

博士學位論文

内容の要旨および審査結果の要旨

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東京国際大学

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本号は、学位規則（昭和 28 年 4 月 1 日文部省令第 9 号）第 8 条による公表を目的とし、2025 年 8 月 29 日に本学において博士の学位を授与した者の論文内容の要旨および論文審査結果の要旨を収録したものである。

学位記番号に付した甲は、学位規則第 4 条第 1 項（いわゆる課程博士）によるものであり、乙は同条第 2 項（いわゆる論文博士）によるものである。

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氏名・（本籍地）	DAMDINSUREN ALTANSHKH（モンゴル）		
学位記番号	甲第61号		
学位の種類	博士（デジタル経営革新）		
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学位論文題目	ECONOMIC MODELS THAT IMPROVE ACCESS TO FORMAL FINANCING FOR ARTISANAL AND SMALL-SCALE GOLD MINERS		
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論文審査委員	（副査）	教授	Jay Rajasekera
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I. 論文内容の要旨

Abstract

Purpose - This dissertation explores illegal gold mining in Mongolia, focusing on the challenges faced by artisanal and small-scale miners (ASGMs), who often operate informally due to limited financial resources. The objective is to move these miners into the component of legal supply chains, increase the Bank of Mongolia's purchases of gold, and develop financial schemes for the benefits of both the bank and ASGMs. The study examines explicitly the obstacles within gold supply chains and the role of financing in facilitating the formalization process.

Design/Methodology/Approach - Data were collected through interviews with five ASGMs regarding their practices and costs. Based on these interviews, we developed a model of gold mining partnerships to evaluate loan policies for ASGMs. We employed a Monte Carlo simulation to compare various loan policies and identify which one yields the best outcomes in terms of the total number of non-defaulting partnerships and the total net profit for both commercial banks and the partnerships involved. Additionally, we created a forecasting method for gold market prices using the ARIMA model, based on 20 years of monthly data from January 2005 to October 2024.

Findings – We develop a loan policy that is the most effective from a commercial bank's perspective. It provides sufficient funding for mining operations while requiring partnerships to repay any excess loan. This approach minimizes unnecessary loans and interest payments. At the end of the second to the last period, the bank assesses each partnership's net cash by subtracting the outstanding loan from available cash. If the net cash falls within a specified range, no additional loans are issued, thereby limiting potential default losses. We also show that risk and profit-sharing in cooperative partnerships effectively reduces risks, and that risk pooling within cooperatives is more

effective than in independent partnerships.

Contributions, academic and practical - This dissertation contributes to four key areas of literature. First, it offers a comprehensive description of gold supply chains in Mongolia, highlighting the differences between formal and informal chains and identifying six reasons for the continued existence of informal supply chains. Second, it investigates high-risk financing for ASGMs, focusing on their financial challenges due to uncertain gold yield in ore and fluctuations in gold prices. Third, the dissertation examines risk-sharing schemes within artisanal and small-scale gold mining cooperatives and the implementation of structured loan policies, enhancing our understanding of how these schemes support miners. Finally, it analyzes a risk-sharing arrangement between a commercial bank and a partnership, addressing financial risks associated with gold content and uncertainties in market prices.

II. 論文審査結果の要旨

審査対象者： 学籍番号 21177901 氏名 DAMDINSUREN ALTANSHKH

論文題目： ECONOMIC MODELS THAT IMPROVE ACCESS TO FORMAL
FINANCING FOR ARTISANAL AND SMALL-SCALE GOLD MINERS

論文審査委員会

審査委員長 松尾 博文

審査員 Jay Rajasekera

審査員 Rangga Handika

1. Summary of student's research topic

The purpose of this dissertation research is to develop bank financing policies for the individual gold miners in Mongolia. Currently, the mining operations by most of individual gold miners in Mongolia are managed and financed by unregistered gold traders, and the mined gold is illegally smuggled out of Mongolia. The existence of this informal gold supply chain in Mongolia reduces significantly the government's international reserves, which include the gold mined from Mongolian soil. The critical reasons why the bank does not finance the individual miners are that the uncertainties in both gold content in mined ore and market price of gold are very high, and that the individual miners do not have financial resource putting for as collateral for a loan.

The author of this research interviewed the registered individual gold miners to find out the standard practice of mining operations in Mongolia and its cost structure, and

develops a stylized mining operational model in Mongolia. Applying simulations to this stylized model, he evaluates extensively the various bank financing policies under the various scenario of uncertain gold market prices and uncertain gold content of mined ore.

Bank financing policies are categorized in terms of loan amount and timing, repayment and timing, interests, loan limit, and the amount of collateral. The uncertainty of gold content in mined ore is modeled by an i.i.d. normal distribution and an autoregressive model over eight months for a mining season. Regarding gold market prices, various gold prices in the initial month of a mining season and an autoregressive model are examined for their effect on financing.

The unregistered gold traders are known to purchase the mined gold for the price at 12.5% less than its market price and finance the mining cost without requiring any collateral, In contrast, the commercial bank purchases the mined gold for the price at \$1.50 less than its market price and finances the mining cost with the 80% value of collateral. The author shows by simulation that the trader's financing policy is much superior to that of the commercial bank due to no default risk for individual miners and high expected profit for gold traders. The author proposes that the commercial bank should apply a loan policy requiring no collateral with the contract to purchase the mined gold for the price at 7% less than its market price. The simulation shows the superiority of this loan policy to that of unregistered gold traders. If this sort of loan policy is practiced by commercial banks, the Mongolian government can expect the conversion of illegal gold miners to registered ones, which eventually will contribute to the increase of the gold mined from Mongolian soil and the nation's international reserves.

The author also investigates the use of cooperatives consisting of individual miners as their members. He shows by simulation that the use of cooperatives pools the financial risk of individual miners, and thus it improves the expected profits of both miners and commercial banks.

2. Evaluation of dissertation content

The research objective is well articulated and appropriate. The title reflects the content well.

The dissertation is structured well. First, it describes the current formal and informal gold supply chains in Mongolia and explains why the informal gold supply chain is dominant for individual gold miners. Second, it describes the literature addressing the issues related to the topic of this research. Third, the stylized gold mining

model is developed based on the current situation in Mongolia, which forms the basis of the analysis in the succeeding chapters. Forth, potentially viable bank financing policies are evaluated for various scenario. Fifth, the comparison of a financial policy by illegal gold traders with that by commercial banks is presented. Sixth, the use of cooperative to pool risk is investigated.

As above, this dissertation is structure logically. It addresses a current practical and important financial issue in Mongolia. It focuses on bank financing polices for individual gold miners vs. that by illegal gold traders. In so doing, the research identifies an important aspect of individual gold mining and develops a potential solution to convert illegal individual gold miners to registered ones. Since the research on financial policies for gold mining does not exist, this research is unique and has originality.

The academic contributions of this research are in the area of financing operations with a unique and extreme structure of high uncertainties in both supply and demand sides. Gold mining has a high uncertainty in supply side and also has a high uncertainty in demand side of gold market price. The dissertation has a potentially great contribution to the practice of gold mining in Mongolia although there are some issues to be addressed before the developed financial policies are applied in practice.

3. Feedback given during examination

The examiners expressed that the comments given in the proposal meeting are well addressed in this dissertation, and it is satisfactory as a Ph.D. dissertation. There were two points suggested to improve the description. First, in the section where the default percentages of two policies are compared statistically, the corresponding hypotheses are suggested to be formally written. In the section where gold market prices are modeled by an ARIMA model, the result of ARCH effect test should be reported. These two comments can be easily responded.

4. Final result of examination

The final examination was conducted on July 15, 2025. The student clearly presented his Ph.D. research, and the academic and practical contributions were presented. Since the arguments are logically presented with evidence, the examiners agree that this dissertation has the contributions to the literature and practice, which warrants the Ph.D. degree. There were minor comments from the examiners; the student revised, updated, and submitted the PhD dissertation accommodating those comments. The examiners judged that the student passed the Final Exam of Ph.D.

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学位授与の日付	2025年8月29日
学位授与の要件	学位規則第4条第1項該当
学位論文題目	ADVERTISING EFFECTIVENESS OF VIRTUAL IDOLS IN SUSTAINABLE FASHION: EXPLORING THE EFFECT OF ANTHROPOMORPHISM AND GENDER ANDROGYNY ON SOURCE CREDIBILITY
論文審査委員	(主査) 教授 Nora Sharkasi
論文審査委員	(副査) 教授 Jay Rajasekera
論文審査委員	(副査) 教授 石黒 久仁子

I. 論文内容の要旨

Abstract

The proliferation of virtual influencers VIs has become a rising trend in marketing, particularly in fashion. The anthropomorphic nature of these metahumans, coupled with their impressive physiques, sexual appeal, and upscale lifestyles, attracts numerous followers on social media platforms. As sustainability gains momentum in consumption, firms gradually consider VIs as a better alternative to promote sustainable products due to their lack of transgression, high level of customization, and control over appearance and content. Consequently, many popular fashion brands embrace VIs as their brand advocates, featuring them in digital runways and using them as brand spokespersons in digital space.

This study examines the effect of anthropomorphism of Metahuman VIs on the advertising effectiveness in different gender contexts (single vs. androgynous gender) in upcycling fashion. Most of the past research explores the VI attributes, the extent of anthropomorphism on followers' relationships, and comparisons between human counterparts. In this study, we examine how the anthropomorphism of VIs affects the credibility and thus the advertising effectiveness of sustainable (upcycling) fashion. Since gender and homophily have persuasive effects on prospective purchasers' attitudes, we further extend the study to examine the customers' tolerance of androgynous in different VI gender roles on the advertising effectiveness.

We collected quantitative data from one of the international universities in

Tokyo, which has major students from Gen Z. By supplementing PLS-SEM and a classification-based ML approach, we examine the mediation role of credibility in the relationship between anthropomorphism and advertising effectiveness, and the moderating effect of gender and upcycled fashion homophily in the link between anthropomorphism and credibility in study I. In study II, we consider different gender roles of the VIs and the effect of tolerance to androgyny of customers in different VIs' gender contexts.

Our findings suggest that the audience accepts highly anthropomorphic VIs as a credible advertising medium. Their credibility and homophily significantly influence the effectiveness of advertising. VIs are being attractive, and posting entertainment content is vital to conveying an advertising message effectively. Unlike human influencers, the gender role of the VI (single or androgynous) is not a significant factor for the audience in general, even though VIs contain higher anthropomorphic cues. The audience prefers the attractive VIs and the entertainment content they share over gender representation in social media, particularly in Gen Z.

Keywords: Anthropomorphism, Upcycling Fashion, Homophily, Content Credibility, Virtual Influencer, Source Credibility, Advertising Effectiveness, Androgynous, Meta-Humans

II. 論文審査結果の要旨

審査対象者： 学籍番号 22177402
氏名 HALLAWA ARACHCHILLAGE RAJITHRA SANKHANI
論文題目： ADVERTISING EFFECTIVENESS OF VIRTUAL IDOLS IN SUSTAINABLE FASHION: EXPLORING THE EFFECT OF ANTHROPOMORPHISM AND GENDER ANDROGYNY ON SOURCE CREDIBILITY

論文審査委員会

審査委員長 Nora Sharkasi
審査員 Jay Rajasekera
審査員 石黒 久仁子

1. Overall Description and Objective of Research

The virtual influencer industry is experiencing increased adoption by marketing professionals, especially within the fashion and upcycling sectors. The industry's

valuation reached USD 6.9 billion in 2023 and is projected to reach USD 154.6 billion by 2032, demonstrating a compound annual growth rate of 41.29% between 2024 and 2032 (SNS Insider, Mar 2025). Despite this growth, academic research on virtual influencers remains limited. Though, recent studies have begun to investigate the diverse facets and underlying mechanisms that contribute to the advertising effectiveness of VIs, as in: Kim et al., 2025; Deng et al., 2024; Ma & Li, 2024; Li & Ma, 2024; Franke et al., 2023; Kim et al., 2023; Zhang & Ren, 2022; Rodrigo-Martín et al., 2021.

This project delves into a highly relevant subject: the impact of virtual influencers on advertising effectiveness. The research methodology involved conducting four independent experiments, each featuring a unique video stimulus. *UnrealEngine* platform was used to create and animate the virtual agent in the video stimulus. Approximately 100 questionnaires were gathered for each experiment (a total of approximately 420). This study represents the initial phase of a larger, three-stage research endeavor.

The core objective of the PhD study is to investigate how the anthropomorphism of virtual influencers influences advertising effectiveness within the upcycling fashion sector. This influence is further analyzed through the mediating role of credibility, which is treated as a second-order construct encompassing both source and content credibility. Uniquely, the study also scrutinizes the varied effects of gender roles on the virtual models. To deepen this exploration of gender's influence, the moderating variable of tolerance for gender androgyny was incorporated. The study focuses on a triad of concepts involving contradictions, virtual influencers blur the boundaries between real and unreal or virtual, while upcycling fashion offers 'new' high-end products made of 'used' recycled materials. Moreover, the gender roles investigated in the study does not only reflect the conventional binary gender (male vs. female) but also considers partly male-female mixed genders (androgynous male and female).

2. Academic Contributions and Research Questions

The existing body of marketing research offers limited insight into the use of human influencers and also virtual influencers for promoting upcycled fashion. The sole study identified in this area, conducted by Hasbullah et al. (2022), employed the theory of planned behavior in a quantitative analysis of Malaysian iGeneration's purchase intentions regarding upcycled fashion products following the COVID-19 pandemic. Likewise, only one study was found that examines the role of virtual influencers in the context of upcycling fashion. Leggett & Davies (2025) utilized a case study approach to

investigate how hashtags facilitate connections between a leading sustainability-focused virtual influencer and her engaged Instagram audience.

Despite the recognized potential of VIs in marketing, academic literature has yet to fully explore their capacity to drive tangible changes in consumer behavior toward upcycling fashion. A recent review of 44 articles by Byun & Ahn (2023) indicated substantial overlap between human and virtual influencers regarding their function as sources of advertising. The review also highlights key distinctions that delineate the constraints and possibilities of VIs in interactive advertising. Indeed, research from Yan et al. (2024) indicated that AI-driven virtual influencers may even surpass the effectiveness of human influencers in high-involvement situations.

This study aims to fill the identified gaps in the realm of VIs endorsing upcycled fashion. Specifically, it investigates how different gender roles portrayed by VIs impact anthropomorphism and, consequently, advertising effectiveness. Grounded in established theoretical frameworks, this research seeks to elucidate the relationship between VI anthropomorphism and advertising effectiveness, with a focus on the mediating roles of source and content credibility. Furthermore, it explores the potential moderating effect of tolerance for gender androgyny on the link between anthropomorphism and VI credibility to provide a more nuanced understanding of audience characteristics. The study aspires to address the following main research questions:

RQ1. Does perceived anthropomorphism of virtual influencers differ with varying gender roles (conventional binary vs. androgynous)?

RQ2. Does virtual influencer's credibility positively mediate the relationship between anthropomorphism and advertising effectiveness?

RQ3. Does customers' tolerance for gender androgyny boost the effect of perceived anthropomorphism on the virtual influencer's credibility?

This PhD thesis has resulted on a complete an academic article that is currently under review by the esteemed Journal of Retailing and Consumers Services.

3. Future Research Direction:

It will be interesting for future research to consider studying behavioral anthropomorphism over mere anthropomorphic appearance, as recent findings indicate that behavioral aspects exert a more substantial influence on credibility through perceived authenticity (e.g., Yin et al., 2025). Given that gender identity studies consider the impact of gender androgyny from both behavioral and appearance

standpoints, exploring voice intonation or body language in relation to gender identity can provide insights into how anthropomorphic behavior and appearance affect credibility (e.g., Haresamudram et al., 2024). The outcomes of this research, applicable to remanufactured goods, can be extended to various service sectors and industries, aiding experts and designers in shaping VI to bolster their source credibility within virtual environments.

3. Appropriateness of research objective, theme, title/subtitle, etc.

The research objective, theme, and title/subtitle are revised, updated, and approved by the PhD Dissertation Committee. During the PhD study, the student's work also received comments from international academics (Professors) to improve the quality of the research works.

4. Appropriateness, adequacy, and originality of awareness of current circumstances, identification of issues, establishment of problems, analysis, resolution, conclusion, etc.

The PhD thesis discusses a very timely topic that is not very well explored yet despite its importance and monetary value in the fashion industry and upcycling fashion, in particular. Gender issues were handled with care and sensitivity and the experiments were executed to capture data from independent samples. The problem statement or practical/experts needs were identified clearly as well as theoretical gaps. Recent literature and developments in relevant academic research was discussed thoroughly. Research problems and issues were handled properly and adequately.

5. Appropriateness of the dissertation structure/consistency and conclusion, etc.

Overall, there is no significant issue with the final version of PhD dissertation. Discussions and conclusions are appropriate and significantly contribute to the current literature.

6. Appropriateness of dissertation format, use of citations, etc.

All relevant reference papers are well-cited in the dissertation. Similarity check was performed using Turnitin. No issue was found.

While the similarity seems "around 25%", it is concluded that all similarities are minor

because of two reasons: i) In the detailed report, we can see that every component in the similarities is 1% or less. ii) Related to i), the similarities indeed are "common words/sentences", such as detailed references/bibliography. So, those similarities are neither large copying nor plagiarism.

7. Final Examination & Results.

The Final Examination was conducted on 30 August 2025. The student clearly presented her PhD project, theoretical and practical contributions were also presented. There were minor comments from the examiners; the student had revised, updated, and submitted the PhD dissertation accommodating all comments. The examiners decided that the student passed the Final Exam of PhD Defense.

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