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Strategy for Improving Crowdfunding Investments in Startup Business

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Purpose: This research was conducted to analyze the extent to which online customer reviews (OCR_s) can stimulate investment backers as a strategy to increase crowdfunding investment.

Design / Method / Approach: This research is quantitative. Natural language processing (NLP) processes review text documents based on linguistic study, a lexicon-based method is used for sentiment analysis classification based on polarity score (pros and cons), while Multiple linear regression forms a model or relationship between online customer reviews and crowdfunding investments. OCR_s consisting of numeric and text features were collected from one hundred technology products (3D printing, drones, cameras, wearables) on Kickstarter.com.

Findings: The study results show that, in addition to positive reviews, the number of comments and the number of sentiment reviews can increase consumer interest in investing in technology products on the crowdfunding platform. Moreover, positive reviews have the most positive effect on crowdfunding investments.

Practical Implications: The study results are expected to be used for startup business, especially technology products as a strategy to increase funding investment on a reward-based crowdfunding platform. Startups can take advantage of online customer reviews as one of important factors in stimulating potential backers and backers to invest.

Social implications: The strategy of utilizing online customer reviews can be used especially for technology product-based startup business to get funding support as a resource in completing a product development stage.

Originality / Value: The novelty of this research is that it focuses on a technological product development stage, product campaigns on a reward-based crowdfunding platform, considering online customer reviews through sentimental (online reviews) and numerical characteristics (number of comments, number of sentiment reviews) simultaneously as a strategy to increase investment.

Research Limitations / Future Research: This study has some limitations as it used only online customer reviews as an attribute that affects crowdfunding investment. Future research is expected to explore online customer reviews to determine important attributes (unique words) as consideration for strategies to increase crowdfunding investment.

Paper type: Empirical

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Стратегія покращення краудфандингових інвестицій у стартап-бізнес

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Мета роботи: Це дослідження було проведено, щоб проаналізувати, наскільки онлайн-огляди клієнтів (OCR_s) можуть стимулювати спонсорів інвестицій як стратегію збільшення інвестицій у краудфандинг.

Дизайн / Метод / Підхід дослідження: Це дослідження є кількісним. Процеси обробки природної мови (NLP) переглядають текстові документи на основі лінгвістичного дослідження, метод на основі лексики використовується для класифікації настроїв на основі оцінки полярності (за і проти), тоді як множинна лінійна регресія формує модель або зв'язок між відгуками клієнтів в Інтернеті та краудфандинговими інвестиціями. OCR_s, що складаються з числових і текстових функцій, були зібрані зі ста технологічних продуктів (3D-друк, дрони, камери, носії) на Kickstarter.com.

Результати дослідження: Результати дослідження показують, що, крім позитивних відгуків, кількість коментарів і кількість відгуків про настрої можуть підвищити інтерес споживачів до інвестування в технологічні продукти на платформі краудфандингу. Більше того, позитивні відгуки найбільш позитивно впливають на краудфандингові інвестиції.

Практична цінність дослідження: Очікується, що результати дослідження будуть використані для стартап-бізнесу, особливо технологічних продуктів, як стратегії збільшення інвестицій у фінансування на краудфандинговій платформі, заснованій на винагородах. Стартапи можуть скористатися перевагами онлайн-оглядів клієнтів як одним із важливих факторів стимулювання потенційних спонсорів і спонсорів, вже готових інвестувати.

Соціальна цінність дослідження: Стратегія використання онлайн-відгуків клієнтів може бути використана особливо для запуску бізнесу на основі технологічних продуктів, щоб отримати фінансову підтримку як ресурс для завершення етапу розробки продукту.

Оригінальність / Цінність дослідження: Новизна цього дослідження полягає в тому, що воно зосереджується на етапі розробки технологічного продукту, продуктових кампаніях на краудфандинговій платформі, заснованій на винагородах, враховуючи онлайн-відгуки клієнтів через сентиментальні (огляди в Інтернеті) та числові характеристики (кількість коментарів, кількість оцінки настроїв) одночасно як стратегія збільшення інвестицій.

Обмеження дослідження / Майбутні дослідження: У цьому дослідженні є деякі обмеження, оскільки було використано лише онлайнові відгуки клієнтів як атрибут, який впливає на інвестиції в краудфандинг. Очікується, що майбутні дослідження будуть вивчати відгуки клієнтів в Інтернеті, щоб визначити важливі атрибути (унікальні слова) для розгляду стратегій збільшення інвестицій у краудфандинг.

Тип статті: Емпіричний

Ключові слова: краудфандинг, стартап-бізнес, онлайн-відгуки клієнтів, аналіз настроїв, процеси обробки природної мови.

1. Introduction

The Industrial Revolution 4.0 is a leap in the industrial sector where information and communication technology utilizes efficiency and creates new business models based on digital technology. Crowdfunding is an example of a new market model. Crowdfunding is a method of collecting funds from a large number of people to finance a project or business via the Internet (*Bal, 2018*). Early stages of development stimulate interest in a new product (*Mollick, 2014*). The increase in crowdfunding funds occurs almost every year. The crowdfunding model developed is based on financial ecology, such as: reward-based, equities, P2P lending, donation-based, fixed incomes. Reward-based crowdfunding is represented by Kickstarter platform. Kickstarter is a crowdfunding-based platform that attracts the attention of start-up business and individuals, because of its ability to help creative projects to realize their ideas by involving millions of people around the world in fundraising (*Kickstarter, 2018*). As it is known, the success of a product in reward-based crowdfunding is determined by the percentage of achievement of pledged funds *(Pasmawati et al., 2018*). In 2020, it was evident that crowdfunding transactions were promised to reach $5.5 billion (*Kickstarter, 2020*). However, as many as 79.34% experienced a very high technology product failure rate (*Pasmawati et al., 2020*).

In contrast to other types of platforms that provide rating and a similar menu as a review, qualitative crowdfunding (text) uses a comment menu as online customer reviews (OCR_s). On a crowdfunding platform, OCR_s are used as a stimulant to express views about the pros and cons of backers. OCR_s are used in various studies for product sales and purchasing and investment decisions (*Forman, Ghose, & Wiesenfeld, 2008; Chintagunta, Gopinath, & Venkataraman, 2011; Fan, Che, & Chen, 2017; Li, Wu, & Mai, 2019*). OCR_s can first be considered thoroughly before potential backers decide to invest. OCR_s are a reliable source of product quality information (*Pasmawati et al., 2020*). Taking into account reviews and advertisements, reviews are more likely to be trusted by customers who have no experience or knowledge of a target product. This indicates that OCR_s are considered to be the mainstay of future product sales (*Hu, Liu, & Jennifer, 2008*).

Several previous studies have discussed OCR_s. *Murllerleile and Joenssen (2015)* and *Mollick et al. (2014)* used comments as a predictive attribute to determine crowdfunding success. The research by *Cordova, Dolci, & Gianfrate (2015)* used comments to find out the impact of overfunding on technology product campaigns. *Wang et al. (2018)* showed that positive reviews, number of comments, and response time have a significant effect on crowdfunding success. However, the lack of previous research has not focused much on future technology product launches and has not explicitly considered the numerical and sentimental characteristics of OCR_s simultaneously as a crowdfunding investment strategy.

In this study, to influence crowdfunding investment, we recommend analyzing the extent to which the attributes of OCR_s can stimulate backers. In addition to public opinion surveys, in this study, the predictor variables are used as sentiment volume and volume reviews. Kickstarter conducts research on high-tech product launches. The crowdfunding platform menu provides text reviews (comments) to give feedback on online customer reviews. Comment text is an open text description of backers' opinions about the product or service (*Jin et al., 2019*). Sentiment analysis (SA) is a method that can extract text data from several sources (*Sharda et al., 2014*) automatically (*Harfoushi & Hasan, 2018; Alrefai, Faris, & Aljarah, 2018*). Nasukawa and Yi were the first scientists to introduce SA (*Nasukawa & Yi, 2003*). Sentiment analysis is Natural Language Processing (NLP) as Linguistic Studies. The proposed model not only summarizes sentimental texts (positive or negative) but also analyzes a numerical feature relationship model using multiple linear regression.

Our results provide important insights into product launches and crowdfunding platforms for considering reviews. Startup business should respond positively and promptly to questions in the comments menu and ask them to provide positive OCR_s for backers. Our research structure helps platform companies to formulate active strategies. Focus is on the most important aspects of feedback and moderation to improve comments without destroying comment data. We also demonstrate innovative methods for analyzing textual and numerical data to aid in these future studies. The information contained in OCR_s provides a clear understanding of how startup business can help develop investment strategies on crowdfunding platforms.

This paper contains several sections, namely: section 2 deals with a problem statement, section 3 contains data collection and research methods, section 4 focuses on results and discussion of the research and evaluation of the impact of OCR_s from previous studies. Section 5 contains conclusions and implications in considering strategy crowdfunding campaigns on technology products in the future.

2. Problem Statement

The purpose of this research is to analyze the extent to which online customer reviews (OCR_s) can stimulate backers to invest in startup business on online crowdfunding platforms as one of the strategies to increase crowdfunding investments.

3. Data and Methods

This research consists of three stages: (1) data collection, (2) classification of sentiment reviews, (3) development of a model of the relationship between variables. Python 3.7 is an open-source programming language. Python 3.7 is used for data collection (text mining and scraping), process review text documents (sentiment analysis) from text mining and development of a relationship model between variables.

3.1. Data Collection

Data is collected from Kickstarter.com. Kickstarter was selected as it is a reward-based crowdfunding platform to help creative projects on startup to achieve funding at the early stages of product development. Apart from being reward-based (products, merchandise, visiting workshops, trainings), Kickstarter also has different characteristics from other crowdfunding platforms (indiegogo). Product campaigns are declared to be successful while being funded ≥100%. Products are unsuccessful to be funded if they do not reach 100% of the funding target.

The research object is technology products (3D printing, drones, cameras, wearables). The selection of technology products is based on the same characteristics (tangibles, goods). Technology products are one of the largest campaigns on the number of products and the second highest unsuccessful funding rate on Kickstarter. The research data set was sourced from 100 tech products on kickstarter.com. 34,006 comments (OCR_s) were collected and divided into 62,072 comment sentences (OCR_{ss}) to identify perceptual processing (Pasmawati et al., 2020). The data collection set uses scraping and text mining methods, as shown in *Fig. 1*. The data set used is online customer reviews (OCR_s) in the form of textual and numeric features. The textual features are backers' reviews, while the numerical features are the number of comments (backers', creators'), the percentage of pledged funding (Ci).

In this case, the success of a product campaign is determined by the percentage of achieving the target funding ≥ 100 percent, while the target funding amount (nominal) is determined by the needs of start-up business without any limitations from an online crowdfunding platform as a mediator.

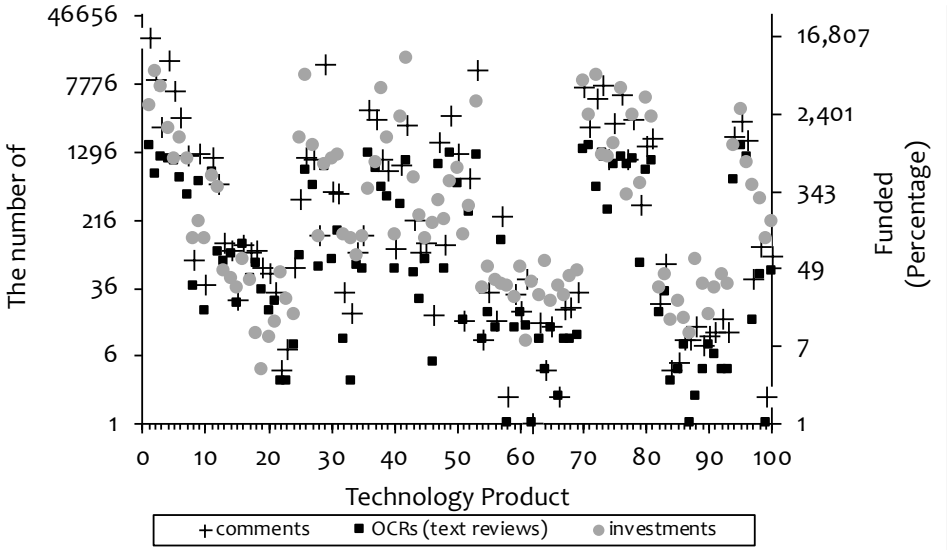

Figure 1. Research data on kickstarter

***Source*:** developed by the authors

3.2. Sentiment Analysis Method

Natural language processing (NLP) is linguistic science. Natural Language Processing (NLP) is used to identify sentimental sentences (*Feldman & Sanger, 2007*). Sentiment analysis is used as an analytical technique to detect opinions from a number of documents. SA is able to express customer opinions automatically and quickly *(Bafna & Toshniwal, 2013; Alrefai et al., 2018)*. This study uses three stages of sentiment analysis, namely: (1) input data review, (2) sentiment classification, (3) sentiment evaluation.

The first stage includes the process when online customer reviews (textual) generated from text mining are split into sentences and saved in CSV format. At the second stage, a lexicon-based classification approach is used to reveal whether sentimental sentences about product campaigns have positive or negative sentiments through a polarity score (*Alrefai et al., 2018*). The polarity score (Ps) of each OCR is a representation of backers' pros, cons and neutral attitude. Positive sentiment (Us^+) occurs when $P_s > .00$. On the other hand, negative sentiment (Us^-) occurs if the score $P_s < .00$, and if $P_s = .000$, then the review has a neutral sentiment. This study uses the representation of pros and cons only. Sentiment lexicon is divided into two approaches, namely dictionary and corpus based. The dictionary-based approach starts with an initial collection of sentiment words with known positive and negative orientations. Then an available thesaurus and corpora like WordNet to find synonyms and antonyms for each word are used. The third stage is the evaluation stage of sentiment analysis using a lexicon-based approach and expert judgment. The lexicon-based approach does not require training data and utilizes a WordNet dictionary, so that sentiment evaluation is based on a resulting classification method, namely the polarity score. Expert judgment is used for the accuracy of sentiment analysis results.

3.3. Model Development

This study uses a lexicon-based approach to analyse backers' opinion through the polarity score. Sentiment classification using the lexicon-based method shows the sentiment of each sentence review (positive, negative) and the number of sentiments of each product (sentiment volume). This result is used as a predictor variable, namely the variable of online customer reviews. The number of comments as a review in the form of numerical features is also used as a predictor variable.

Based on the predictor variables that have been determined above, this study develops a model of the relationship between the predictor variables (sentiment reviews, sentiment volume, the volume of comments), and crowdfunding investments (funded) are related to each other. Multiple linear regression is a linear regression model that is suitable for analysing the relationship of three predictor variables (sentiment reviews, sentiment volume, the volume of comments). This study tested the relationship between the variables simultaneously and partially. The research model is shown in *Fig. 2*. Crowdfunding investments and predictor variables (sentiment reviews, sentiment volume, the volume of comments) are related to each other based on the model.

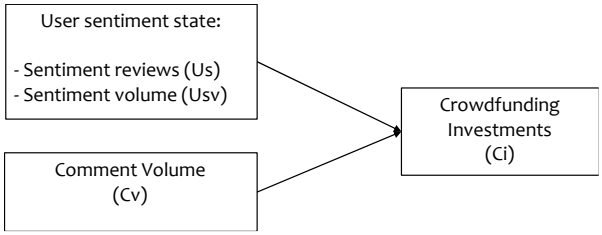

Figure 2. Research model

***Source*:** developed by the authors

The regression line equation based on the least square method is used to predict C_i through the relationship and influence of predictor variables. Measurement of the rate of change of crowdfunding investments requires a multiple determination coefficient (R-Square) described by the response attribute. The coefficient of determination is $0 \leq R^2 \leq 1$ which reaches the upper limit when the data is complete. The predictor variables have a very strong influence on the response variable if the value of R^2 is close to 1. On the other hand, the effect of the predictor variables on the response variable is small if R^2 is close to 0.

The strong and weak relationship between the variables is shown from a P_{value}. The higher the P_{value} is, the stronger the relationship between the variables is. The same is true for the influence of the variables, the higher the R-Square is, the stronger the predictor variables affect C_i. The P_{value} is used to analyse the relationship between affective variables. If the $P_{value} > .05$, it indicates that the predictor variable has a close relationship with the response variable and vice versa. The formulation of the regression equation (1), as follows.

$$C_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n X_3 + \varepsilon_i \quad (1)$$

4. Result and Discussion

4.1. Sentiment Reviews Analysis

The results of the polarity score show that the number of positive sentiments is 67.19% and negative sentiments are 32.81%. For example, the results of the Ps are shown in *Fig. 3*. The summary of the number of sentiments showing the number of an overview of 100 technology products can be seen in *Fig. 4*.

Based on the data in *Fig.3* and *Fig.4*, it is known that the number of sentiment reviews of a product varies. The highest number of positive reviews was 1406 OCR_{ss}, namely product-95, while the lowest was product-99. It is also known that the highest number of negative reviews was 693 OCR_{ss}, namely product-49, while there were 11 products that did not have negative reviews.

sentiment	Reviews	polarity_score	neutral	negative	positive
Positive	@Gary - who can I email on the campaign for me...	0.3182	0.827	0.000	0.173
Positive	1) I'm in France, do you think the orthotic wi...	0.8495	0.826	0.000	0.174
Positive	3. What can you tell us about Superthotics sme...	0.5661	0.872	0.000	0.128
Positive	4. Can you please reduce the pledge totals if ...	0.5481	0.800	0.041	0.159
Positive	A. will it aid my Bullion at all ? (I hope it...	0.6810	0.663	0.000	0.337
Positive	Also, do you believe that this will help upper...	0.4926	0.527	0.145	0.329
Positive	Any option for add-on for additional bottles o...	0.6199	0.807	0.000	0.193
Positive	As early supporters, will there be any discoun...	0.4939	0.833	0.000	0.167
Positive	B. I hope it won't make the feet hurt in the a...	0.1779	0.679	0.128	0.192
Positive	Because I who carry a number 41.5 / 42 which c...	0.7024	0.830	0.045	0.125
Positive	Being slightly pessimistic... What if they don...	0.5192	0.886	0.000	0.114

Figure 3. An example of a polarity score taken from reviews

***Source*:** developed by the authors

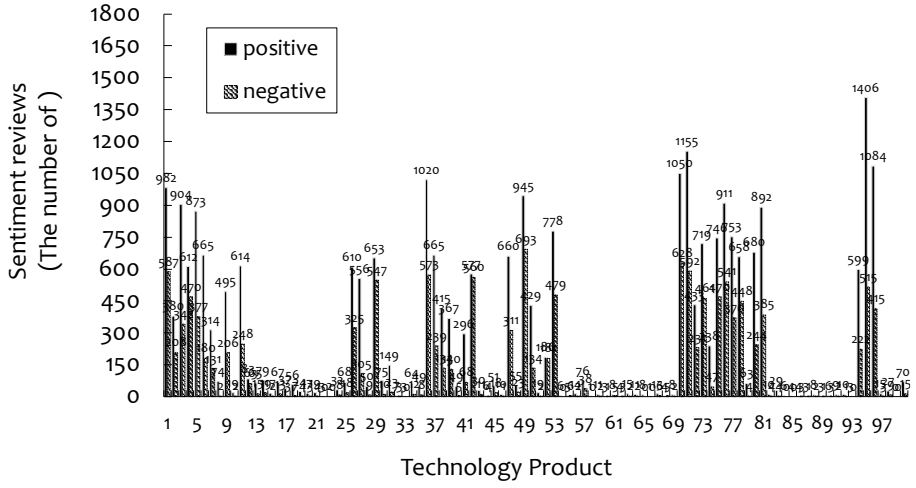

Figure 4. Summary of sentiment reviews

***Source*:** developed by the authors

Fig. 5 shows that sentiment reviews reach 58% of success in achieving investment/funding targets which are influenced by $U_s^+ > U_s^-$. The resulting success percentage has a small difference compared to the success percentage affected by $U_s^+ < U_s^-$. This percentage concludes that further analysis is needed regarding sentiment reviews to determine the correlation between sentiment review variables. The findings by *Salganik et al (2006)* and *Salganik & Watts (2008)*, suggest that backers' investment support is indicated by positive reviews. This statement needs to be proven and analyzed as described in the section.

4.2. Sentiment Volume Analysis

Sentiment volume analysis was conducted to determine the relationship and influence of the number of positive, negative reviews, and the combined number of sentiment reviews (*Fig.6*). A sentiment review value uses a relative value with normalization in the form of log. Regression analysis shows that the relative of positive ($R_vU_s^{+/}$) and negative ($R_vU_s^{-/+}$) reviews has a weak relationship with crowdfunding investments (R^2 close to 0; $P_{value} < .05$). Regression analysis also shows a significant and strong relationship and effect on the C_i (R^2 close to 1; $P_{value} > .05$). Regression analysis also shows that the relative of combined sentiment (R_vUs^{+-}) has a significant and strong relationship and influence on C_i (R^2 close to 1; $P_{value} > .05$).

Increasing sentiment volume can be done by stimulating positive backers' opinions in the comments menu as a review. In addition, creators or startup business can trigger backers to provide positive opinions through positive text questions and respond to backers' reviews. The creator's quick response can avoid an excessive number of negative opinions that can have a negative impact on backers' support in the future. This is confirmed by *Yoo & Gretzel (2011)* and *Bradley, Sparks, Weber (2015)* that reviews are feedback and can be altruistic as motivation for subsequent customer information sharing.

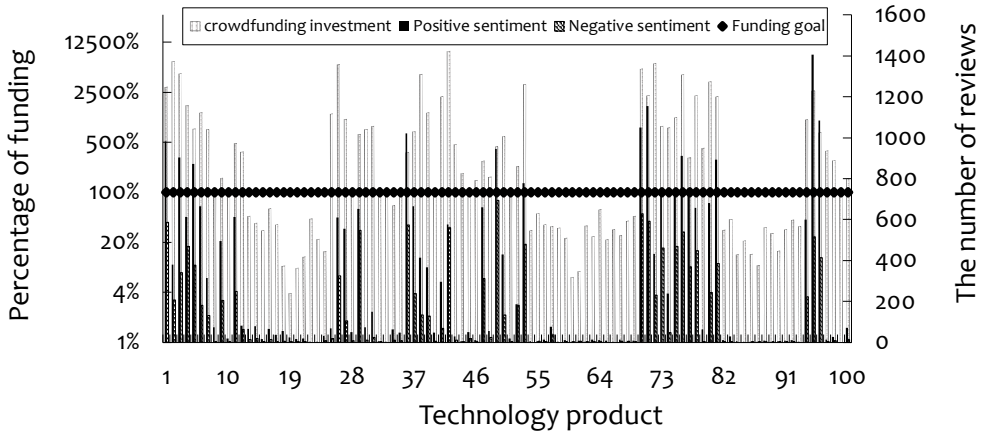

Figure 5. Successful achievement of crowdfunding investments based on sentiment reviews

***Source*:** developed by the authors

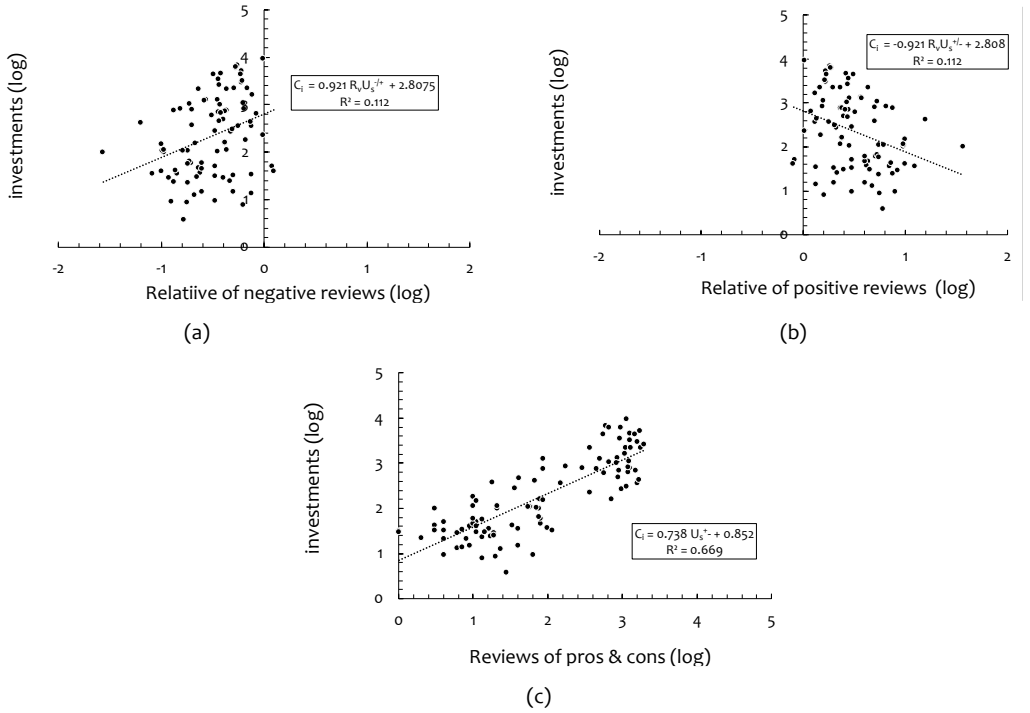

Figure 6. Correlation between sentiment volume and crowdfunding investments

***Source*:** developed by the authors

Furthermore, based on the results of the percentage of success in achieved funding through crowdfunding investment data, it is known that 100 technology products have a success percentage of 61 % for the U_s^+ predictor. Meanwhile, based on the predictor U_s^{+-}, it shows the success of 78 %. This shows that U_s^+ and U_s^{+-} have an effect on the achievement of crowdfunding investments in technology products. In previous studies, positive reviews were able to increase purchase *(Bambauer-sachse & Mangold, 2013; Floyd et al., 2014; Li et al., 2019; Ullah et al., 2016; Zhang et al., 2019)*. In this study, apart from the number of positive reviews, the number of combined sentiment reviews also affects crowdfunding investment.

4.3. Comment Volume Analysis

Comment volume (C_v) is the number of comments consisting of reviews by creators/startup business and backers. This data is obtained in the comment's menu on a crowdfunding platform in numerical form. Based on the correlation results in *Fig. 7*, there is a strong influence and relationship between C_v and C_i (R^2 is close to 1 and P_{value} > .05). These results also indicate that it is necessary to consider comment volume as a predictor that affects the amount of investment in online crowdfunding.

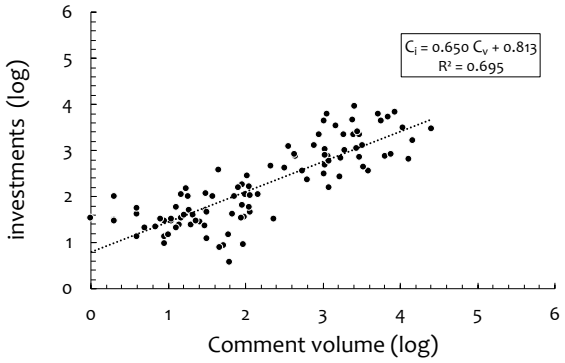

Figure 7. Correlation between comment volume and crowdfunding investments

***Source*:** developed by the authors

In addition to showing the credibility of a product, the number of comments is also able to stimulate future backers to access the comments menu and seek information, as well as participate in continuing the form of opinion reviews. These comments can directly affect backers so that it can increase backers' desire to invest in crowdfunding platforms. The increase in a number of comments can be done by actively answering backers' questions quickly on interaction in the comments and stimulating a product campaign. Therefore, coordination between crowdfunding platforms (intermediaries) and startups (creators) to implement strategic initiatives, focusing on relevant feedback aspects without manipulating survey data, is critical in achieving crowdfunding investment goals. This confirms that a comment (review) is one of the success factors of crowdfunding.

4.4. Model Evaluation

Based on the analysis of the regression model, it is shown that there is a very significant correlation between online customer reviews (OCR_s) and investment crowdfunding. This is evidenced by the significance value <.05 and the coefficient of determination (R^2 = .838). Regression analysis also shows that most of the achievements of crowdfunding investments are explained by the OCR_s variable, which is 70.28% and a small portion, namely 29.72%, is explained or influenced by other variables (Adjusted R^2 = .694; R^2 = .703). It can be concluded from the results that positive sentiment reviews have a significant influence on crowdfunding investments and have the highest relationship and influence of OCR_s (t.stat = .023; P_{value} = .982). The sentiment information review shows the results of backers' product evaluation. Responsive or unresponsive startup business interactions will determine the number of comments and have an impact on crowdfunding investments. OCR_s are information received and perceived by backers in the past. Positive reviews show enthusiasm and confidence in the products offered. The regression model that is formulated on invested crowdfunding is shown in *Fig.*7.

$$\text{Crowdfunding Investments}_i = 0.782 + 0.036\,(\text{pos\_}_{\text{sentiment reviews}}) + \\ + 0.248\,(\text{sentiment}_{\text{volume}}) + 0.447\,(\text{comment}_{\text{volume}})$$

This formulated regression shows that the higher the OCR_s are, the higher the number of crowdfunding investments from backers is (Coef. .782). From a backers' point of view or perspective, supporting comments listed on the platform are information that can influence subsequent supporting investment decisions. Compared to previous research on crowdfunding platforms, the length of a review, positive reviews, and the speed of comments affect the success of a product on a crowdfunding platform *(Wang et al., 2018)*. This research indicates that, apart from numerical features, text features of OCR_s have a positive influence on crowdfunding investments. Moreover, the text feature in the form of positive sentiment reviews has a very significant influence compared to other OCR_s attributes. However, a combined number of sentiment reviews (pros and cons) also needs to be considered to provide accurate experience information from backers to potential backers.

5. Conclusion

This study concludes that online customer reviews (OCR_s) can stimulate backers to decide whether or not to invest in a crowdfunding platform. It is proven that OCR_s have a significant influence on crowdfunding investment. The findings of this study also show that the positive review attribute is the most significant attribute of all OCR_s attributes. The cumulative number of positive and negative sentiment reviews is also considered in the strategy of increasing investments on an online crowdfunding platform. OCR_s have not only a numerical feature (comment volume) but also a textual feature that provides information based on the opinions of real backers in the form of positive or negative sentimental reviews.

The results of the study are expected to be used for startup business, especially technology products as a strategy to increase funding investment on a reward-based crowdfunding platform. Startups can advantage and be responsive to OCR_s as one of important factors in stimulating potential backers and backers to invest. The strategy of utilizing OCR_s can be used especially for technology product-based startup business to get funding support as a resource in completing a product development stage.

This study has some limitations as it used only online customer reviews as an attribute that affects crowdfunding investment. Future research is expected to explore online customer reviews to determine important attributes (unique words) as consideration for strategies to increase crowdfunding investment.

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7. Competing interests

The autors declare that they have no competing interests.

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