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Development of Early Startup Companies' Valuation Model Based on Android Mobile Application: The Angel Investor's Perspective

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Abstract— **This research aims to develop a valuation model for early startup companies based on an Android mobile application (Valuasi app). This application aims to help early startups to evaluate their company performance. This research method uses the research development method. The first stage is to develop a startup valuation model by determining the criteria using the multi-criteria decision making (MCDM) method and weighting the criteria using the simple additive weighting (SAW) method. The instrument and the weight determination of the valuation model have been validated from the perspective of angel investors, practitioners, and academics. The second stage is developing an Android-based startup valuation model application. The third stage is an evaluation by the users of the application. Using the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the results show that a potential user's intent to use the application is affected by the performance expectancy and social influence toward the application. This valuation model is expected to help early startup companies conduct business valuations, so they can attract investors, especially angel investors. In addition, the results showed that there was a positive response from users in using the 'Valuasi app', which was indicated by the positive and significant effect of performance expectations on usage intentions, and a positive and significant influence on social influence and behavioral intentions on user behavior. This research shows that 'Valuasi app' can be used to assess start up valuation. However, further improvements are needed to support application facilities so as to increase the ease of using the "Start Up Valuation App" application.**

Keywords— **valuation model; early startup; angel investor; Android-based application.**

I. INTRODUCTION

In the second quarter of 2021, economic growth in Indonesia reached 7.07%. Startups are one of the factors that have accelerated this growth; even during the pandemic, the startups' growth reached 11%. The growth and development of innovative industries or technology-based startups create jobs, strengthen the local economy, increase tax revenues, generate foreign exchange from exports, and boost local products' use. At the early startup stage, a company's access to funding is the most significant challenge to its growth [1], [2]. The difficulty in accessing funding is caused by, among other things, the company's lack of ability to convince investors and its difficulties in conducting business valuations. Business valuations for early startup companies are a significant obstacle for investors and startup entrepreneurs [3], [4]. The valuation of startups is complex due to the lack of historical data and the high uncertainty

affecting their development [5]. The unavailability of cash flows, and the capital costs that are likely to be incurred, are obstacles to arriving at a valuation using the discounted cash flow (DCF) method for early startup companies [6]. So there is a requirement for a valuation model that is easy for startup entrepreneurs and investors to use [7]. However, current research into the valuation of startup companies is still limited [3].

Therefore, this study aims to develop an early startup company's valuation model based on an Android mobile application (Valuasi app). The valuation model developed in this study uses an evaluation from the perspective of angel investors by considering financial and non-financial performance. This model modifies [3] and [8] by evaluating quantitative and qualitative criteria adapted to the Indonesian context. This valuation model will be developed based on the Android operating system to make it easier to access and use by early startup entrepreneurs in Indonesia

In the first stage, the development of a valuation model and valuation model's application. This application is one of the

technological developments that can help startup companies evaluate their performance and make decisions such as expanding their business. In addition, this application also helps investors and creditors in making funding or investment decisions. Meanwhile, the next stage is evaluating application users by the CEO or startup founder.

II. MATERIALS AND METHOD

A. Funding Based on a Startup Company's Development.

The stage of development of a company determines the source of its funds [9]. The first stage is the seed round. This early-stage funding usually helps startups to have a representative office, complete a prototype of their product, and recruit many talented employees. The funding comes from the owner's funds, family, or friends at this stage. In comparison, the main purpose of this initial startup funding is to discover the potential of the product being created and identify potential users who require the product when it is developed. In the early startup stage, the product or service has been formed, and the market has been identified. At this stage, funding from angel investors is expected. Funding at this stage is used to get inputs and improve the product. In the early development stage, the company has started production but has not yet made a profit. Funding generally comes from venture capitalists or commercial banks. The company has reached an established level in the expansion stage and will soon go public.
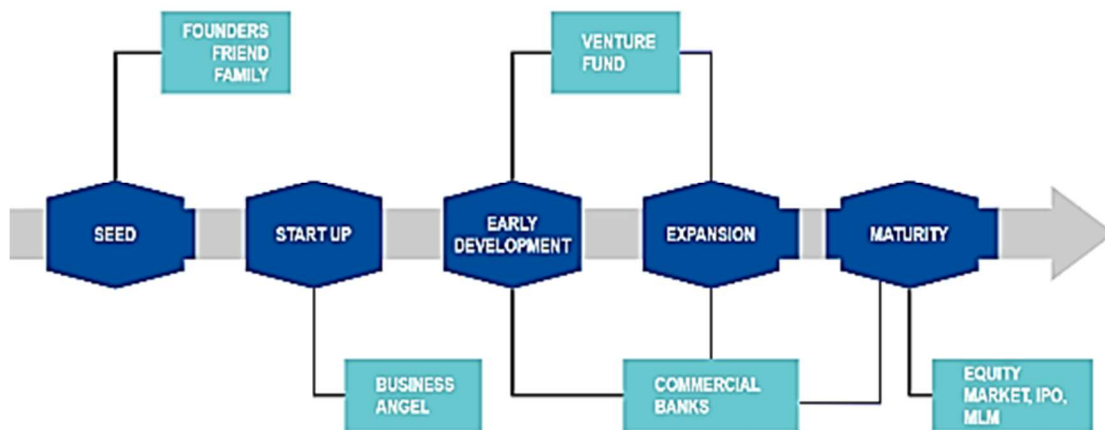

Fig. 1 Development and Financing for a Firm Source : [8]

Based on a survey conducted of startup entrepreneurs in Indonesia, at the early startup stage, the majority of startups (66%) used their capital, 31% of startups used grant funds as their initial business capital, and only 3% of startups used funds from loans [10]. Startup companies need additional funds to help them grow. Early startups expect to be funded by the government or angel investors: 29% of startups seek funding from the government, 49% from investors, and 21% from other sources [10].

Funding from angel investors is one of the sources of funding that startups are interested in due to some factors as follows:

- Angel investors generally will act as mentors to guide startup entrepreneurs.
- Angel investors tend to be more involved with the companies they invest in and are often involved in the day-to-day operations.
- Angel investors are usually motivated beyond their return on investment (ROI) desire, they enjoy helping other entrepreneurs build businesses [11].

B. Startup Valuation Model

Currently, the attention of experts to the valuation of startups is still limited. This is due to insufficient research on the determinants of valuations for private companies and on the investment decisions of angel investors [12]. Several factors are considered by investors when evaluating a company. First, the evaluation of startup companies depends not only on the characteristics of the startup companies but also on the characteristics of the investors. Investors who are interested in startup businesses include angel investors and venture capitalists. Angel investors (AI) are private investors who provide capital for new businesses and help develop them [12], [13], [14], [15]. AI tends to be more involved with the companies they invest in and is often involved in the company's day-to-day operations [11]. AI is usually motivated beyond the return on investment (ROI) they may get, and they enjoy helping other entrepreneurs build businesses [11]. When AI is motivated to mentor entrepreneurs, they might pay more attention to entrepreneurial passions, as entrepreneurs who pursue their passions tend to work harder to make their businesses successful [16].

Venture capitalists (VC) are professional investors that fund a portfolio of high-growth companies that have a transformative impact on the modern corporate landscape [17]. VCs usually do not fund startups in the early stages; instead, they target companies that are at the stage of commercializing their ideas. VCs will buy shares in these companies, nurture their growth and seek cash from a substantial return on their investment. This study focuses on the valuation model from the perspective of an angel investor. Angel investors (AI) use various criteria to make investment decisions. The following are eight critical factors in the funding criteria used by angel investors.

Factor	Criteria included
Adoption	Product interest
	Benefits
	Innovation
Product status	Status
	Technology risk
	Development risk
Protectability	Protectability
	Other barriers
Customer engagement	Market validation
	Customer engagement
Route to market	Operations
	Market entry
	Distribution partners
Market potential	Market size
	Market growth
	Market competitiveness
Relevant experience	Industry experience
	Management ability
	Team experience
	Team record
Financial model	Cashflow
	Profitability
	Realistic forecast

Source: [18]

In general, four evaluation models are often used in startup evaluations: the discounted cash flow (DCF) model, earnings multiple models, net assets model, and the venture capital model [8]. These methods require accounting information data. For example, the DCF method requires company cash flow data. This means none of these methods are fully adopted by startup companies due to the absence of accounting data, financial data, and other historical data.

This study uses the weighting method of the multi-criteria decision-making (MCDM) method; after the criteria have been determined then, they are evaluated using simple additive weighting (SAW), which is adapted from the Stankevičiene method [8]. This method consists of three stages: the first stage is done by selecting the assessment criteria; the second stage uses SAW to give weight to the predetermined criteria, and experts in their fields carry out the weighting; In the third stage, the ranking of startups that will receive funding is then determined.

C. Methods

This section consists of three subsections: first, the development of a valuation model; second, the development of the valuation model's application; and the third stage is the users' evaluation of the application.

1) Valuation Model's Development: The development of the valuation model in this study is based on several criteria:

- The valuation model in this study is for companies in the early stages of a startup.
- This valuation model is based on the perspective of angel investors because in the early stages of a startup, angel investors are the source of funding expected by the company.
- By using multi-criteria decision making (MCDM), the resulting analysis is based on several criteria to make decisions, as MCDM is based on qualitative and quantitative criteria.
- Information technology (IT) and non-IT companies use the limited valuation model. The determination of the valuation model includes: (a) The determination of the criteria used by angel investors for the development of the company; the criteria are classified for IT and non-IT companies; this determination is based on the results of previous empirical research and has been adapted to Indonesian conditions. (b) Determining the weight of each criterion; the weights are determined based on an angel investor's perspective. (c) Various experts determine the weights: the angel investors, business practitioners, and banking practitioners. (d) The score is determined by using simple additive weighting (SAW), by adding up the weighted criteria. (e) creating an Android-based valuation model application. This valuation model application is created using research and development (R&D) methods. (f) A user evaluation using the UTAUT model. The formula used is:

$$s_j = \sum_{i=1}^{k} \omega_1 \tau_{ij}$$

Where S = the sum of the weighting of all the criteria; k = criteria; w = weights; τ = criteria

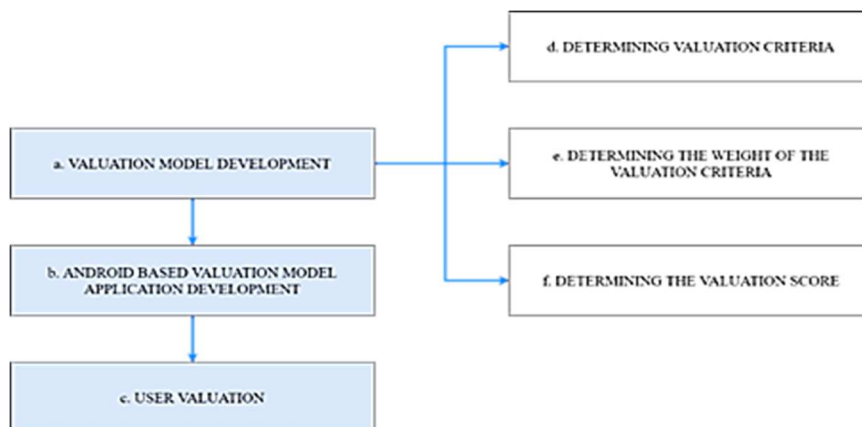In summary, the stages for making a valuation model are as follows:

Fig. 2 Stages of the Valuation Model's Development

2) Android-based Valuation Model's Application Development: This stage employs research and development methods used to produce certain products and test their effectiveness. This study uses a 4D development model developed by Thiagarajan et al. [19]. The procedure for 4D development consists of four stages: define, design, develop and disseminate. In the define phase, the determination and definition of the needs in the valuation process were carried out by both the investors and the startup companies. In the design phase, an Android-based startup valuation application is designed for the valuation of startup companies. The application's development model uses scrum. Scrum is a framework through which people can tackle complex adaptive problems while simultaneously delivering products of the highest possible value productively and creatively. Scrum exposes the ineffectiveness of product management and work techniques to continuously improve a product, a team, and work environment performance. The scrum framework consists of the scrum team and the associated roles, events, artifacts, and rules. Each component in this framework has a specific purpose, which is critical to the successful use of scrum. The scrum approach consists of activities:

- Backlog is a list of needs or features that provide value to the client's business, and the product backlog that can be created can be increased.
- Sprints are work units that are needed to meet the needs specified in the backlog, according to the time specified in the time-box; during this process, the backlog is not increased.
- Scrum meetings are routine meetings held every day to evaluate what is being done, the existing obstacles, and the completion targets for the next meeting material.
- Demo provides software upgrades so they can be demonstrated and evaluated by potential clients.

3) User's Evaluation: This application was tested on startup owners and their management to assess the users' intentions to use the application for their businesses' valuations. The users' intention assessment used the unified theory of acceptance and the use of technology (UTAUT) model. The Unified Theory of Acceptance and Use of Technology (UTAUT) is a model designed to understand and predict individual behavior in technology users, which was not achieved in the previous model.
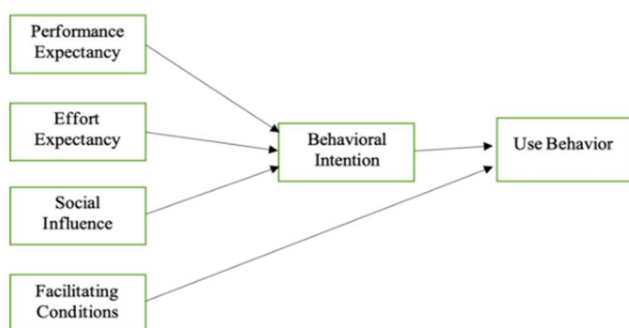

Fig. 3 Research Model. Source: [20]

UTAUT uses four constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions

which are direct determinants of user behavioral intentions in using a technology [20], [21]. The most important part of the UTAUT model is the relationship between the users' intentions and the construct's variables: performance expectancy, business expectancy, social influence and facilitating conditions [22]. Figure 3 shows the research model. The detail of the evaluation is presented as follows:

Effect of Performance Expectations on Behavioral Intentions. Performance expectancy is similar to the construct of perceived usefulness in the technology acceptance model (TAM) [21]. This variable reflects a user's perceptions of increased performance [22]. This Valuasi app is easy to use, which will increase the behavioral intention to use it. The proposed first hypothesis is H1: Performance expectancy positively affects the behavioral intention to use the early startup companies' valuation model, based on an Android mobile application (Valuasi app).

The Effect of Effort Expectations on Behavioral Intentions. Effort expectancy reflects the users' perceptions of the difficulty level of using the early startup valuation application. Based on the UTAUT theory, positive effort expectations will affect the performance expectations [20]. When a user feels that using this Valuasi app does not require much effort, the user will have high expectations of getting the expected performance. So, the proposed second hypothesis is H2: Effort expectancy positively affects the behavioral intention to use the early startup companies' valuation model, based on an Android mobile application (Valuasi app).

Social Influence on Behavioral Intentions. Social influence reflects the influence of the opinions of the users' friends, relatives, and superiors on the behavior intention [22]. Their opinions will affect the use of mobile applications by the users [23]. Furthermore, this variable reflects whether the users' environments, such as their friends, relatives, and superiors, affect the use of early startup valuation applications. The proposed third hypothesis is H3: Social influence positively affects the behavioral intention to use the early startup companies' valuation model, based on an Android mobile application (Valuasi app).

Effect of Facilitating Conditions on Usage Behavior. This variable reflects the influence of knowledge, resources, and abilities on information technology [21]. This variable reflects whether the user has the knowledge to use the application, the skills required to access and operate the internet, and the resources to provide data services [22]. The availability of the facilitating conditions will improve the user behavior. The proposed fourth hypothesis is H4: Facilitating conditions positively affect the user behavior of the early startup companies' valuation model, based on an Android mobile application (Valuasi app).

The Influence of Behavioral Intentions on Use Behavior. The existence of new technology does not necessarily foster an individual's intention to use it [24]. The use of new technology is influenced by behavioral intentions, social norms, and other opinions [20]. Behavioral intentions to use the early startup valuation mobile application affect user behavior, so the proposed fifth hypothesis is H5: Behavioral intentions positively affect the user behavior of the early startup companies' valuation model, based on an Android mobile application (Valuasi app).

III. RESULTS AND DISCUSSION

A. Development of Assessment Model

In developing the evaluation model, the indicators and grids were determined based on previous empirical research, expert judgment, and the angel investors' judgment. Furthermore, the instrument and determination of the weight of the early startup valuation model were validated by angel investors, practitioners, and academics to get the appropriate valuation model. The startup valuation model indicators for technology and non-tech companies are attached in Table 2.

TABLE II
VALUATION FOR TECHNOLOGY COMPANIES (OVERVIEW)

N	Valuation Categories	Valuation sub-categories	Questionnaire	WEIGHT (%)
	Products and technology	A1. Proprietary technology	A1.1.Is the technology proprietary?	1
			A1.2. If the technology is owned by you, have you already own, or have you applied for, HKI (patents, copyrights, industrial designs, trademarks, etc.)?	1
		A2. Technology development stage	A2.1. At what stage of development is the technology at today?	1
		A3. Researcher support	A.3.1. Is there researcher support (from the college) for the use and development of the technology?	1
			A.3.2 Reputation of researchers in the field of research	1
		A4. Materials	A.4.1. Are the raw materials imported or local?	1
			A.4.2. Form of purchased raw materials	1
		A5. Industry strategy	A.5.1. Have you implemented process technology (e.g., just in time, zero inventory, 4.0, etc.)?	2
			A.5.2. Is the production process carried out in an integrated manner or is it still separate?	2
		A6. Production result	A.6.1. Does the product being sold have a quality advantage compared to competing products?	2
			A.6.2. Are there always improvements or new product developments?	1
		A7. Economical impact	A.7.1. Does this product have a big enough economic impact?	2
		A8. Social impact	A.8.1. Does this product involve many people in its production or use?	2
		A9. Environment impact	A.9.1. Does this product have an impact on environmental preservation?	2
		A10. Use of disruptive technology to generate digital value	A.10.1. Does this product have digital value (using disruptive technology in the categories database, big data, artificial intelligence, IOT, smart sensor, 3D printing, DSP chip, embedded software, animation, virtual / augmented reality)?	2
			Sub Total	29
B	Marketing and business	B.1 Marketing strategy	B.1.1 Do you know the key to success in order to be able to sell your product and be profitable (unique selling proposition)?	4
			B.1.2 How does your product's price compare to your competitors' product prices?	4
			B.1.3 Do you implement efficiencies so that costs can be reduced and operational performance can be increased?	1
			B.1.4 Does the marketing team know what the profit rate of the product being sold should be?	2
			B.1.16 Is there a sales turnover target that must be achieved by the marketing team, and are there sanctions if it is not achieved?	2
			B.1.17 Does the marketing team make and carry out a market needs survey which becomes a reference for future marketing plans?	1
			B.1.18 Does the marketing team create and carry out a survey of competitors' products?	1
			B.1.19 Do you often hold customer gatherings in order to capture their needs?	1
			B.1.20 Does the marketing team often attend exhibitions?	1
			B.1.21 Do you know how the business volume can be enlarged (scaled up) and is there a planning document?	4
		B.2 Marketing operations	B.2.1 Does the marketing team schedule periodic visits to consumers?	1
			B.2.2 Are there records of feedback and follow-up action for consumer complaints?	1
			B.2.3 Does the marketing team have a draft proposal template, a draft cooperation agreement, or a draft contract that is ready to be used at any time?	1
			B.2.4 Does the marketing team have a good record of sending orders to consumers?	1
			B.2.5 Is the marketing team able to make bills to consumers?	1
		B.3 Marketing tools	B.3.1 Does the marketing team have marketing tools (eg printed leaflets, sample products, promotional videos, transportation tools, goody-bags, souvenirs, laptops, projectors, etc.)?	1
			Sub total	46
C	HR and organization	C.1 HR	C.1.1 Do researchers / patent holders / technology owners as employees also occupy positions in the company?	1
			C.1.2 Are all positions completely filled and have personnel?	1
			C.1.3 Is the number of existing human resources sufficient?	1
		C.2 Organization	C.2.1 Does this company already have an organizational structure?	1
			C.2.2 Is there a clear division of tasks according to functions in the organization?	1

D	Legal, financial and risk	D.1 The legality of the company	D.1.1 Does this company already have a deed of establishment by a notary?	1
		D.2 Product legality	D.2.1 Do the products sold meet the legal requirements completely (eg production permits, distribution permits, PIRT certificates, halal, BPOM, SNI, KLH, etc.)?	2
		D.3 SOP (standard operational procedure)	D.3.1 Does this company already have SOPs that regulate work procedures in each section?	1
		D.4 Financial	D.4.1 Do the finance staff record every item of expenditure and income, and store and administer evidence of financial accountability (bonds, receipts, bills, etc.)?	1
			D.4.2 Does the company have a cash flow?	2
		D.5 Risk	D.5.1 Has the company created and implemented risk management?	1

B. Android-based Valuation Model's Application

This research developed an early startup companies' valuation model based on an Android mobile application (Valuasi app) that refers to the 4D development model. This development results in an Android application that can be operated on an Android device, computer, or laptop based on Windows. This application consists of two parts: the startup section and the reviewer section.

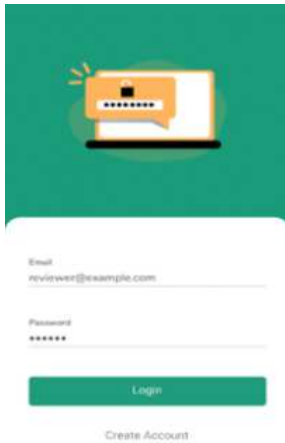*1) Startup Section:* This section is a menu to create a new account or log in.

Fig. 4 Application Homepage

Startup Homepage. After successful login, the user can see the home page, which has the following information: the user's name, the company name, score, a count button which will direct the user to the questionnaire page, a profile button which will direct the user to the complete profile information, a password button which will direct the user to a page to change the password, and an exit button which is used for logging out of the application.

Valuation Section. Users can complete the questionnaire by pressing the start button on the start page. Then they can see the category list page: product & technology categories, marketing and business, HR and organizations, and legal finance & risk. After selecting a category, several sub-categories will appear. In each sub-category, there are questions. Then the user will see the question page of the questionnaire. Users are asked to choose the most appropriate response to the company's condition and press the up button to proceed to the next question. After filling out the questionnaire in all the categories, the user will be directed to the home page, and the score will appear.
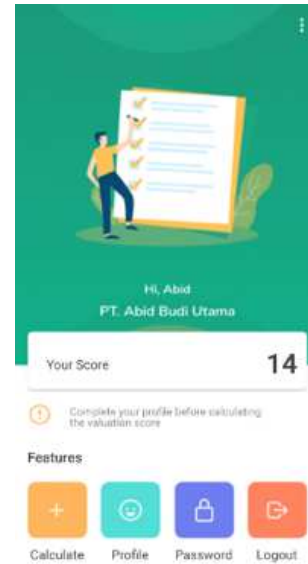

Fig. 5 Valuation Score

2) Reviewer Section: In addition to providing a valuation for startups, this application is equipped with a reviewer page that aims to facilitate access for reviewers or investors to conduct assessments and analyze startup data. To enter the reviewer page, the user must have a reviewer or admin-level account; this account can be created on the web application from the app's valuation.

Reviewer Homepage. After the user has successfully logged in, the user can see the reviewer start page, which contains information such as the startup list and the startup valuation's comparison.

Fig. 6 Startup Graphics

The startup list page contains the name of the startup and the total score of the startup. In the compare startup section, the user can compare the startup's performance by pressing the compare button.

3) System Evaluation: Before the application was released, the application was evaluated by experts and potential users. First, the expert appraisal assessed the feasibility of the startup valuation application, and material and media experts carried out validation. Second, development testing (a product trial) was carried out to find out the results of implementing the startup valuation application. Expert assessments and the product's trial generated reactions, comments, and suggestions. These results were used as the basis for carrying out modifications to the product.

C. Hypotheses Testing

The respondents in this study were the CEOs of startups or the startups' founders. Partial least squares structural equation modeling (PLS-SEM) was used for testing the measurement and structural models. The measurement model assessed the reliability and validity of a measure's (indicator's) specific construction, while the structural model examined the relationship between the constructs.

1) Measurement Model's Analysis: The analysis of the measurements of this study revealed that all the measures were significant and above the loading level of 0.60, indicating that the measures had more variance with their respective constructs than with the error variance. The results showed that all the measures met the convergent validity requirements because all the measures had a loading of above 0.60 for the expected construct and discriminant validity (Table 3).

TABLE III
COMBINED LOADING AND CROSS-LOADING

	BI	EE	FC	PE	SI	UB	Outer Loading	P Value
BI1	**0.91**	0.63	0.71	0.71	0.75	0.72	0.91	0.00
BI2	**0.94**	0.56	0.69	0.76	0.72	0.84	0.94	0.00
BI3	**0.96**	0.70	0.81	0.79	0.77	0.91	0.96	0.00
EE1	0.58	**0.90**	0.69	0.71	0.76	0.56	0.90	0.89
EE2	0.66	**0.94**	0.80	0.63	0.69	0.64	0.94	0.89
EE3	0.62	**0.95**	0.76	0.62	0.69	0.55	0.95	0.89
EE4	0.60	**0.86**	0.76	0.66	0.71	0.47	0.86	0.89
FC1	0.73	0.77	**0.83**	0.73	0.74	0.71	0.83	0.40
FC2	0.70	0.70	**0.91**	0.70	0.78	0.66	0.91	0.40
FC3	0.61	0.71	**0.83**	0.54	0.67	0.53	0.83	0.40
FC4	0.69	0.68	**0.89**	0.61	0.75	0.70	0.89	0.40
PE1	0.74	0.69	0.77	**0.95**	0.75	0.66	0.94	0.02
PE2	0.76	0.58	0.60	**0.92**	0.71	0.67	0.92	0.02
PE3	0.68	0.74	0.75	**0.88**	0.76	0.74	0.89	0.02
PE4	0.76	0.59	0.63	**0.88**	0.67	0.64	0.88	0.02
SI1	0.81	0.80	0.83	0.81	**0.97**	0.77	0.96	0.04
SI2	0.76	0.69	0.79	0.70	**0.97**	0.68	0.97	0.04
SI3	0.75	0.75	0.83	0.78	**0.96**	0.77	0.96	0.04
USE1	0.88	0.61	0.76	0.74	0.74	**1.00**	1.00	

Values in bold show the highest loading factor value in each column

2) Structural Model's Analysis: The structural model was used to test the hypothesized relationships. The results of the structural model are presented in Fig. 7.
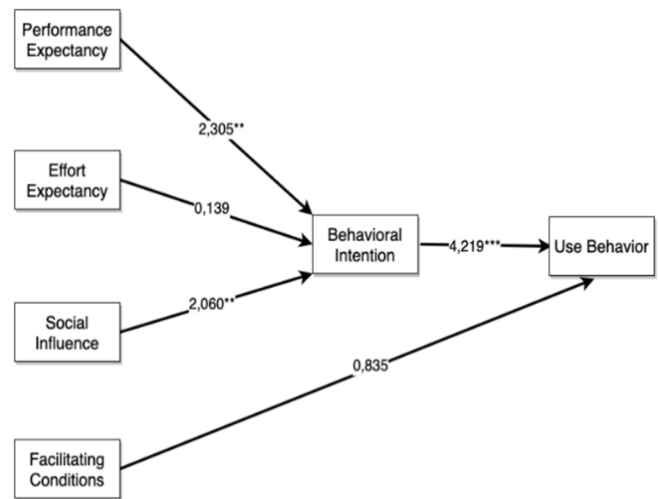
Notes: ***= p < 0.01; **= p < 0.05; *= p < 0.1
Fig. 7 Structural Model's Analysis

Performance expectancy had a significant positive effect on behavioral intention (β=2.305; p<0.05), so H1 is supported. Social influence also significantly affected behavioral intention (β=2.060; p<0.05), so H3 is supported. Behavioral intention also had a positive effect on user behavior ((β=2.060; p<0.01), therefore H5 is supported. However, effort expectancy and facilitating conditions did not affect use behavior, so H2 and H4 are not supported.

IV. CONCLUSION

When trying to scale up the company, one of the greatest difficulties for a startup company is access to funding. To get access to funding, a business valuation is needed. This research's primary objective has been to develop a valuation model for early startup companies based on an Android mobile application (Valuasi app). This valuation model is expected to help early startup companies conduct business valuations, so they can attract investors, especially angel investors. The research method uses research development methods. The first stage is to develop a valuation model. A valuation model can be established with the criteria and the weighting the angel investors use when evaluating companies. The second stage is to develop an early startup companies' valuation model based on an Android mobile application (Valuasi app). The material experts, media experts, and users gave very good to good ratings of the Valuasi app. The third stage is user acceptance testing using the UTAUT model. The test results show that performance expectancy and social influence positively and significantly affect behavioral intentions. This finding supports [22]. In addition, environmental factors such as the opinions of the users' friends, relatives, and superiors play an important role in influencing the users' behavioral intentions. Behavioral intentions have a positive and significant effect on user behavior. However, there are still weaknesses in the application, so improvements are needed to meet the effort expectations of the users.

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