Journal of Cultural Product & Design
Vol. 77. 2024. pp. 1-00
https://doi.org/10.18555/kicpd.2024.77.015

A Study on Effective OSMU(One Source Multiple Use) Animation Production Using 3D Printing Technology

- Focused on “Battle Magmon” Toy Products for the Domestic Market -

3D 프린팅 기술을 활용한 효율적인 OSMU 애니메이션 제작에 대한 연구

- 국내 시장을 위한 “배틀 매그몬” 완구 제품 중심으로 -

윤정우(Yoon, Jungwoo)*
가톨릭대학교 미디어기술콘텐츠학과

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Abstract

As the domestic animation market has recently moved away from previous subcontract production, the general competition system, structure in distribution, and complications in the general planning of the animation process are being raised as problematic issues in the animation industry, creating difficulty in securing profit in animation production. This study suggests a One Source Multiple Use (OSMU) strategy for the domestic animation market to collaborate with the toy industry and utilize 3D printing technology to revitalize the domestic animation industry and secure profit structure, which may lead to the revitalization of the domestic animation market. “Battle Magmon” animation was chosen as a sample to research and develop easy-to-follow and cost-practical steps in a collaborative project between animation and toy production, which can provide a more efficient and productive workflow in the domestic toy-based animation industry. The study aimed to investigate and suggest OSMU in domestic animation that creates multiple results with one animation source. With market research, case studies of domestic and Japanese animation markets, and the prospect of 3D printing technology, the study suggests a pipeline of how the domestic animation industry can incorporate OSMU strategies focusing on collaborative simultaneous production of character toy products into upcoming animation planning and building characters in animation.

Keyword / OSMU, Animation Production, Toy Character, Domestic Market, 3D Printing Technology

* jungwooyoon@catholic.ac.kr

국문요약

●추가

중심어 / ●추가

1. Introduction

As AI and machines offer alternatives to existing professions, the most crucial factors in economic development are human creative ability and economic production. In this context, cultural elements have gained significant importance. To keep pace with the rapidly changing economic environment, it is not just important, but imperative to adapt to a new industry that can create high-added value based on creativity, imagination, and cutting-edge technology. For this, OSMU (One Source Multiple Use) strategies, with their potential to transform the industry, inspire confidence in the future of the Korean animation industry.

However, the domestic animation market has recently moved away from previous subcontract production. Problems exist in areas including the general competition system, structure in distribution, and complications in the planning phase. As the government's support policy for fostering animation creation and accumulating creative capabilities within the industry, the movement to improve the industry's constitution is becoming more active. Among them, the importance of commercialization is being emphasized. Domestic animation production companies plan and produce numerous works each year. However, only a few works are connected to the business, which generates a profit structure. It is even more challenging to recover content production costs, leading to a shrinking investment.

Amidst these challenges, a new breed of animation producers has emerged, proposing innovative development plans for Korean animation. Through various initiatives, they have introduced the concept of OSMU, leveraging it across diverse industries in line with the advancements in cultural information technology. This approach transforms products into successful ventures, thereby maximizing the synergy effect.

This study presents analysis and alternatives for OSMU, the core of the animation profit structure. It focuses on 'Battle Magmon' in various fields, especially animation and related commercialization, from the early planning stage. The study also seeks to utilize 3D printing technology for easy and cost-effective preliminary toy product manufacturing suggestions. Each element is planned and directed to serve as an opportunity to develop the current Korean animation industry to the next level.

1.1. Aims & Objectives

Despite their potential for secured profit in the animation business, toy-based animation projects often need more support in production due to the intricate planning procedures and high development costs. However, establishing a structured system in

toy-based animation can significantly improve success rates and ensure stable profits in the domestic animation industry. This study takes 'Battle Magmon,' an animation currently in the preliminary planning stage, as a case study, aiming to research and develop a system that is not only easy to follow but also cost-effective for small-scale or start-up domestic animation companies. The practicality of this system is crucial in ensuring the industry's growth, as it provides a sustainable and efficient production model.

1.2. Method of Study

The study method is the first market research and review on domestic and Japanese animation market-focused OSMU cases that are prosecuted in collaboration with toy object productions. It is also a market review of 3D printing technology and the 3D printing industry. The second is to design and print 3D toy objects based on the characters of the pilot animation, "Battle Magmon," and find the most effective ways to use simple and cost-effective 3D printing methods according to the market review.

The third step of this research involves providing a rendering of the design and technical designs for the 'Battle Magmon toy objects.' This includes conducting 3D modeling research for settings based on designs compatible with animation and products. The 3D printing settings for sample printing, including compositing, final background creation, character rendering data synthesis, and color correction, will be developed using Cura, a widely used 3D printing software. This practical application of the research ensures its relevance and potential impact in the animation and toy production industry.

Lastly, guidelines on OSMU animation production in collaboration with toy products should be suggested.

2. Market Review

As the digital video landscape expands and platforms diversify, the animation industry is at the forefront of this evolution. It is not just about films and characters anymore. Animation has emerged as a robust economic value-added industry, with its influence and ripple effects extending to various sectors.

The animation industry creates high added value through transformation between media, with significantly higher inter-industry correlation effects linked to publishing, video, stationary character goods, computer games, advertising, and theme parks. Animation films have multiple contents that are highly linkable for effective OSMU strategies.

2.1. Animation OSMU in Japan

According to the 2010 research by the Korea Creative Content Agency (KOCCA), 'Research on ways to strengthen the international competitiveness of Korean Wave content and TV animation,' the research studies and analyzes specifically Toei and Bandai, two of Japan's most prominent animation companies and current leaders of Japan's character industry.[1] Toei has established itself as a company with the largest and most extensive video software in Japan centered on Toei Donghwa, which opened as Japan's first animation production company in 1956.

'Study on the current status of the Japanese animation industry and Korea-Japan co-production model' conducted by the Korea Film Council (KOFIC) in 2001 discusses the history of the animation industry of Japan and their character

1) KOCCA. (2010). *Research on ways to strengthen the international competitiveness of Korean Wave content and TV animation, Korea Creative Contents Agency.*

toy industry.[2] It explains that Japan owns many worldwide famous animated characters in animations such as the super robot series of the big hit 'Mazinger Z' of the 1960s and 1970s, 'Galaxy Express 999 ', 'Dragon Ball,' 'Sailor Moon,' and 'One Piece.' Bandai, originally a stationery company, has developed into a large company encompassing toys, entertainment games, and other market segments using Toei's characters.[3]

The study also highlights the strategic investment of Toei in discovering characters. The company allocates an annual budget of about 10 billion yen to fund and sponsor the production costs of nearly 20 different Japanese TV animation shows, which make up half of the animations aired on Japanese television every week. This proactive sponsorship strategy is aimed at securing the rights to use the characters if the sponsored animations become a big hit. Furthermore, 〈Table 1〉 presents the proportion of Japanese animation domestic sales conducted by AJA Hana Stock.

〈Chart 1〉 Proportion of Japanese Animation Domestic Sales

In addition, according to the 'Japanese Animation Business Strategy', the popularity of the Japanese animation Mobile Suit Gundam series and the character Ogu in the 1980s led to significant developments.[4] Bandai, a prominent player in the toy industry, signed a contract with an animation company and began developing animation characters. This strategic move was a response to the needs and preferences of the enthusiasts, leading to the creation of an animation series. The animation and toy industries have been simultaneously developing in collaboration, resulting in the continuous release of dozens of series and the production of animations. The commercialization and execution of animation in Japan, known as OSMU, is structured to be carried out through planning and production by large corporations like Bandai.

2.2. Animation OSMU in Korea

Although the domestic animation industry shows an upward trend, its relatively small size and profit structure need improvement. The profit structure in the animation industry is being stabilized by collaborating with the animation character goods market, which is more stable in size and shows rapid growth. Toy manufacturers such as Son Ohgong, Aurora, Young Silup, and Mimi World are leading the growth of the character market.[5]

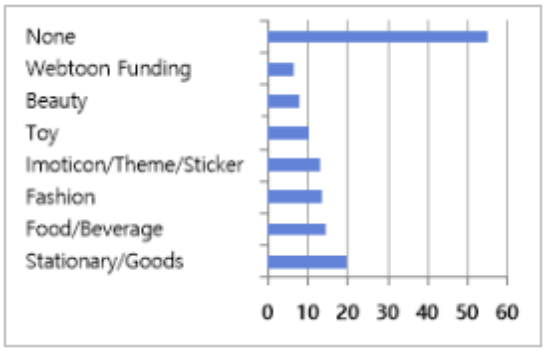
According to the 'Animation Industry White Paper' researched by KOCCA in 2022, The growth of the domestic character industry is in line with the growth of domestically produced characters. Since 2003, the character industry has shown rapid growth with the advent of the children's president, Pororo, and growth continued with the implementation of the 'domestic animation total quantity system' in 2005.[6] The most significant outcome of expanding the domestic animation total quantity system is the vibrant distribution of domestic animation and

2) KOFIC. (2001). *Study on the current status of the Japanese animation industry and Korea-Japan co-production model.*
3) KOFIC. (2001). Study on the current status of the Japanese animation industry and Korea-Japan co-production model. *Korea Film Council.*
4) Nitkei, B. P. (2001). *Japanese animation and business strategy.* Hanwool Academy.
5) Ilovecharacter.com (2023). Toy Ranking of May 2023. *I Love Character.*
6) KOCCA. (2022). *Animation Industry White Paper*, pp.2-16.

expansion and exposure of domestic animation/ characters to viewers, revitalizing the overall character market, as reported in Economy Seoul 2020.[7)]

Cha's 'The Effect of the Increase of Adult Consumer Using Emoticon Character Toward Package Design – Based on Kakaofriends of Kakaotalk' not only describes the character consumption culture among adults but also hints at a promising market. The study explains that the character market, once the exclusive domain of infants and children, expanded with the advent of the smartphone era in 2009. This led to a character consumption trend targeting 'kidults,' including emoticon characters for mobile messengers such as KakaoTalk and Line Friends.[8)] The market, now encompassing middle and high school students and adults, presents a lucrative opportunity. Below 〈Chart 2〉 is a chart of consumers with experience in purchasing animation webtoon goods, and it shows that stationery goods are at the top. Toys also take a recognizable proportion, indicating the potential for animation-related goods such as stationery and toy goods to support in securing profit structure in terms of OSMU strategies in the domestic market.

〈Chart 2〉 Experience of Purchasing Animation Webtoon Goods



Significantly, domestic TV animations, which primarily cater to children, have made substantial progress in enhancing their business model through strategic alliances with character markets aimed at children. A pivotal element of this strategy is the integration of TV animation with the toy industry, a move that has not only spurred character manufacturing growth but also secured young audiences and enhanced the visibility of the animation series, as highlighted by DX Times in their 2021 article '3 Changes in the Toy Industry Adapted to COVID-19'.[9)]

Furthermore, the financial benefits reaped from successful collaborations between TV animation and the toy industry provide a reassuring testament to the profitability of such alliances. Consider the case of Sonokong/Choirak Co., Ltd., a distributor of 〈Turning Mecard〉 and 〈Hello Carbot〉 toys. The popularity of the animation 〈Turning Mecard〉 and its associated toys is a clear reflection of the success of this collaboration. 'Turning Mecard Tobot, a Domestic Toy That 'Rebounds' in Popularity', an article by Yunhap News in 2015, reports on the impressive financial outcome of this successful partnership, which resulted in a significant earnings surprise.[10)] This underscores the importance of the original work and the strategic use of licensing in establishing a solid profit structure for content.

2.3. 3D Printing Industry

According to 3D printing-related data released by the Ministry of Science and ICT (Minister Lee Jong-ho, from now on referred to as the Ministry of Science and ICT), the global 3D printing market is expected to grow by an average of 'about 27.5%'

7) Economy Seoul. (2020). Because of this, 'Pororo's success' began... The government plans to 'abolish the 1% TV programming obligation'. *Economy Seoul*.
8) Cha, I. K. (2018). The Effect of the Increase of Adult Consumer Using Emoticon Character toward Package Design-Based on Kakaofriends of Kakaotalk. *Journal of The Korean Society of Illustration Research, 55*, pp.17-26.
9) DX Times. (2021). 3 changes in the toy industry adapted to COVID-19. *DX Times*.
10) Yunhap News. (2015). Turning Mecard Tobot, a domestic toy that 'rebounds' in popularity. *Yunhap News*.

per year due to 'expanding demand for digital manufacturing' after the COVID-19 pandemic. The domestic 3D printing market, currently valued at KRW 454 billion (10.2% growth) as of 2022, may be smaller than the global market in terms of size and growth. However, it is poised for a significant upswing of 'about 20%' this year, a testament to the crucial role of government support in fostering industry growth. This support, coupled with the expansion of solution supply, is driving the domestic market's growth. A survey by Industry News in 2023 estimates the size of the domestic 3D printing market in 2023 to reach 'up to 620 billion won.'[11)]

In Korea, 'Carima' and 'Instek' are the companies with original 3D printing technology that manufacture industrial 3D printers and scanners. However, a notable player in the market is 'INUS Technology,' which developed dimensional reverse engineering S/W and was later acquired by 3D System, a move that significantly influenced the 3D printing landscape. Personal 3D printers are mainly based on open source and are combined with the community to trade finished products, kits, and design rights. Due to the issue of possession of original technology and technology diffusion in both global and domestic markets, the leader in terms of technical standards and user experience dominates the market. Based on the above, 3D printers have already been widely used for a long time, and the ripple effect will be significant if a system is developed in areas that can become the central axis of the OSMU base.

3. Study Method

3.1. Study Aim

The aim of the study is to establish an easy-to-follow and cost-effective OSMU system linked to animation planning and development, incorporate 3D printing technology for preliminary toy object production, and suggest guidelines for such OSMU planning in animation and toy production for start-up companies.

3.2. Study Procedure

'Battle Magmon' has been selected for this particular study as it is the SF boy animation genre, which is most favored by children as shown in the below 〈Table 1〉, which shows the chart of popular children's toy ranks conducted by Asia Economy in 2017. 'Turning Mecard' and 'Hello Carbot' are in the top of the rank, and these animations are in the similar genre as 'Battle Magmon'. The characters selected to be created into toy objects were animal characters that children highly prefer, such as dragon, dinosaur and Tiger.

〈Table 1〉 Preferred List of Toys by Children for Holiday Gift.

	Childrens' day (2015)	Christmas (2015)	Childrens' day (2015)	Christmas (2015)
1	Turning Mecard	Turning Mecard	Turning Mecard	Hello Carbot
2	Hello Carbot	Lego	Hello Carbot	Lego
3	Pororo	Hello Carbot	Pororo	Turning Mecard
4	Tobot	Pororo	Lego	Dinocore
5	Lego	Tobot	Tobot	Pororo
6	Secret Juju	Power Rangers	Tayo	Secret Juju
7	Mimi	Kongsuni	Kongsuni	Bay Bkade Burst
8	Mini Tukgondae	Tayo	Mimi	SofiRuby
9	Tayo	Secret Juju	Sylvanian Family	Kongsuni
10	Yokai Watch	Mimi	Secret Juju	Power Rangers

Core technical contents include designing and

11) Industry News. (2023). Industrial 3D printing expected to grow at an average annual rate of 27.5% until 2026 Source. *Industry News*.

developing toy objects in animation using 3D programs and producing product samples for OSMU conversion of toy objects modeled for animation using a 3D printer. Lastly, the feasibility of prototype commercialization, a process in which your expertise and input are crucial, should be checked through actual product samples, and corrections and supplements for mass production should be made. The key in technical planning and developing of toy objects focused on the simplicity of the form of the toy object and how fast it can be printed, and most of all; cost-effectiveness was considered the most. Cost generated in 3D printing is mostly the time it takes to print the design and the mass of material being used to print the object, and due to these factors, the level of complexity in design is critical in cost reduction. Below 〈Table 2〉 is a table that shows the consideration points for cost-effective 3D printing in steps suggested by Xometry.[12)]

〈Table 2〉 Cost Effective 3D Printing

Cost Effective 3D Printing		
1	Design	Hollowing 3D Model
		Size of 3D Printed Object
		Improve the Design
2	Manufacturing Option	Choice of Material
		Choice of Process
		Volume of Production
3	Finishing Phase	Eliminate the Support Structures
		Selecting the Finishing Process

The production process is, first, design planning, which includes design development and system construction to produce 3D animation of toy objects for actual animation and products. Second, storyboard production of "Battle Magmon." Third, 3D modeling includes research for 3D modeling settings based on designs compatible with animation and products. Fourth, production of 2D animation and toy-related objects in 3D animation.

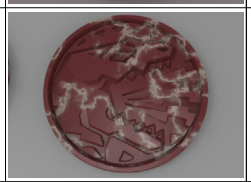
The final steps of the production process are crucial in bringing the vision of "Battle Magmon" to life. These include setting and preparing 3D printing settings for sample printing using Cura, compositing, final background and character rendering data synthesis, and color correction.

4. Study Result

4.1. Development Result

Development of four types of toy object designs, composed of Dragon, Dinosaur, Red Bird, and Tiger, have been made for commercialization in actual animations completed as shown in below 〈Table 3〉.

〈Table 3〉 Toy Object Designs

Dragon		
Dinosaur		
Red Bird		
Tiger		

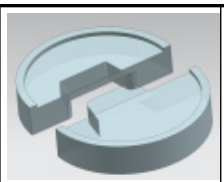
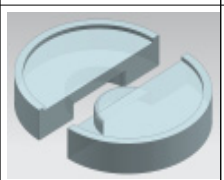
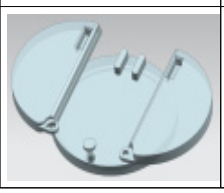
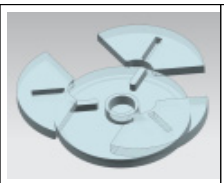
As mentioned in the above study procedure, these specific animal characters were planned and made

12) Xometry. (2023). *How to Reduce the Cost of 3D Printing*. https://xometry.pro/en-eu/articles/3d-printing-cost/

into toy products as these genres of animal characters are most preferred by children. The designs of the toy objects followed the guidelines of the cost-effective 3D printing methods presented in Xometry. The overall size and form were small coin shapes that did not have a significant contrast in terms of depth and did not include any support structures.

Five technical designs of the forms of the toys have been developed for toy objects, as seen below 〈Table 4〉. The toy products have a simple round coin shape, which can be detached and reassembled, as transformable types of toys are preferred by children. As 3D printing objects in complex shapes is not cost-effective, the overall form needs more depth and curves to prevent products from being damaged easily and to keep cost efficient. Furthermore, the material chosen for printing was high-quality white polyamide, which is one of the most cost-efficient materials for 3D printing. Lastly, the dyeing method has been selected for finishing as it is more cost-efficient and faster than the painting method. The toys were designed to be separated and assembled. All designs have an interlocking structure that separates into two to four different pieces. When interlocked, the interlocking structures have magnetic inserts, combining them into one whole piece of toy object.

〈Table 4〉 Technical Designs of Toy Objects

A		Structural Type: Male and Female Binding Structure Material: ABS Size: 40mm (Diameter) Bonding Force: Neodymium Magnet Magnetic Insert Method
B		Structural Type: Male and Female Binding Structure Material: ABS Size: 40mm (Diameter) Bonding Force: Neodymium Magnet Magnetic Insert Method
C		Structural Type: Rotation Expansion Method Material: ABS Size: 40mm (Diameter) Bonding Force: Neodymium Magnet Magnetic Insert Method
D		Structural Type: Individual Distribution Method Material: ABS Size: 40mm (Diameter) Bonding Force: Neodymium Magnet Magnetic Insert Method
E		Structural Type: Left and Right Deployment Method Material: ABS Size: 40mm (Diameter) Bonding Force: Neodymium Magnet Magnetic Insert Method

5. Conclusion

This study has been conducted to create an easy-to-follow pipeline for small-scale start-up domestic animation industries to secure a profit structure and revitalize the animation market by improving the plan structure. Animation companies or animation project plans should consider various aspects of the projects in order to secure a profit structure, as when profit structure stables, it will lead to improvement and diffusion of domestic animation projects. This study's outcome first included establishing a simple and cost-effective pipeline of OSMU animation with the collaboration of toy production using 3D printing technology and producing both pilot animation and toy objects simultaneously for a synergy effect. The study provides critical points in selecting animation production genres and character kinds based on children's preferences and the genres and trends among the targeted market. The study's outcome also includes suggestions for 3D printing production of toy products on cost-practical designs, methods, and finishes.

5.1. Implication of Study

This study aimed to investigate the potential animation OSMU planning strategy of commercialization for startups and scaled companies or small businesses. The presented OSMU strategy in this study does not

require possessing a manufacturing factory or system; samples can be easily made through 3D printing, which can provide improved visualization for further planning within the company as well as related staff and stakeholders so that the process of OSMU planning can be carried out successfully. Such a plan can provide growth momentum to startups and small companies. Furthermore, such planning can achieve efficiency in product manufacturing. Though 3D printing the designed models, errors or improvements can be made before turning the design into mass production, which can cause more significant damage to the overall project and budget. The following points in the below 〈Table 5〉 are suggested for future production in animation OSMU strategies in collaboration with toy productions.

〈Table 5〉 Suggestions for Animation-Toy OSMU Production

Areas	Details
Selection of Animation/ Character	Selection of the animation genre and planning of toy characters according to the target market preference.
Timing of Production	Simultaneous introduction of pilot animation and 3D printed toys for a more significant synergy effect.
3D Printing in Design Aspect	Design toy objects in the simplest forms and follow cost-effective guidelines, such as small size, forms with less depth contrast, and hollowed forms.
3D Printing in Technical Aspect	Selection of 3D printing materials and finishing methods to further secure the cost of production.

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투고일 : 2023년 05월 19일
심사일 : 2023년 06월 10일
게재확정일 : 2023년 06월 22일