Combining statistical and interpretative analyses for testing IT implementation readiness

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Abstract. Researchers often use interpretative data analysis to test questionnaires by confirming the results of statistical analysis, but the researchers did not elaborate comprehensively how confirmation was made. Most use statistical analysis techniques only to test and assess questionnaires. In addition, interpretive confirmation is common for experienced researchers when conducting research, in contrast to novice researchers who have problems confirming the interpretive results of the questionnaire. This study explains how to combine statistical and interpretative analysis with testing the IT implementation questionnaire on HEI. The aim is to assess the questionnaire using statistics and interpret the results of statistical analysis. This finding can help researchers to test questionnaires; confirmation results can be a consideration and knowledge to revise the questionnaire.

1. Introduction

It is common practice for researchers to revise the questionnaire using statistical analysis, in addition to the revision of the questionnaire carried out by analyzing the interpretation of the researchers. Although technically interpretive data analysis is widely used to test survey questionnaire research and statistical analysis is only a technique for testing questionnaires [1], but the combination of the two data analysis techniques is poorly studied in full and clear in the literature. In addition, although interpretive confirmation is common practice experienced researchers, but for researchers who are just doing research it seems difficult. Thus, the presentation of a combination of data analysis techniques is very necessary.

This study explains how to combine statistical and interpretative analysis with testing the Information Technology Implementation readiness (ITIR) questionnaire. The aim is to assess the questionnaire with statistical methods and interpret the results of statistical analysis. In addition, this finding can practically help researchers to test questionnaires that have been made; confirmation results can be taken into consideration for revising the questionnaire that has been made. The following are two research questions that are used to guide the implementation of the research:

- Q1. Does the ITIR questionnaire statistically have right property?

- Q2. Does the ITIR questionnaire explain the response and understanding of the people who were sampled?

The structure of this article consists of five parts. First, explain the background of this research. Second, briefly explain the literature review, models, variables, indicators, and statement questions as input from the questionnaire testing. third, describe the research method. The fourth presents the results of the discussion. Finally, conclude with the conclusion of the results of the study of this article.

2. Literature review

It can be seen clearly that IT implementation has a significant impact on HEI's progress, what if successful IT implementation [2-5]. This means that the successful implementation of IT is a major challenge for HEI before obtaining benefits. Conversely, failure of IT implementation will bring financial losses; hampering the academic system [6], the delay in administrative services and poor management of stakeholder needs [7,8]. Previous studies that measured IT implementation readiness, showed that IT implementation readiness criteria were related to People, Process, Technology, Governance, Policy, Work Environment, and Infrastructure [4,9-12]. Several surveys on IT implementation readiness Marcel [13], Paper [14], Subrahmanyam [15] revealed that one indication of implementation failure was, According to Mohamad Ali Murtadho, namely due to system incompatibility with business processes and information needed by organizations [16]. According to Curry et al., the failure of the implementation of information systems in organizational business processes including universities (universities) is not only due to technical factors but also to non-technical problems (human factors, processes, and work organizations) [17]. Unlike Curry [18], differentiating failure in the implementation of an information system into two aspects, namely technical aspects, and non-technical aspects [19,20].

In this study, the researchers developed the ITIR model (Figure 1) by adopting the Service quality, E-Readiness [9] and ZEN Framework [13,21] models, combining models, and adapting models based on input-process-output logic (IPO) [22,23] and causal assumptions of the process of developing studies of previous models [2,21,24-26]. The six variables of the model are developed, namely IT Content (ITC), Institutional Context (INC), People (PPL), Process (PRC), Technology (TCG), Service Quality (SVQ), and IT implementation Readiness (ITIR) variables. The questionnaire was broken down from the model developed by defining variables and indicators from previous works referring to adoption and adaptation (Tables 1 and 2).

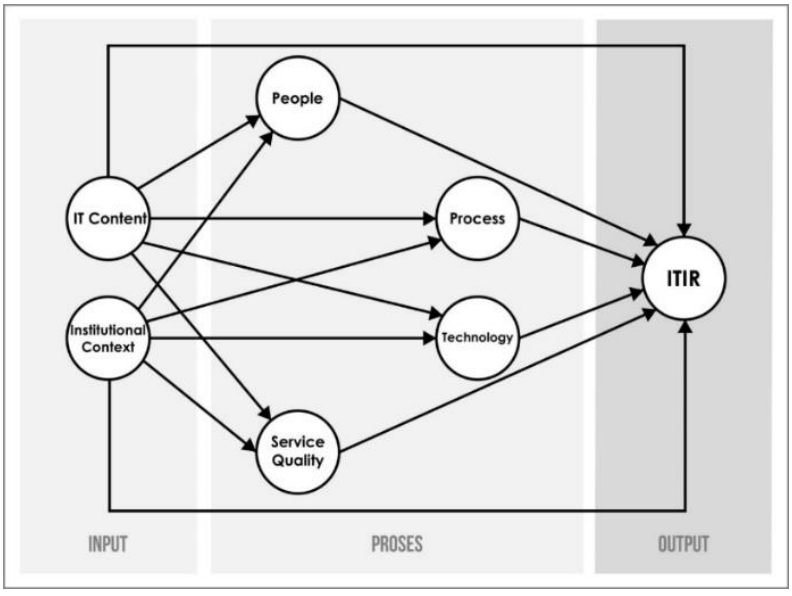

Figure 1. ITIR model.

Table 1. List of variables and indicators.

Variables	Indicators	Reference
IT Content	Timeliness, Completeness, Consistency, Relevance, Technology Complexity, Information Quality, System Quality, Perceived Usefulness, Perceived Ease of Use	[27],[2],[5],[24]
Institutional Context	Institutional Policies, Management Involvement, Infrastructure Availability, External Environments, Legal Environment	[27],[28],[29],[30]
People	Workforce Capability, Leadership, Competency, Resources, Change Management, Resources, and Cultural Infrastructure	[31],[32],[33]
Process	Culture, Governance, Awareness, Strategy, Management, Commitment	[31],[32],[33]
Technology	Infrastructure, Security, Networking, Data, Telecommunication	[31],[32],[33]
Service Quality	Responsiveness, Availability, Functionality, Extension, Reliability, Efficiency, Effectiveness	[34],[9],[35]
ITIR	Technology Management, IT skills, IT Partnership, Quality Improvement, IT acquaintance	[13], [21]

3. Research methods

The questionnaire is part of the research, the assessment study of the questionnaire is based on previous studies (i.e., literature review, model development, and instrument development). The input of this research is the design of the study and the questionnaire of the model developed. Figure 2 presents the six phases of this study. About research design, the researchers selected 40 valid data from 40 respondents in HEI. Data is obtained from a website that contains research questionnaires that are broadcast through social media and e-mail.

The data obtained was collected using MS. Excel 2017 and then the data is prepared for the analysis phase using IBM SPSS 20. Regarding the amount of data, the PLS-SEM method is then used in the analysis phase using SmartPLS 2.0 to test indicator reliability, internal consistency reliability, convergent validity, and discriminant validity assessment [36].

Table 2. Question of the first questionnaire.

Code	Questionnaire
ITC1	IT can process data into information needed
ITC2	IT can provide complete information
ITC3	IT is consistent and easy to maintain
ITC4	IT can solve problems
ITC5	IT can display detailed information
ITC6	IT can provide useful information
ITC7	IT is very flexible to use
ITC8	IT can increase productivity
ITC9	IT is easy to learn
INC1	Institutional policies affect the readiness to implement IT in Higher Education

Table 2. Cont.

Code	Questionnaire
INC2	Management's alignments influence the readiness of IT implementation in Higher Education
INC3	The ability to transfer knowledge influences the readiness of IT implementation in Higher Education
INC4	External Environment influences the readiness of IT implementation in Higher Education
INC5	Regulation affects the readiness of IT implementation in Higher Education
PPL1	Skilled experts influence the readiness of IT implementation in Higher Education
PPL2	Leadership influences the readiness of IT implementation in Higher Education
PPL3	Competence influences the readiness of IT implementation in Higher Education
PPL4	Resources affect the readiness of IT implementation in Higher Education
PPL5	Change Management affects the readiness of IT implementation in Higher Education
PPL6	infrastructure and regulation resources affect the readiness of IT implementation in Higher Education
PCS1	Culture influences the readiness of IT implementation in Higher Education
PCS2	IT governance affects the readiness of IT implementation in Higher Education
PCS3	Awareness influences the readiness of IT implementation in Higher Education
PCS4	Achievement strategies affect the readiness of IT implementation in Higher Education
PCS5	Management commitment affects the readiness of IT implementation in universities
TCH1	Availability of Infrastructure Software and Hardware affects the readiness of IT implementation in Higher Education
TCH2	The security of IT systems affects the readiness of IT implementation in Higher Education
TCH3	The availability of the internet affects the readiness of IT implementation in Higher Education
TCH4	Data Management affects the readiness of IT implementation in Higher Education
TCH5	Submission of data/information accurately affects the readiness of IT implementation in Higher Education
SVQ1	IT systems can respond quickly to user needs
SVQ2	IT systems can maintain the availability of data/information properly
SVQ3	IT systems can provide added value to universities
SVQ4	IT systems can expand the role of IT in Higher Education
SVQ5	Reliable IT systems are needed by universities
SVQ6	IT systems can make time efficiency
SVQ7	IT systems can do work effectively
ITIR1	IT can increase competitive advantage
ITIR2	IT can improve user skills
ITIR3	IT can increase business value
ITIR4	IT can improve service quality
ITIR5	IT can increase stakeholder participation

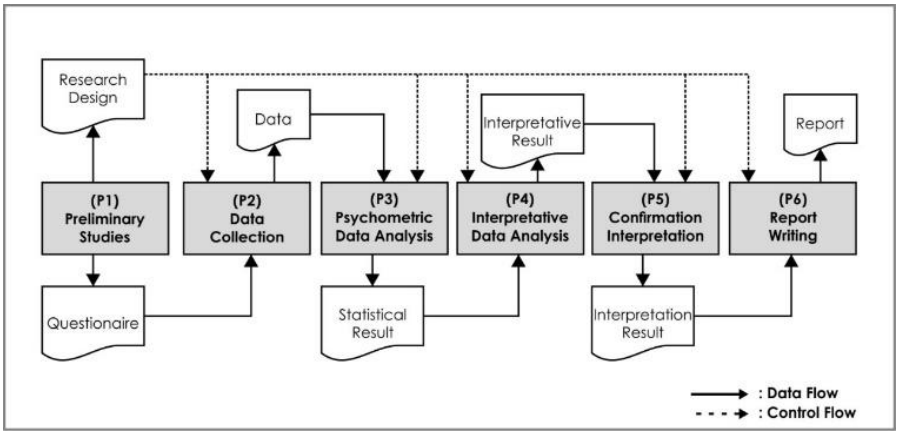

Figure 2. Research design.

Then the statistical results were used as input from interpretive assessment in two brainstorming sessions. In addition to the demographic information of respondents, the cognitive aspects and responses of respondents were also factors that were considered and discussed in the interpretative analysis phase [37]. Both the results of statistical and interpretative analyses are then interpreted using a confirmation matrix to represent the confirmation findings [38]. In addition, the recommendations were then revealed based on the findings and limitations of the study.

4. Results and discussion

4.1. Demographic information

Table 3 presents three characteristics of respondents, namely gender, education, and college.

Table 3. Demographic and information respondents.

Characteristic	Group	n	%
Education	High School	4	4%
	Diploma	16	16%
	Graduate	50	50%
	Post Graduate	26	26%
	S3	4	4%
Work Duration	< 2 year	18	18%
	2-5 year	40	40%
	5-10 year	34	34%
	> 10 year	8	8%
Position	Low Manager	19	19%
	Middle Manager	18	18%
	Top Manager	6	6%
	Staff IT	48	48%
	Other	9	9%

In short, the distribution of questionnaires covers almost the targeted area; information characteristics may have consistency with the people in HEI who have actively involved in IT implementation in HEI. Based on aspects of estimation, consistency can be used to predict research findings [39,40]. Other considerations and sample data are one of the limitations of the study. No doubt the consistency of the data used with the real conditions of the object of research may be more helpful in estimating the validity of the research findings. Therefore, it is recommended for primary research to examine the samples used.

4.2. Statistics analysis result

- Based on the statistical examination, the results show that six of the 42 (fourty two) indicators were rejected (Table 4).
- Based on the testing of the values on the outer loading, there is a value below the standard 0.7, namely the INC3 indicator with a value of 0.624 so that the indicator needs to be removed.
- This test is done by looking at the composite reliability (CR) value with a threshold above 0.7.
- This test is done by looking at the average variance extracted (AVE) value with a minimum AVE value of 0.5.
- After several tests, there are 5 (five) indicators deleted again, namely: INC2, INC1, ITC9, ITC5, PPL3, with each value being 0.718; 0.679; 0.735; 0.735; 0.747. By removing these seven indicators, it is necessary to re-examine internal consistency reliability, composite reliability (CR), convergent validity, and discriminant validity.

Table 4. The statistical analysis result.

Ind	OL	CL						
		INC	ITC	ITIR	PCS	PPL	SVQ	TCH
ITC1	0,753	0,445	0,753	0,452	0,441	0,453	0,487	0,469
ITC2	0,876	0,463	0,876	0,519	0,387	0,437	0,382	0,404
ITC3	0,780	0,404	0,780	0,322	0,235	0,333	0,327	0,324
ITC4	0,790	0,440	0,790	0,471	0,438	0,437	0,541	0,425
ITC5*								
ITC6	0,939	0,581	0,939	0,547	0,454	0,507	0,438	0,530
ITC7	0,920	0,570	0,920	0,528	0,446	0,486	0,431	0,489
ITC8	0,936	0,554	0,936	0,568	0,463	0,469	0,436	0,517
ITC9*								
INC1*								
INC2*								
INC3*								
INC4	0,899	0,899	0,480	0,610	0,731	0,740	0,763	0,709
INC5	0,883	0,883	0,506	0,710	0,758	0,810	0,737	0,853
PPL1	0,785	0,596	0,362	0,601	0,657	0,785	0,672	0,653
PPL2	0,876	0,740	0,490	0,662	0,743	0,876	0,724	0,727
PPL3*								
PPL4	0,898	0,781	0,360	0,608	0,686	0,898	0,765	0,721
PPL5	0,866	0,754	0,525	0,724	0,747	0,866	0,627	0,723
PPL6	0,881	0,798	0,508	0,708	0,745	0,881	0,644	0,791
PCS1	0,849	0,694	0,354	0,647	0,849	0,731	0,622	0,642
PCS2	0,843	0,692	0,438	0,587	0,843	0,668	0,583	0,561
PCS3	0,911	0,788	0,424	0,794	0,911	0,791	0,812	0,799
PCS4	0,866	0,719	0,377	0,683	0,866	0,719	0,822	0,739
PCS5	0,863	0,697	0,513	0,746	0,863	0,688	0,584	0,673
TCH1	0,874	0,739	0,541	0,750	0,698	0,736	0,608	0,874
TCH2	0,877	0,733	0,599	0,708	0,718	0,704	0,606	0,877
TCH3	0,925	0,786	0,422	0,703	0,768	0,807	0,76	0,925
TCH4	0,843	0,680	0,337	0,665	0,666	0,789	0,756	0,843
TCH5	0,821	0,565	0,398	0,636	0,576	0,604	0,732	0,821
SVQ1	0,863	0,596	0,401	0,650	0,606	0,633	0,863	0,650
SVQ2	0,879	0,649	0,426	0,626	0,625	0,659	0,879	0,648
SVQ3	0,870	0,675	0,275	0,568	0,586	0,666	0,870	0,716
SVQ4	0,903	0,710	0,365	0,642	0,760	0,695	0,903	0,723
SVQ5	0,877	0,706	0,463	0,637	0,687	0,679	0,877	0,647
SVQ6	0,932	0,781	0,502	0,711	0,814	0,770	0,932	0,761
SVQ7	0,913	0,775	0,493	0,738	0,781	0,795	0,913	0,779
ITIR1	0,844	0,713	0,441	0,844	0,750	0,754	0,764	0,703
ITIR2	0,770	0,376	0,510	0,770	0,535	0,448	0,549	0,582
ITIR3	0,912	0,623	0,606	0,912	0,746	0,643	0,663	0,749
ITIR4	0,925	0,656	0,547	0,925	0,730	0,741	0,652	0,723
ITIR5	0,870	0,674	0,378	0,870	0,691	0,721	0,649	0,688

In short, even though six item indicators were deleted, the proposed model could be statistically justified as a model with psychometric properties [37]. However, the assessment may still be a limitation that refers to the instrument developed and the data used.

4.3. Interpretation analysis result

The results of statistical analysis are used for interpretive evaluation by considering the responses and cognitions of people who are considered competent in their fields. In short, the results of interpretative evaluations are:

- Indicator ITC5 and ITC9 are relevant indicators for ITIR model research, but both of these indicators are rejected in this study, researchers assume that the rejection of this indicator is similar to indicators on other variables, so that based on analysis there is bias on this indicator.
- Like ITC5 and ITC9, rejection of INC1, INC2, and INC3 indicators may be caused by respondents referring to demographic factors. Researchers assume that the less ideal environmental factors in HEI for IT implementation are very influential on this indicator, so it needs to be reviewed or adjusted to the general conditions of HEI in Indonesia.
- As with INC1 and INC2 indicators, rejection occurs in PPL3 indicators; this is because the factor People are close to or almost the same as Institutional Context factors so that bias can occur, this is in Kimoro's opinion [9].

In summary, table 5 shows a confirmation interpretation between statistical and interpretative results. The table shows about 42 questions with six indicators (i.e., ITC5, ITC6, ITC9, INC1, INC2, INC3, and PPL3). It is recommended to be accepted taking into account the demographic distribution of the samples used [38]. Here, this study recommends reviewing and refining questions.

Table 5. The confirmation interpretation.

Ind	Result		Recommendation
	S	I	
ITC1	Accepted	Confirmed	Confirm to accept
ITC2	Accepted	Confirmed	Confirm to accept
ITC3	Accepted	Confirmed	Confirm to accept
ITC4	Accepted	Confirmed	Confirm to accept
ITC5*	Rejected	Unconfirmed	Review the question
ITC6	Accepted	Confirmed	Confirm to accept
ITC7	Accepted	Confirmed	Confirm to accept
ITC8	Accepted	Confirmed	Confirm to accept
ITC9*	Rejected	Unconfirmed	Review the question
INC1*	Rejected	Unconfirmed	Review the question
INC2*	Rejected	Unconfirmed	Review the question
INC3*	Rejected	Unconfirmed	Review the question
INC4	Accepted	Confirmed	Confirm to accept
INC5	Accepted	Confirmed	Confirm to accept
PPL1	Accepted	Confirmed	Confirm to accept
PPL2	Accepted	Confirmed	Confirm to accept
PPL3*	Rejected	Unconfirmed	Review the question
PPL4	Accepted	Confirmed	Confirm to accept
PPL5	Accepted	Confirmed	Confirm to accept
PPL6	Accepted	Confirmed	Confirm to accept
PCS1	Accepted	Confirmed	Confirm to accept
PCS2	Accepted	Confirmed	Confirm to accept
PCS3	Accepted	Confirmed	Confirm to accept
PCS4	Accepted	Confirmed	Confirm to accept
PCS5	Accepted	Confirmed	Confirm to accept
TCH1	Accepted	Confirmed	Confirm to accept
TCH2	Accepted	Confirmed	Confirm to accept
TCH3	Accepted	Confirmed	Confirm to accept
TCH4	Accepted	Confirmed	Confirm to accept
TCH5	Accepted	Confirmed	Confirm to accept

Table 5. Cont.

SVQ1	Accepted	Confirmed	Confirm to accept
SVQ2	Accepted	Confirmed	Confirm to accept
SVQ3	Accepted	Confirmed	Confirm to accept
SVQ4	Accepted	Confirmed	Confirm to accept
SVQ5	Accepted	Confirmed	Confirm to accept
SVQ6	Accepted	Confirmed	Confirm to accept
SVQ7	Accepted	Confirmed	Confirm to accept
ITIR1	Accepted	Confirmed	Confirm to accept
ITIR2	Accepted	Confirmed	Confirm to accept
ITIR3	Accepted	Confirmed	Confirm to accept
ITIR4	Accepted	Confirmed	Confirm to accept
ITIR5	Accepted	Confirmed	Confirm to accept

5. Conclusions

Questions about the suitability of the questions developed in this study may be of interest to IS researchers, especially those who developed survey instruments based on adoption, combination, and adaptation from previous studies. However, in addition to the relatively limited number of instruments to be assessed, there are still some shortcomings in instrument assessment studies. Therefore, conducting research may still be interesting to continue.

In this study, the sequential statistical and interpretative assessment was carried out to examine and explore the validity and reliability of the questionnaire. The results show that six out of 42 instrument questions are recommended to be rejected. In addition to the results of the confirmation of psychometric and interpretative analyses, a clear presentation of the meta conclusions can also be the second point highlighted in this study.

In addition, this study also limits its use according to the sample used, the developmental questionnaire itself, and interpretive analysis techniques and abilities. Therefore, findings cannot be generalized to others. In addition, although this study may not contribute theoretically to the field of research, at least, the recommendations proposed here might be one of the practical considerations for revising the main study questionnaire and the clarity of research behaviour might be one of the questionnaires — assessment of alternatives for similar work.

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