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Kewarganegaraan	:	Indonesia
Jenis Ciptaan	:	**Karya Ilmiah**
Judul Ciptaan	:	**Curriculum Design For Digital Financial Innovation In Higher Education Institutions In Indonesia**
Tanggal dan tempat diumumkan untuk pertama kali di wilayah Indonesia atau di luar wilayah Indonesia	:	23 September 2022, di Bandung
Jangka waktu pelindungan	:	Berlaku selama 50 (lima puluh) tahun sejak Ciptaan tersebut pertama kali dilakukan Pengumuman.
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Jurnal Manajemen Teknologi

Indonesian Journal for the Science of Management

ISSN: 1412-1700
Volume 15 Number 1 2016
Accredited by DGHE
SK No. 81/DIKTI/Kep/2011

15
Number 1 2016
Accredited by DGHE

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Vol 21, No 3 (2022)

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Jurnal Manajemen Teknologi, 21(3), 2022,319-338
Available online at http://journal.sbm.itb.ac.id

Curriculum Design for Digital Financial Innovation in Higher Education Institutions in Indonesia

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Abstract. *Due to rapid technological advancement, the financial industry is now transitioning from traditional to digitally based financial services. In Indonesia in particular, this transformation is being carried out in accordance with the idea of digital finance innovation. However, within the Indonesian financial industry, there is a competency gap that hinders the rate of progress of this transformation. Accordingly, this study aims to create a curriculum designed explicitly for digital finance innovation for Indonesian higher education institutions in order to address the existing competency gap. Through the application of multivariate regression analysis, eight required competencies and their respective subjects were identified in this study. The identified competencies can provide insights for higher education institutions in creating a curriculum to ensure that their future graduates can fill the competency gap within the Indonesian financial industry. The results of the study state that: (i) an effective and appropriate relationship between DA, RM, BM, and SM competencies and can improve the ability of financial institutions to identify and manage risks in their environment; (ii) the relationship between FIK knowledge and PRO and BM competencies can help financial institutions ensure that their DFI products, such as applications, meet the standards set by regulators and improve management practices; (iii) the relationship between FL and PRO competencies can improve the organization's ability to reduce the possibility of miscommunication and misperceptions surrounding DFI ideas. Hence, these findings have implications for the university curriculum that implements them, bolstering the output of graduates who can help accelerate the actualization of the digital financial innovation agendas of the Indonesian financial industry.*

Keywords: *digital finance innovation; financial technology; higher education institutions*

Abstrak. *Dengan pesatnya kemajuan teknologi yang terjadi, industri keuangan kini berada pada fase transisi dari layanan keuangan tradisional ke layanan keuangan berbasis digital. Khusus di Indonesia, transformasi dilakukan dengan mengikuti ide inovasi keuangan digital. Namun, dalam industri keuangan Indonesia, terdapat gap kompetensi yang menghambat laju kemajuan transformasi. Oleh karena itu, penelitian ini bertujuan untuk membuat kurikulum yang dirancang secara eksplisit di bawah inovasi keuangan digital untuk institusi pendidikan tinggi di Indonesia dalam rangka mengatasi kesenjangan kompetensi yang ada. Melalui penerapan analisis regresi multivariat delapan kompetensi yang dibutuhkan dan subjek masing-masing diidentifikasi. Kompetensi yang teridentifikasi dapat memberikan wawasan bagi institusi pendidikan tinggi dalam membuat kurikulum untuk memastikan lulusan masa depan mereka dapat mengisi gap kompetensi di industri keuangan Indonesia. Hasil penelitian menyatakan bahwa (i) Hubungan yang efektif dan tepat antara kompetensi DA, RM, BM, dan SM dapat meningkatkan kemampuan lembaga keuangan dalam mengidentifikasi dan mengelola risiko berada di dalam lingkungannya, (ii) Hubungan antar pengetahuan FIK dengan kompetensi PRO dan BM dapat membantu lembaga keuangan memastikan produk IKD mereka seperti aplikasi dalam memenuhi standar yang ditentukan oleh regulator seiring dengan peningkatan praktik manajemen dan (iii) Hubungan antara kompetensi FL dan PRO dapat meningkatkan kemampuan organisasi untuk mengurangi kemungkinan miskomunikasi dan persepsi yang salah tentang ide IKD. Oleh karena itu, hasil temuan ini berimplikasi bagi Kurrikulum PT yang menerapkannya, memungkinkan output lulusannya dapat membantu industri keuangan Indonesia mempercepat aktualisasi agenda inovasi keuangan digital*

Kata kunci: *Inovasi keuangan digital, teknologi keuangan, institusi pendidikan tinggi*

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Received: September 5th, 2022; Revision: September 19th, 2022; Accepted: September 23th, 2022
Print ISSN: 1412-1700; Online ISSN: 2089-7928. DOI: http://dx.doi.org/10.12695/jmt.2022.21.3.6

Introduction

Technological advancement has changed business landscapes, especially in information and financial domains (International Trade Centre, 2018). The level of disruption caused by technological advancement has changed the ways that the financial industry interacts with its customers. The products they produce now provide more convenience to their users, including financial systems, lending activities, wealth management, insurance, and even financial planning. Furthermore, this disruption has also led to digital banking and financial technology (fintech) (Arjunwadkar, 2018; Simatupang, 2021). Therefore, each company has to adapt to changes as the initial efforts to solve the impacts accordingly. Adaptation in this context means that companies have to immediately adopt new technologies, and more or less be able to effectively and accurately make use of available technology to help them ensure sustainability.

Technological advancement and digital transformation allows the fintech industry to diversify services and products to meet users' financial needs (see Arner, Barberis, & Buckley, 2017; Iman, 2020; Mehrban et al., 2020; Romanova & Kudinska, 2016). At this level, fintech industry has covered services and products currently offered by traditional banks. Although the products and services offered by fintech companies are relatively similar to those of the banks, they are considered more advanced because they are able to reduce operational costs, target and penetrate market niche, and give more personal services to existing and potential customers (Lee & Shin, 2018).

The advancement of fintech industry growth occurring in Indonesia has also reached the stage where Indonesian regulators have to interfere to ensure co-existence between fintech companies and conventional banks, providing protection for customers in financial sectors. Indonesian regulators (the Financial Service Authority/ *Otoritas Jasa Keuangan*) issued a legal framework for fintech companies in 2016, with regulations including three important aspects related to their activities and operation regarding: (1) rights, responsibilities and prohibition, (2) customer recognition and protection, and (3) education and development (Davis, Maddock, & Foo, 2017). However, from educational and developmental perspectives, Indonesia faces some drawbacks and challenges to improving the growth rate of national financial inclusion. According to the Indonesian Fintech Association [AFTECH] (2020), the Indonesian fintech industry needs special knowledge, talent, and expertise in the domains of data analysis, programming, risk management, financial industry, business, and marketing. As long as there is a competency gap in Indonesian fintech industry, it will hinder the progress of thefintech industry in creating and realizing Digital Financial Innovation (DFI) that can be used to accelerate the growth rate of financial inclusion in Indonesia.

In addition, if this competency gap is not immediately solved, it can decrease the fintech industry's ability to conduct (one or more) business coverages that are defined within the DFI concept. Specifically, by referring to the regulations of Financial Service Authority Number 13/2018, the DFI is divided into eight business coverages: (1) transactional solutions, (2) capital increase, (3) investment management, (4) fund raising and distribution, (5) insurance, (6) market support, (7) other digital financial supports, and (8) other financial service activities.

The role of higher education institutions is very important in solving the competency gap of the fintech industry. In the context of Indonesia, the role of higher education institutions as suppliers of highly competent individuals (workforce) is emphasized in state law, and it is also expected of such higher education institutions that they ensure their graduates obtain the skills needed to work in the 4.0 industrial era (Ministry of Research, Technology, 2016, 2019).

However, there is no curriculum explicitly designed to fulfill the fintech industry's need for experts in actualizing DFI agendas and completing all requirements determined in the Indonesian Qualification Framework for learning results. Based on this brief bcakground above, the purpose of this research is to provide a curriculum that concentrates on DFI concepts for higher education institutions in Indonesia.

More specifically, there are two objectives of this study:

- To identify which courses in higher education institutions are significant in fulfilling the needs required to improve the growth rate of Indonesian financial inclusion through DFI; and
- to recommend curriculum materials designed explicitly in accordance with the competencies needed by DFI concepts in the future, which represent 18 business clusters.

The findings of this research provide information needed by the management of Indonesian higher education institutions to design and make curriculum reflecting DFI concepts. In addition, the information revealed in this research will help higher education institutions improve their involvement in developing and creating graduates on the importance of DFI. This can thereby improve the effective roles of higher education institutions in reducing the burden taken on by the Indonesian financial industry in reducing the competency gap available in this area, especially in the case of the Indonesian fintech industry.

Therefore, the more graduates that know and comprehend the relations between the domains of financial industry, business, computer science, management, and information technology (IT), the easier it becomes for Indonesia to improve the growth rate of its financial inclusion.

Theoretical Framework and Hypothetical Development

DFI development has made changes towards market demand of competency or expertise, especially in the financial industry. DFI products require technical and managerial skills, as well as related knowledge of financial industry.

The AFTEC (2020) stated that there are eight competency gaps that need to be addressed, including, among others,: *data analytics* (DA), *programming* (PRO), *risk management* (RM), *financial industry knowledge* (FIK), *user interface* and *user experience* (UIUX), *business* and *management* (BM), *sales* and *marketing* (SM), and *foreign languages* (FL). Therefore, the need of competency gap is obtained from some competency sources in the field of DFI. The hypotheses of this research are based on these eight gaps and seek to examine the integration influences between competencies.

Hypothesis Development

DA and PRO competencies are competencies that study information systems to support IT capabilities. In a previous study, Cárdenas-Navia (2015) stated that individuals with PRO competency are also supported by having a strong understanding of data analytics. In the curriculum for information systems made by Topi et al. (2010), it was found that, to support DA and PRO expertise, there should be basic competencies related to the creation of information systems, data and information management, data mining, and information search and retrieval. Therefore:

H1: DA competency positively influences PRO competency and vice versa.

In the process of making an application, fintech website, or digital banking, PRO, DA and UIUX competencies must be integrated (Kang, 2016). In order to support UIUX expertise, DA competency must be used to optimize user preference and patterns through big data analytics that can be used to make UIUX *(Hussain et al., 2014; Lutfi & Fasciani, 2017).*

Conversely, UIUX competency can bolster DA expertise when presenting *data visualization systems,* which facilitates the DA process '. Meanwhile, through integration of PRO and UIUX competencies, the data process can be conducted in the back-end and front-end of a website or an application to make it easier and faster to use . This leads us to the following hypotheses:

H2: DA competency positively influences UIUX competency and vice versa;

H3: PRO competency positively influences UIUX competency and vice versa.

UIUX expertise or competency can also be integrated with FIK knowledge and competency and/or RM expertise, particularly in the fintech industry, for example, in using Application Program Interfaces (API). Initially, API was in innovation in UIUX, used for easy payment processes. In risk mitigation of shadow banking, the API standard was finally created and arranged by regulators of the financial industry (Arjunwadkar, 2018). When applying API, RM can be said to play a role in supporting UIUX development of a company in accordance with the regulations learned in FIK. Therefore, we arrive at the following hypotheses:

H4: UIUX competency positively influences FIK competency and vice versa;

H5: UIUX competency positively influences RM competency and vice versa;

H6: RM competency positively influences FIK competency and vice versa.

Integration of competency and/or DA, PRO, and RM expertise owned by a financial company can lead to integration in other DFI activities (Mckinsey & Company, 2020). DA and PRO can support the risk assessment process with RM expertise, such as credit risk analysis, security and fraud management, and reputational risk *(X. He, 2019; Pavlidis, Filter, & Buschulte, 2019).* Conversely, RM competency can support DA and PRO expertise in predicting risks of DA and PRO activities, such as cyber-security and fraud risk aspects (Andriyas, Simatupang, & Sirait, 2019).

H7: DA competency positively influences RM competency and vice versa;

H8: PRO competency positively influences RM competency and vice versa.

RM, BM, SM, and FL expertise can also be positively integrated in non-tech fields. Reputation risk is one such example . The role of RM competency in supporting risk governance, system integration, and operation risks aspects is the maintenence of the company's reputation. Meanwhile, the role of BM competency is related to business ethics used to maintain a company's reputation.

It also includes SM competency, such as marketing communication and *branding* (CIM, 2016) and is supported by FL competency related to linguistic skills, such as writing and oral skills that can influence a company's image (Hadjichristidis, Geipel, & Savadori, 2015). This leads us to:

H9: RM competency positively influences BM competency and vice versa;

H10: RM competency positively influences SM competency and vice versa;

H11: RM competency positively influences FL competency and vice versa ;

H12: BM competency positively influences SM competency and vice versa;

H13: BM competency positively influences FL competency and vice versa;

H14: SM competency positively influences FL competency and vice versa .

The financial industry is a highly regulated industry, which means that FIK can influence decision making processes of BM in the financial industry (Jagtiani & John, 2018) and vice versa (Romanova & Kudinska, 2016). DA and PRO competencies can aid BM expertise (Bach, Krstič, Seljan, & Turulja, 2019; Srivastava & Gopalkrishnan, 2015). Financial regulation of FIK competency, will influence the competency standards of DA and PRO because they must fulfill requirements and be in accordance with the law applied by regulators regarding topics such as customer privacy protection, mitigation and fraud prevention, and data and information security –(Bamberger, 2010; Klus, Lohwasser, Holotiuk, & Moormann, 2019).

On the other hand, UIUX competency can support BM by serving customers through displays and experiences appreciated by customers . BM competency can support managerial expertise in DA, PRO, and UIUX expertise. Therefore, we hypothesize that:
H15: FIK competency positively influences DA competency and vice versa ;
H16: FIK competency positively influences PRO competency and vice versa;
H17: FIK competency positively influences BM competency and vice versa;
H18: BM competency positively influences DA competency and vice versa;
H19: BM competency positively influences PRO competency and vice versa;
H20: BM competency positively influences UIUX competency and vice versa.

The highly regulated financial industry makes FIK competency capable of supporting SM and FL expertise in communication, according to the financial industry regulations (Larsson & Viitaoja, 2017; Sunikka, Bragge, & Kallio, 2011), and particulary international banking *(Konara & Wei, 2014)*. On the contrary, SM competency is also relevant to marketing activities, such as DFI product creation, which is adjusted to consumer needs that can influence changes in developing FIK insight (Arjunwadkar, 2018). FL competency development is going to influence document writing, such as of policies or regulations, through consideration of readability problems in information processing of FIK insights (Besuglov & Crasselt, 2021).
H21: FIK competency positively influences SM competency and vice versa;
H22: FIK competency positively influences FL and vice versa.

DA, PRO, FL, UIUX, and SM competencies can support and integrate with each other. For example, in the making of fintech companies' applications or websites, DA and PRO competencies can play a role in helping SM expertise of business intelligence activities in collecting and analyzing data that can be in social media, image, text, and the clickstream needed to carry out marketing research (Moro, Cortez, & Rita, 2015).

Marketing research results in SM competency that can support UIUX competency in designing interesting displays and accesses popular among consumers . Alternatively, FL competency can influence the use of copywriting in supporting UIUX, especially in making websites or applications.

In regards to DA and PRO expertise, FL competency mitigates misperceptions and miscommunications when making websites or applications (Arévalo, Cantera, García-Marina, & Alves-Castro, 2021). DA and PRO competencies can become mediators, such as in applications and websites, in the effectiveness of the FL communication learning process (Kern, 2014; Shirkhani & Fahim, 2011).
H23: SM positively influences DA competency and vice versa;
H24: SM competency positively influences PRO competency and vice versa;
H25: SM competency positively influences UIUX competency and vice versa;
H26: DA competency positively influences FL competency and vice versa;
H27: PRO competency positively influences FL competency and vice versa ;
H28: UIUX competency positively influences FL competency and and vice versa.

Research Methodology

Data collection
In this research, data collection was performed with questionnaires. The data collection used here includes information on the perception of fintech company leaders regarding the importance of certain academic competencies needed to make and actualize DFI curriculae. The data were obtained through questionnaires that were distributed and answered by AFTECH members. Additionally, the respondents who were desginated as questionnaire targets were those with positions in their company's middle or upper management. Out of 86 companies registered as AFTECH members, there were only 14 companies that filled out the questionnaires, resulting in a response rate of 16%.

Variable Operationalization

The group of variables (i.e., the competencies needed and each subject course) used to develop a curriculum oriented toward DFI concepts were based on a literature review.

The variables obtained were used as part of the questionnaire to reveal the competencies needed to create and actualize DFI in Indonesia's financial industry. The competencies related to DFI identification are presented in Table 1.

Table 1
Variable Operationalizations

Variable	Competency	Sub competency	Subject	Source
X1	*Data and analytics*	X1-1	*Data quality*	(Ghasemaghaei, Ebrahimi, & Hassanein, 2018)
		X1-2	*Big data*	
		X1-3	*Domain knowledge*	
		X1-4	*Analytical skills*	
		X1-5	*Information system foundation*	
X2	*Programming*	X2-1	*Enterprise architecture*	(Topi et al., 2010)
		X2-2	*Data analysis and design*	
		X2-3	*Business process management*	
		X2-4	*Business intelligence and data mining*	
		X2-5	*Enterprise system*	
		X2-6	*Information search and retrieval*	
		X2-7	*IT management*	
		X2-8	*IT infrastructure*	
		X2-9	*Data and information management*	
		X2-10	*System analysis and design*	
		X2-11	*IT audit and control*	
		X2-12	*IT security and risk management*	
		X2-13	*Information system strategy, management, and acquisition*	
X3	*Risk management*	X3-1	*Operational risk*	(Boyson, 2014)
		X3-2	*Integration risk*	
		X3-3	*Governance risk*	
X4	*Financial industry knowledge*	X4-1	*Financial services industryes*	(IBM, 2016)
		X4-2	*Financial industry regulations*	
		X4-3	*Organization knowledge*	
X5	*User interface and user experience*	X5-1	*User interface and user experience*	

Table 1 (Continued)
Variable Operationalizations

Variable	Competency	Sub competency	Subject	Source
X6	*Business and management*	X6-1	*Business markets*	(IBM, 2016)
		X6-2	*Business process design*	
		X6-3	*Business ethics*	
		X6-4	*Operational function*	
		X6-5	*Process management*	
		X6-6	*Product and services*	
		X6-7	*Decision making and critical thinking*	
		X6-8	*Communication and interpersonal skills*	
X7	*Sales and marketing*	X7-1	*Sales forecasting*	(Blanch & Volbeda, 2016)
		X7-2	*Data analysis, synthetization, and evaluation*	
		X7-3	*Sales pitch*	
		X7-4	*Buyer behavior*	
		X7-5	*Relationship management*	
		X7-6	*Digital integration*	
		X7-7	*Product management*	
		X7-8	*Customer experience*	(CIM, 2016)
		X7-9	*Partnership marketing*	
		X7-10	*Risk and reputation management*	
		X7-11	*Brand*	
		X7-12	*Integrated marketing communication*	
X8	*Foreign language*	X8-1	*Foreign language*	(Andrivna & Mykolaivna, 2021)

However, such analysis does not consider inter-dependence among the competencies needed, which can provide companies in related financial industries with insight on the competencies needed, and specifically those which can help them actualize the agenda of their digital innovation. Furthermore, such findings can also be used to motivate higher education curricula to develop and create students with the specific competencies needed in the financial industry.

The statistical approach used to determine significance and inter-dependence among competencies needed to design DFI curriculum will be explained further in the next sub-sections.

Table 2
The Importance Of Competencies Needed For DFI (N = 14).

Label	Competency	$\bar{x}$	*SD*
X1	*Data analytics*	2.34	0.56
X2	*Programming*	2.13	0.50
X3	*Risk Management*	1.76	0.33
X4	*Financial industry knowledge*	2.12	0.56
X5	*User interface and user experience*	2.50	0.65
X6	*Business and management*	2.05	0.44
X7	*Sales and marketing*	2.05	0.53
X8	*Foreign language*	2.07	0.73

Note: Likert scale is from 0 ("do not agree and not relevant") to 3 ("agree and relevant"); the higher an average score is, the more relevant and significant the competency needed for DFI will be $\bar{x}$ = average, *SD* = standard deviation.

Research Methods

In this study, there were various ways to determine significance and inter-dependence among variables needed (represented in Table 2). First, the significance level analysis of competency needed was conducted by multivariate regression. Each competency needed acted as a dependent variable available in eight regression model equations. Other competencies not used as dependent variable were used as independent variables. The approach was conducted to reveal what other competencies had a positively significant (or very relevant) influence on the dependent variables.

Multivariate Regression Model

In this research, we use statistical calculation as a tool to analyze and interprete data, so as to reduce the raw data interpretation used. The analysis focuses on the significance level of competencies needed for a multivariate regression.

In this context, the need for competency or expertise was assigned a role as a dependent variable in the regression model. Therefore, the dependent variables of: data analytics (DA), programming (PRO), risk management (RM), financial industry knowledge (FIK), user interface and user experience (UIUX), business and management (BM), sales and marketing (SM), and foreign languages (FL) had regression equations. Each dependent variable in the regression had another competency as an independent variable. The regression equations used in this research were as follows:

$$DA = \alpha + \beta_1 X_2 + \beta_2 X_3 + \beta_3 X_4 + \beta_4 X_5 + \beta_5 X_6 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (1)$$

$$PRO = \alpha + \beta_1 X_1 + \beta_2 X_3 + \beta_3 X_4 + \beta_4 X_5 + \beta_5 X_6 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (2)$$

$$RM = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_4 + \beta_4 X_5 + \beta_5 X_6 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (3)$$

$$FIK = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_5 + \beta_5 X_6 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (4)$$

$$UIUX = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_6 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (5)$$

$$BM = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_7 + \beta_7 X_8 + \varepsilon \quad (6)$$

$$SM = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_8 + \varepsilon \quad (7)$$

$$FL = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon \quad (8)$$

In these equations ((1) up to (8)), α is an intercept value, β_(1…7) is the regression coefficient, ∈ is standard error coefficient, and X_i (i=1,…n) are independent variables of regression equations. Each independent variable was analyzed to determine and explain competencies that were relevant and important for shaping and educating future graduates in a given expertise. For example, in relation to DFI, if RM is statistically significant against DA competency, higher education institutions should prepare their students basic understanding, mechanisms, and work procedures in RM practices. Such knowledge can then be combined with a statistical model and DA technique which is appropriate to provide information with relevant, reliable, and accurate risk orientation. In this manner, graduates can use the combination of knowledge and expertise to help financial institutions reduce specific risks in their industry

Results And Discussion Of Respondents' Profiles

As shown in Table 3, it was found that around 36% of the total participants were those with leadership positions held in different assignments (for example: digital marketing, communication, and state positions), which differ in responsibility and traditional accountability, and are usually found in other leadership positions (for example: operational, legal, and information).

The other respondents (64%) held traditional positions in their companies' organizational structure, including from middle management to upper management. Although the number of samples was limited, the data highlights the need to increase the growth rate of Indonesian finance through digital financial innovation. Higher education institutions can use this insight in formulating and determining courses that can fulfill the demand of one or various types of expertise in the Indonesian financial industry.

Table 3
Sample Characteristics

Category	Frequency	Percentage
Gender		
Male	7	50.00%
Female	7	50.00%
Total	14	100%
Position		
Chief Executive Officer	2	14.29%
Chief Operating Officer	1	7.14%
Vice President	2	14.29%
Operations Director	1	7.14%
Legal Director	1	7.14%
Specialized Director	5	35.71%
General Manager	1	7.14%
Manager	1	7.14%
Total	14	100%

Some respondents shared general views on competency or expertise needed by fintech companies to complete operational activities, as well as the governance mechanisms that they used to create more accurate information and help the company leaders in making effective decisions and solutions. Other respondents showed that the need in Indonesia's fintech industry was mainly oriented toward the domain of company governance, such as in roles related to internal auditing, compliance, and consumer protection.

Based on different insights obtained from the respondents, we can conclude that there was a division in the worries among the company leaders and fintech managers. Firstly, this related to how they effectively used available technology and analytical methods to improve their services and products. Secondly, this addressed how respondents gave attention in regards to how fintech companies effectively and completely ensured that their business activities complied with the law issued by regulators (which include the Financial Service Authority and Bank Sentral Indonesia). In this case, the graduate candidates were expected to be able to understand how company governance operates in practice and how they can effectively improve company activities through accurate application of available technology, particularly when realizing the agenda of digital financial innovations.

Result analysis and validity and reliability measurement

The construct and variables of validity and reliability results are shown in Table 4. Construct reliability and validity was evaluated using Cronbach Alpha and factor analysis. As a whole, most constructed with UIUX, and FL had a Cronbach Alpha value above 0.6, indicating that the respondents' answers can be considered consistent and reliable.

Based on the guideline determined by Hair et al. (2014), a construct is considered reliable and valid when three requirements are met, as follows: (1) Cronbach Alpha value > 0.6, (2) minimum eigenvalue > 1, and (3) factor loading of at least > 0.5.

From Table 4, it can be seen that UIUX and FL were not valid and not reliable. Based on Cronbach Alpha, the assessment of reliability needs at least two items in the construct with the purpose of approaches mentioned in order to check internal consistency among them. Meanwhile, the analysis of factor loadings assessed the items' correlations and variance, which were calculated in each construct using at least two items. Aside from these two constructs, the rest can be considered valid and reliable.

Table 4
Validity And Reliability Test Result At DFI

Required Competency	*Subjects*	$\bar{X}$	*SD*	*Factor Loading*	*Cronbach Alpha*	*Eigenvalue (% of cumulative variance)*
Data analytics (X1)	X1-1	2.50	0.76	0.81	0.782	1.178 (82.8)
	X1-2	2.43	0.65	0.923		
	X1-3	2.07	1.00	0.726		
	X1-4	2.64	0.50	0.842		
	X1-5	2.07	0.92	0.666		
Programming (X2)	X2-1	1.93	0.92	0.72	0.905	1.031 (78.9)
	X2-2	2.14	0.66	0.591		
	X2-3	2.14	0.54	0.741		

Table 4 (Continued)
Validity And Reliability Test Result At DFI

Required Competency	*Subjects*	$\overline{x}$	*SD*	*Factor Loading*	*Cronbach Alpha*	*Eigenvalue (% of cumulative variance)*
	X2-4	2.29	0.73	0.776		
	X2-5	1.64	0.75	0.697		
	X2-6	2.07	0.62	0.877		
	X2-7	2.14	0.66	0.716		
	X2-8	1.86	0.77	0.664		
Programming (X2)	X2-9	2.29	0.47	0.615		
	X2-10	2.43	0.51	0.617		
	X2-11	2.29	0.61	0.592		
	X2-12	2.43	0.65	0.715		
	X2-13	2	0.78	0.847		
Risk management (X3)	X3-1	2	0.88	0.938	0.938	2.679
	X3-2	1.71	0.99	0.968		(89.3)
	X3-3	1.57	1.02	0.929		
Financial industry knowledge	X4-1	2.36	0.63	0.744	0.64	1.813
(X4)	X4-2	2.36	0.63	0.819		(60.4)
	X4-3	1.64	1.01	0.767		
User interface and user experience (X5)	X5-1	2.5	0.65	NA	NA	NA
Business and management	X6-1	2.07	0.83	0.84	0.938	5.611
(X6)	X6-2	1.93	0.83	0.837		(70.1)
	X6-3	1.93	0.92	0.822		
	X6-4	2.07	0.92	0.94		
	X6-5	1.93	0.83	0.892		
	X6-6	2.21	0.58	0.685		
	X6-7	2.14	0.95	0.791		
	X6-8	2.14	0.95	0.87		
Sales and marketing (X7)	X7-1	1.86	0.77	0.637	0.933	1.13
	X7-2	2.29	0.61	0.609		(81.5)
	X7-3	1.86	0.95	0.86		
	X7-4	2.07	1.07	0.565		
	X7-5	1.93	0.92	0.825		
	X7-6	2.14	0.66	0.531		
	X7-7	2.07	0.92	0.853		
	X7-8	2.29	0.83	0.896		
	X7-9	2.14	0.77	0.907		
	X7-10	2.07	0.92	0.76		
	X7-11	1.86	0.86	0.9		
_	X7-12	2	0.96	0.911		
Foreign language (X8)	X8-1	2.07	0.73	NA	NA	NA

Note. x = average; SD = standard deviation; NA = not applicable (cannot be applied).

Regression Result

The regression result on the influence of competencies needed (independent variables) on special expertise competencies (dependent variables) needed for DFI can be seen in Table 5. Although statistical significance level varied among these independent variables in each regression model, the findings show that only some competencies are needed and can be considered relevant for expertise requirements in a DFI context. Conversely, there were some independent variables with negative influences on dependent variables in some regression models, indicating that some competencies needed are considered irrelevant based on expertise. Therefore, although such competencies are considered to be a part of designing DFI curriculum, they shall not improve expertise or lend additional ability for specific expertise in DFI. In the regression model, all of them had high and significant *F* ratios, at the statistically significant level of 5%.

Out of 28 hypotheses, six were found to besignificant, i.e.: (1) H7, (2) H10, (3) H12, (4) H16, (5) H17, and (6) H27, where the significance level of independent variables in each regression model varied, ranging from 1% to 10%. The findings of the regression analysis are presented in eight expertise needed for DFI, i.e. (1) DA, (2) PRO, (3) RM, (4) FIK, (5) UIUX, (6) BM, (7) SM,(8) FL.

The regression model of DA showed that only RM competency (B=1.02;P<10%) had a significant effect and was able to positively improve DA expertise. The DA regression model was the only one with single independent variables that were statistically significant, while the other regression models are at least supported by independent variables that were statistically significant.

The regression model of PRO showed that FIK competency (B=0.89;P<1%) and FL (B=0.255;P<5%) were very relevant and able to improve the ability of PRO expertise. BM competency (B=-0.52;P<10%) was also statistically significant in the PRO regression model. However, in this case, such competency was considered to be irrelevant because of its negative influence on dependent variables.

In the regression model of FIK, PRO competency (B=0.971;P<5%) and BM competency (B=0.681;P<5%), were very relevant and positively able to improve FIK knowledge. However, FL competency (B=-0.237;P<5%) did not influence FIK knowledge positively. This indicates that FL competency was considered irrelevant to FIK knowledge.

In the regression model for BM competency, it was found out that competencies of FIK (B=0.907;P<5%) and SM (B=0.019;P<1%) positively influenced BM expertise. However, PRO competency (B=0.836;P<10%) was found to be irrelevant for BM expertise.

The regression model for FL showed that only PRO competency. The regression model for FL showed that only PRO competency (B=2.599;P<5%) positively influenced FL expertise in the making of a DFI curriculum. FIK competency(B=-2.217;P<5%) was considered irrelevant to FL expertise.

The competency models of DA (B=0.4;P<10%) and SM (B=1.69;P<5%) positively influenced RM expertise.

The regression model of SM expertise was influenced positively by the competencies of RM (B=0.324;P<5%) and BM (B=0.754;P<5%). This indicates that both competencies were considered relevant to SM expertise.

The UIUX competency showed that there was no competency that was statistically significant. This finding shows that in a DFI context, the UIUX expertise does not depend on other competencies.

Discussion

The statistical findings described in the previous part show that each expertise needed for DFI had every competency considered relevant and could lead to improved, additional capability. Therefore, Table 6 presents the rank of related competencies that are able to improve the types of expertise needed for DFI.

DA expertise can further be supported and improved by adding RM. This is eventually no doubt, in consideration of RM role in a company, to help leaders identify threats and opportunities facing a company's industry (Boyson, 2014; Bromiley, McShane, Nair, & Rustambekov, 2015). This finding indicates that complimenting DA expertise with RM competency can increase a company's ability and capacity to make more accurate, risk-oriented decisions, particularly in conditions related to companies' internal and external environments. The information made by the company contributes to more effective decisions determining which needs are to be improved in order to guarantee an acceptable level of performance. In this case, higher education institutions are recommended to teach future graduates about the need and importance of RM in the DA domain to make sure the finding that the students have is useful for the company, either in helping the company adapt with its environment or in accurately indicating areas for improvement in business processes.

Competency in PRO as related to DFI can further be improved by applying knowledge related to FIK and FL competencies. In particular, the relationship between PRO and FIK is very important in the financial industry, which is a highly regulated industry, so the PRO capability level and standard should fulfill the requirements and be in accordance with the law applied by regulators, such as it concerns customer privacy protection, mitigation, fraud prevention, and data and information security –(Bamberger, 2010; Klus et al., 2019).

Therefore, the addition of related FIK knowledge can contribute to the PRO expertise improvement and allow the improvement of the quality of codes that agree with DFI ideas. Yet, the roles using FL competency essentially have the ability to improve the level of understanding and clarity when communicating various types of information across personnel, either in oral or written communication (Arévalo et al., 2021).

Regarding PRO competency, the higher ability a person has in FL, the lower the risk that miscommunication occurs among programmers when developing the applications following DFI ideas.

Based on this finding, higher education institutions should add additional courses focusing on how the financial industry operates generally. Additionally, higher education institutions should also educate future graduates on the newest standards in the financial industry, as applied to DFI purposes. However, higher education institutions should also consider FL competency in PRO competency. This is because graduates who are friendly with FL can help the company's programmers to deliver important information and, at the same time, help to reduce misperception possibilities in PRO activities.

The knowledge on FIK had a mutually dependant relationship with PRO competency related to BM. As previously explained, the PRO ability level of a company (particularly banks and fintech companies) should be in accordance with the standards determined by regulators. The products or services created through PRO activities should meet the needs of customers in the financial industry and at the same time be in accordance with the regulations issued by the regulator. This happens for BM competency in regards to FIK knowledge. The better knowledge employees of the financial industry have, the better they can help the company in realizing their values, either through creation or proposition (Shih, Chang, & Lin, 2010). Therefore, regarding DFI, higher education insitutions should ensure that their graduates understand either technical or basic knowledge that can be applied in the financial industry.

As for RM expertise, its ability and effectiveness in DFI can be improved by combination with DA and SM competencies. By adding DA, companies can improve and optimize RM processes (Choi, Chan, & Yue, 2017; Dicuonzo, Galeone, Zappimbulso, & Dell'Atti, 2019).

Therefore, companies should formulate effective decisions in accordance with their needs and purposes. In a similar sense, the inclusion of SM competency in RM makes it possible for companies to map the conditions related to SM coverage available and coming (Ferrell, Johnston, & Ferrell, 2007; Piercy, 2010; Ritchie, Brindley, & Armstrong, 2008). Therefore, companies may optimally reveal opportunities and risks, while at the same time protecting and improve their value and proposition creation through risk-oriented thinking patterns, approaches, and decisions. Higher education institutions should ensure that their future graduates obtain adequate knowledge and RM practical ability integrated with DA and SM competencies in order to prepare them to carry out the DFI agenda of the financial industry.

BM expertise improvement can also be achieved by including financial industry knowledge and SM competency. Furthermore, each SM expertise improvement can also be applied in this special condition through inclusion of RM combined with BM. Indeed, each company in the financial industry should ensure that it can accurately identify the needs of customers' finances and formulate SM strategies by fulfilling available demand (Larsson & Viitaoja, 2017; Sunikka et al., 2011). Equally, each financial institution also has to make sure that the business management and behavior is in accordance with issued regulations (Prorokowski & Prorokowski, 2014). Therefore, higher education institutions must make sure that their graduates understand how the financial industry operates, especially regarding the relationship between characteristics of fundamental industry and technical ability needed in relation to products and services offered.

In certain cases, it was found out that, in the competency identified, there was something less relevant about UIUX expertise. Although some competencies (aside from RM, FL, FIK, BM) had positive impacts, the findings show that UIUX expertise stands out as a separate entity in DFI.

Those with UIUX expertise are able to help financial institutions in making products that enable customers to conduct digital financial transactions comfortably (Apari et al., 2013). Based on this, higher education institutions should consider UIUX competency users as part of future programs related to DFI. This can help financial institutions to improve digital-based products, which are able to make things facilitate financial activities digitally and enable the fulfillment of customers' financial needs.

It can be said that most expertise needed is applicable for DFI, except UIUX, which is generally related to one another. This finding indicates that synchronization and integration among expertise are very important for innovate the financial industry. Therefore, higher education institutions must ensure that their graduates have the knowledge and technical ability that is applicable in the financial industry and can help accelerate the actualization of the DFI agenda.

The ranking is based on the coefficient and statistic significance of independent variables presented in Table 5.

In this case, the higher the coefficient of the independent variables and their statistical significance, the higher the ranking which represents the level of importance of certain competencies to support expertise in the digital finance innovation curriculum.

Table 5
The Results Of Multivariate Regression For Each Competency.

Independent variable	Dependent variable															
	DA		PRO		RM		FIK		UIUX		BM		SM		FL	
	B	*SEC*	*B*	*SEC*	*B*	*SEC*	*B*	*SEC*	*B*	*SEC*	*B*	*SEC*	*B*	*SEC*	*B*	*SEC*
Intercept	1.582**	0.629	-0.342	0.181	-0.683	0.492	0.428**	0.163	0.48	1.031	-0.31	0.26	0.195	0.234	0.813	0.65
X1			0.155	0.082	0.4***	0.197	-0.164	0.085	0.068	0.474	0.142	0.117	-0.134	0.098	-0.161	0.324
X2	2.412	1.274			-0.423	0.995	0.971*	0.157	1.881	1.71	-0.836***	0.388	0.378	0.414	2.599**	0.756
X3	1.02***	0.502	-0.069	0.163			0.175	0.157	-1.07	0.62	-0.249	0.183	0.324**	0.12	-0.334	0.509
X4	-2.335	1.212	0.89*	0.144	0.982	0.88			-0.95	1.752	0.907**	0.328	-0.5	0.37	-2.217**	0.858
X5	0.05	0.35	0.089	0.081	-0.31	0.18	-0.049	0.091			-0.069	0.109	0.141	0.077	-0.372	0.24
X6	1.377	1.142	-0.52***	0.242	-0.95	0.697	0.618**	0.223	-0.91	1.434			0.745*	0.171	1.268	0.89
X7	-1.788	1.298	0.323	0.354	1.696**	0.626	-0.466	0.345	2.548	1.386	1.019*	0.234			-0.138	1.203
X8	-0.246	0.495	0.255**	0.074	-0.2	0.306	-0.237**	0.092	-0.77	0.496	0.199	0.14	-0.016	0.138		
Model Summary																
R^2	0.851		0.985		0.977		0.979		0.843		0.99		0.991		0.94	

Note: B = *non-standardised* coefficient; SEC = *standard error* coefficient; DA and X1 = *data analytics*; PRO and X2 = *programming*; RM and X3 = *risk management*; FIK and X4 = *financial industry knowledge*; UIUX and X5 = *user interface* and *user experience*; BM and X6 = *business* and *management*; SM and X7 = *sales* and *marketing*; FL and X8 = *foreign language*.
R^2 is *dependent variable's* variant proportion explained by independent variables in regression equation.
*, **, and *** indicate statistical significance at the levels of 1%, 5%, and 10%, respectively.

Table 6.
The Competency Rank Supporting Certain Expertise Needed For Innovation Of Digital Finance

Ranking	DA	PRO	RM	FIK	UIUX	BM	SM	FL
1	RM	FIK	SM	PRO		SM	BM	PRO
2		FL	DA	BM		FIK	RM	

Note: DA = *data analytics*; PRO = *programming*; RM = *risk management*; FIK = *financial industry knowledge*; UIUX = *user interface and user experience*; BM = *business and management*; SM = *sales and marketing*; FL = *foreign language*.

Conclusions, limitations and recommendations

This research aims to develope curricula design explicitly based on DFI ideas and to find gaps in DFI. Through a literature survey, eight competencies were identified, which relate to the financial industry's needs for actualizing DFI agenda, and include DA, PRO, RM, FIK, UIUX, BM, SM, and FL. The identified competencies were further examined using the multivariate regression.

The results of the regression analysis show that each identified competency can be improved by being supported and integrated with other competencies. However, only a few of them were considered significant and relevant if specified in certain competencies. Inter-dependent relationships among some competencies indicate that integration and synchronization among those competencies are very important for DFI. In all identified competencies, only UIUX users appeared as isolated competencies. In other words, there was no identified competency that complimented or improved UIUX competency in a statistically signifcant manner, indicating that the UIUX competency users stood out as having a different type of expertise relative to DFI ideas.

Conclusions

From a practitioners' point of view, the research findings imply that these eight typse of expertise can help the financial industry to realize its DFI agenda. Furthermore, when an organization can synchronize the eight competencies, then it can improve digital financial services and product delivery, in particular.

Hence, these findings imply:

- Effective and accurate relationships between DA, RM, BM, and SM competencies can improve financial institutions ability in identifying and managing risks in their environment. At the same time, they can be complimented with relevant information to further improve quality and effectiveness of decision making processes in creating values or propositions.
- The relationship between FIK knowledge and PRO and BM competencies can help financial institutions to ensure that their DFI products, such as applications, meet the standards determined by regulators and can improve managerial practices. Therefore, leading financial institutions creating financial products and services designed explicitly using DFI ideas can fulfill legal aspects and criteria of effective governance.
- The relationship between FL and PRO competencies can improve organizations' abilities to reduce potential miscommunication and wrongful perception of DFI ideas. The result is services and products of digital finance that are created to fulfill customers' needs and demands accurately and effectively.

In terms of managerial implications for the academic field, the finding of this study can be used by higher education institutions to design curricula that help solve competency gaps in the financial industry. To do this, higher education institutions also have to make sure that their courses compliment one another and are related, as there is overlap between the domains of computer science and management in DFI.

Limitations

Though this research fulfill its objectives, there are still two limitations to pay attention to. First, the data used in the analysis was only based on the perception of fintech companies. As a result, DFI perception of traditional financial institutions (for example, banks and insurance companies) is not under consideration in this study. Therefore, it is advisable for that future research consider the perceptions of other financial institutions. Going with such a recommendation, we advise explaining the needs and desires of certain competencies in each spectrum of financial industry activities related to DFI. Finally, the methods of this research only used statistical approaches that measure the influence level of competencies in improving certain expertise needed for DFI.

Recommendations

Based on the limitations above, we recommend applying the approach of analytical hierarchy process in future research in order to rank competency sequences according to influence and relevance as they relate to DFI. Then, in relation to the curriculum designed around DFI ideas, and the findings on analytical hierarchy process, these can be represented through the application of an academic credit systemI.

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Submission date: 05-Apr-2023 01:17PM (UTC+0700)
Submission ID: 2056386914
File name: ulum_Design_for_Digital_Financial_Innovation_4944-10351-1-PB.pdf (9.34M)
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