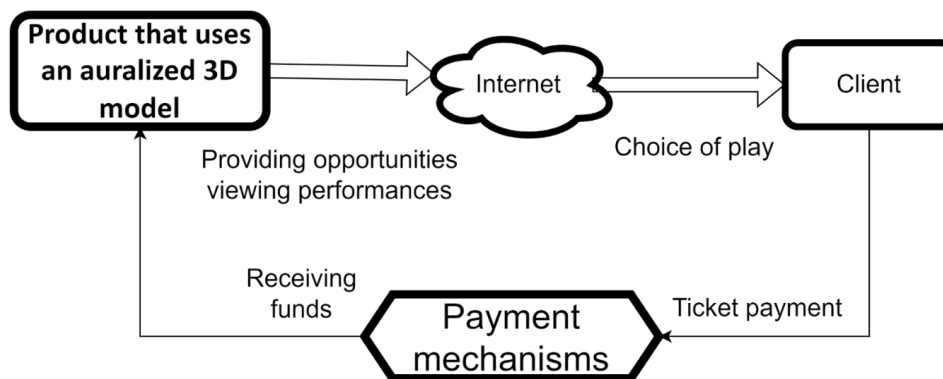

Fig. 1. E-commerce business process on the example of buying a ticket for a performance. Source [9] (modified by the authors)

In *block 5,* product revenues from an auralised 3D model can be derived from government allocations, for example, for the development of cultural heritage. At the same time, an auralised 3D model as a product can earn money on its own through various monetisation routes [16-19]:
1. advertising in the product;
2. additional options: in-app purchases, subscriptions, payment for downloads;
3. creating a marketplace.

In the case of the *first* monetisation path, it is advisable to use one of the most common business processes - "Affiliations" (Fig. 2), which demonstrates the interaction between three entities: listeners, sellers and the affiliate network (Google Adwords, Facebook Ads) [20].

Data about user behaviour and habits may be collected and provided to advertisers for in-app advertising in the following forms:
- Banner advertising [21-23], which is placed in the form of banner posters when watching a performance;
- Native advertising, in which the user hovers over an object and has the opportunity to follow an advertising link. Examples for a product with an auralised 3D model include: the clothes of other viewers, furniture on stage, musical instruments, etc;
- An intermediate full-screen web page with ads displayed before or after the expected page;
- Video advertising in a product with an auralised 3D model that can be displayed at all possible viewing levels.
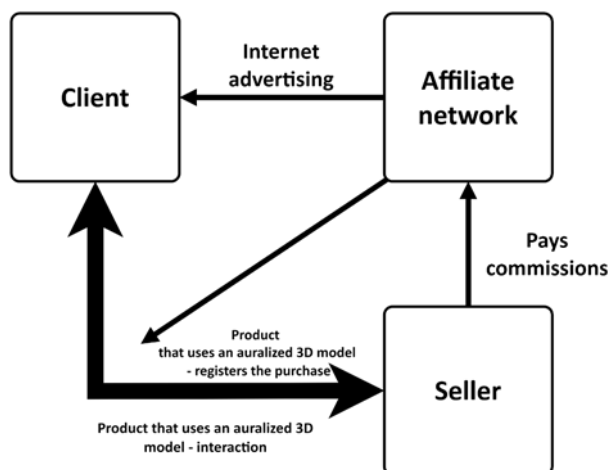
Fig. 2. Business process "Affiliation". Source [9] (modified by the authors)

In the case of the *second* monetisation path (purchase of goods), it is advisable to consider the business process "Additional features" [24], which usually includes a fairly well-thought-out pricing strategy [25]. In a product that uses an auralised 3D model, the user can choose additional features (Fig. 3). When forming the value proposition of a ticket to a performance, it is necessary to determine which additional features can bring maximum revenue.

Using the *third* monetisation path, new markets or marketplaces can be created to connect listeners with performers of musical works with an auralised 3D model. In addition, there is an opportunity to develop a marketplace that can be joined by other theatres around the world, providing relevant services and paying interest for the use of the auralised 3D model.
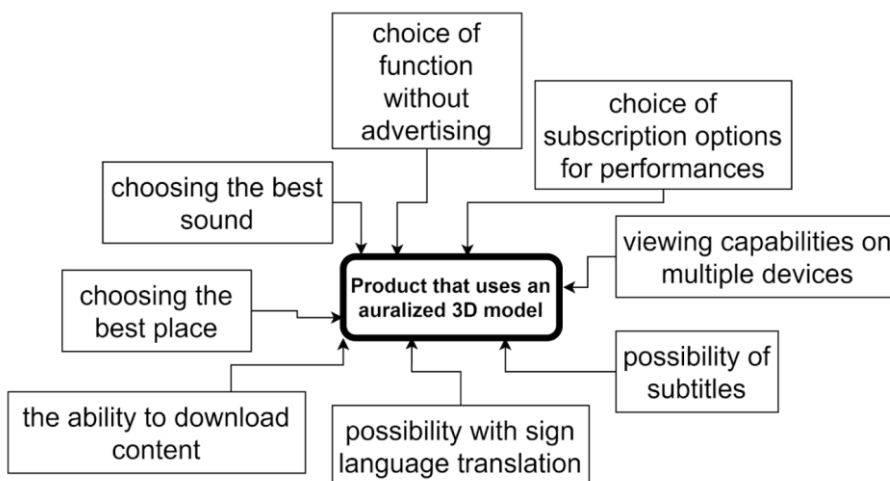

Fig. 3. Business process "Additional opportunities". Source [9] (modified by the authors)

Business model 2 "Barter"

One of the most attractive on the Internet is the Pay with a Tweet system based on the Barter business model, which uses social media platforms to promote products and services [9].

The application of this business model to a product using an auralised 3D model makes it possible to create a potential base of classical music listeners and, accordingly, to form a feedback base. Moreover, it is possible to test future products with an auralised 3D model. Figure 6 shows an example of how the Barter business process is used to interact with classical music listeners and social media communities with a product that uses an auralised 3D model.

Business model 3 "Joint ownership"

Under the Shared Ownership business model, investors do not purchase the entire asset, but only a portion of it. At the same time, the owners of the product using the auralised 3D model manage the assets (capital). Applying this business model to a product that uses an auralised 3D model will create an investment environment. Figure 4 shows an example of how potential investors interact with the owner of a product that uses an auralised 3D model within the Shared Ownership business process.
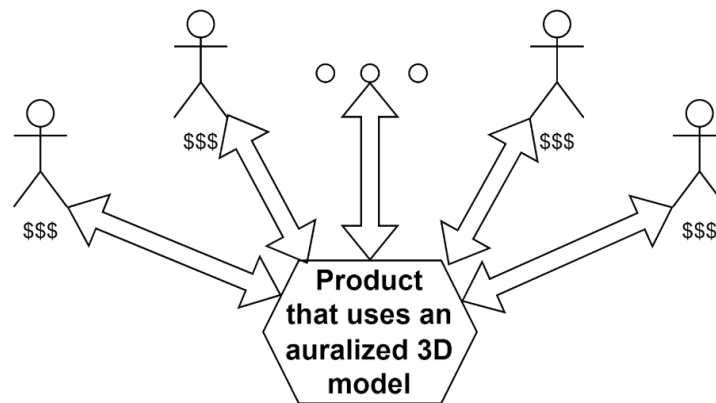
Fig. 4. Business process "Joint ownership". Source [9] (modified by the authors)

Simulation Model of Business Processes for Auralisation Product Using System Dynamics

Based on the business processes described above and system dynamics methods [26], and taking into account previous experimental studies, the structure of the simulation model was developed (Fig. 5). It will allow us to predict the revenue stream from the production of an auralised 3D model in the form of a VR application for theatre. The structure shows that each business process is a separate stream: Affiliation, Barter, E-commerce, Joint_ownership, MONEY.
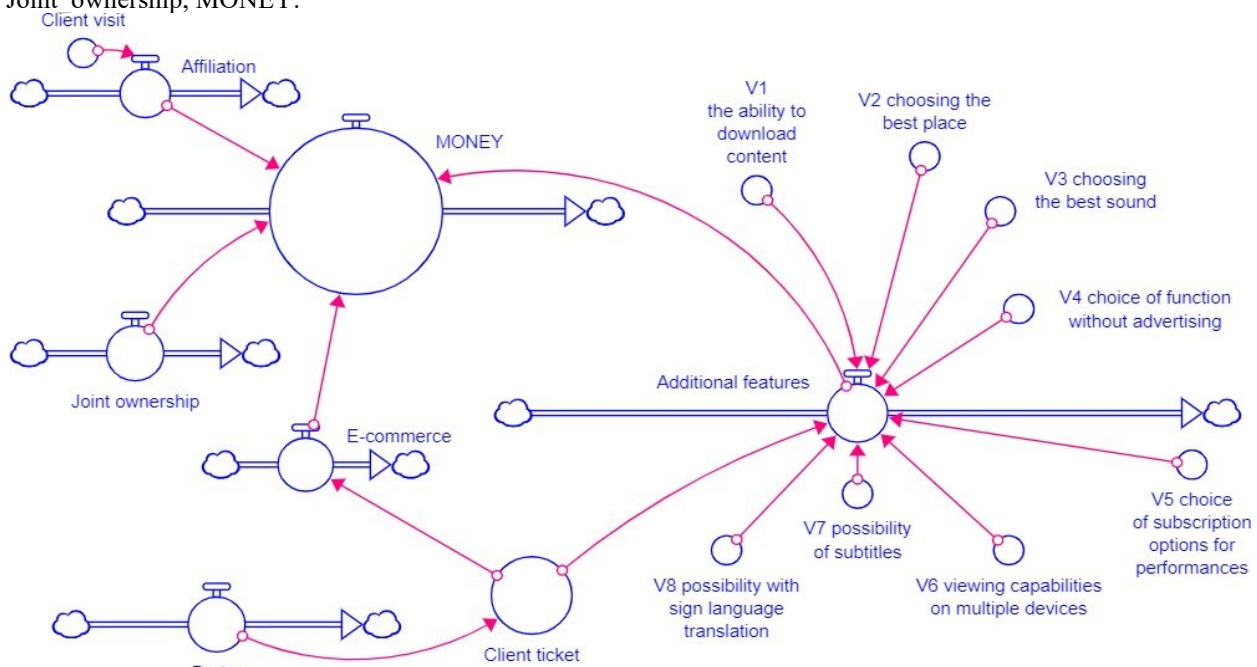

Fig. 5. Structure of the business modelling simulation model for auralisation technology

The Affiliation flow is dependent on the Client visit parameter. The Barter flow, in the definition of a money flow, has only an impact on the number of people who have purchased tickets (Client ticket). E-commerce is affected only by the Client ticket.

The Joint_ownership stream has the most parameters to influence, because many different possibilities can be provided when listening to a performance in a theatre based on auralisation technology. For example, it can be: V1 the ability to download content; V2 choosing the best location; V3 choosing the best sound; V4 choosing a function without advertising; V5 choosing subscription options for performances; V6 viewing capabilities on multiple devices; V7 possibility of subtitles; V8 possibility with sign language translation.

Conclusions.

The authors developed business models for the product using the auralised 3D model. Business processes are also presented within the business models, in particular: Affiliation, Barter, E-commerce, Joint_ownership.

Based on the business processes the structure of the simulation model was proposed. The outcomes can be extended and adapted to other products.

In further, authors are going to run the scenario modelling using system dynamics approaches as well as in-depth analysis of marketing research employing a number of demonstrative experiences.

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