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Research article

Absorptive capacity between knowledge sharing and agile software process improvement success in Indonesian telecommunication company

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ABSTRACT

This study investigates the role of absorptive capacity as a mediator in the relationship between knowledge sharing and agile software process improvement. Data was collected from 99 participants with experience in agile software development teams at two agile-based Indonesian telecommunication companies. The analysis was conducted using the PLS-SEM method and an embedded two-stage approach. The results demonstrate that absorptive capacity fully mediates the impact of knowledge sharing on the success of agile software process improvement (SPI). However, knowledge sharing alone does not significantly enhance agile SPI success. These findings highlight the importance of absorptive capacity in leveraging knowledge sharing to achieve agile SPI success, particularly within agile software development teams in Indonesian telecommunication companies.

Keywords: Absorptive capacity, knowledge sharing, agile software development, agile software process improvement

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Abstrak

Penelitian ini menyelidiki peran kapasitas absorptif sebagai mediator dalam hubungan antara berbagi pengetahuan dan peningkatan proses perangkat lunak agile. Data dikumpulkan dari 99 partisipan yang memiliki pengalaman dalam tim pengembangan perangkat lunak agile di dua perusahaan telekomunikasi Indonesia berbasis agile. Analisis dilakukan menggunakan metode PLS-SEM dan pendekatan dua tahap terintegrasi. Hasil penelitian menunjukkan bahwa kapasitas absorptif sepenuhnya memediasi dampak berbagi pengetahuan terhadap keberhasilan peningkatan proses perangkat lunak agile (SPI). Namun, berbagi pengetahuan saja tidak secara signifikan meningkatkan keberhasilan SPI agile. Temuan ini menyoroti pentingnya kapasitas absorptif dalam memanfaatkan berbagi pengetahuan untuk mencapai keberhasilan SPI agile, terutama dalam tim pengembangan perangkat lunak agile di perusahaan telekomunikasi Indonesia.

Kata Kunci: Kapasitas Absorptif, Berbagi Pengetahuan, Pengembangan Perangkat Lunak *Agile*, Perbaikan Proses Perangkat Lunak *Agile*

1. Introduction

By early 2023, Indonesia had 353.8 million active cellular mobile connections, representing 128% of its population (Kemp, 2023). With this fact, the telecommunication industry is in a prime position to shape the future of digital growth. Conversely, the telecommunication industries have started using agile methods to empower their IT team to deliver customer-focused IT functionality quickly (Lestari, 2018; Purwandono, 2019). Most organisations worldwide have used agile methods. Digital.ai's (2023) study found that 71% of survey takers use the agile method in their software development lifecycle. The study involved participants: 48% from North America, 26% from Europe, 13% from Asia, 9% from South America, 2% from Africa and 3% from Australia-New Zealand.

Agile software development (ASD) is a change-driven approach to developing software with volatile requirements (Hoda, Salleh, Grundy, & Tee, 2017). It focuses on collaboration and fast delivery of working software to empirically learn the customers' needs and deliver valuable products (Ramesh, Cao, & Baskerville, 2010). A regular reflection on improving their practices to increase efficiency should be portrayed by the software development team, which is one of the agile principles that closely relates to software process improvement. Therefore, agile approaches require continuous improvement, tuning and altering the software development process (Poth, Sasabe, Mas, & Mesquida, 2018).

Software process improvement (SPI) is the systematic and continuous approach of improving and tailoring a firm's software development processes to increase the maturity and quality of software processes (Institute, 2010). In the agile mindset, new challenges and opportunities for conducting SPI are also emerging (Santana, Queiroz, Vasconcelos, & Gusmao, 2015). Many software industries face problems while implementing SPI in their ASD projects, although it has been used for many years. Digital.ai (2021) found that not more than 39% of organisations have been using process improvement as the measure of success of agile implementation in 2021. These facts are not good, considering process improvement is the most significant aspect of software development (Khan, Keung, Niazi, Hussain, & Ahmad, 2017). Based on organisational learning theory, SPI requires continual endeavours for the ASD team to maintain competence. However, the existing literature does not fully grasp how to address a firm's learning ability to internalise external SPI knowledge or how organisational learning continually supports changing SPI needs under dynamic environments (Liao, Fei, & Chen, 2007).

Based on dynamic capabilities theory, the continual learning ability in SPI refers to an organisation's abilities to adapt, renew, and reconfigure internal and external competencies to address rapidly changing environments (Zahra & George, 2002).

Based on all organisational issues faced in implementing agile SPI, knowledge sharing is one important issue related to both SPI success and ACAP in information system research (J. C. Lee & Chen, 2019; J. C. Lee, Chen, & Shiue, 2017; J. C. Lee, Hsu, & Chen, 2016). Knowledge sharing occurs when individuals communicate or obtain knowledge from one another (Bilgihan, Peng, & Kandampully, 2014; Chen & Hung, 2010). Knowledge sharing significantly influences ACAP (J. Lee, Lee, & Park, 2014; Rafique, Hameed, & Agha, 2018; Raharso, 2021) and SPI success (J. C. Lee, Shiue, & Chen, 2016). Although knowledge sharing has been known to be important for ACAP and SPI success, only a few studies have examined ACAP's role as a mediator in the relationship between knowledge sharing and SPI success, particularly in the ASD team. This research examined the mediating effect of ACAP on the relationship between knowledge sharing and agile SPI success in the ASD team of Indonesian telecommunication industries. By achieving this objective, the research not only contributes to the extant SPI research on the effect of ACAP on agile SPI success but also contributes to understanding the mediation effect of ACAP on the link between knowledge sharing and agile SPI success. The results outline the implications and limitations of the research, as well as directions for future research.

2. Theoretical background

2.1. Knowledge Sharing and ACAP

Knowledge sharing occurs when individuals transfer or gain knowledge from others (Bilgihan et al., 2014; Chen & Hung, 2010). According to Hung and Cheng (2013), knowledge sharing is exchanging knowledge between individuals, groups, or organizations. Meanwhile, Absorptive capacity is introduced by Cohen & Levinthal (1990) as the ability to recognise the value of new information, assimilate it, and apply it to commercial ends. Zahra and George (2002) employed the concept of absorptive capacity (ACAP) to gain a deeper understanding of an organisation's dynamic ability to acquire, assimilate, transform, and utilise knowledge from external environments. ACAP is divided into Potential ACAP (PACAP) and Realized ACAP (RACAP). PACAP refers to acquiring and interpreting external SPI knowledge to address a firm's dynamic improvement needs (J. C. Lee et al., 2017). RACAP refers to two dimensions: transforming and exploiting acquired SPI knowledge expected to benefit a firm (J. C. Lee & Chen, 2019; J. C. Lee et al., 2017; J. C. Lee, Hsu, et al., 2016).

Lee et al.'s (2014), Raharso's (2021) and Rafique et al.'s (2018) studies found that knowledge sharing significantly influences ACAP. Different from Lee et al.'s (2014) study, Raharso (2021) and Rafique et al. (2018) investigated the relationship between knowledge sharing and ACAP in a non-IT context. Thus, the following hypotheses are proposed in this research:

H1. Knowledge sharing has a significant positive effect on ACAP.

Meanwhile, limited studies have investigated the relationship between knowledge sharing, PACAP, and RACAP dimensions. Thus, based on the findings of Lee et al. (2014), Raharso (2021) and Rafique et al. (2018) studies, the following hypotheses are proposed in this research:

H1a. Knowledge sharing has a significant positive effect on acquisition.
H1b. Knowledge sharing has a significant positive effect on assimilation.
H1c. Knowledge sharing has a significant positive effect on transformation.
H1d. Knowledge sharing has a significant positive effect on exploitation.

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The research model of the relationship between knowledge sharing and ACAP can be seen in Figure 1.

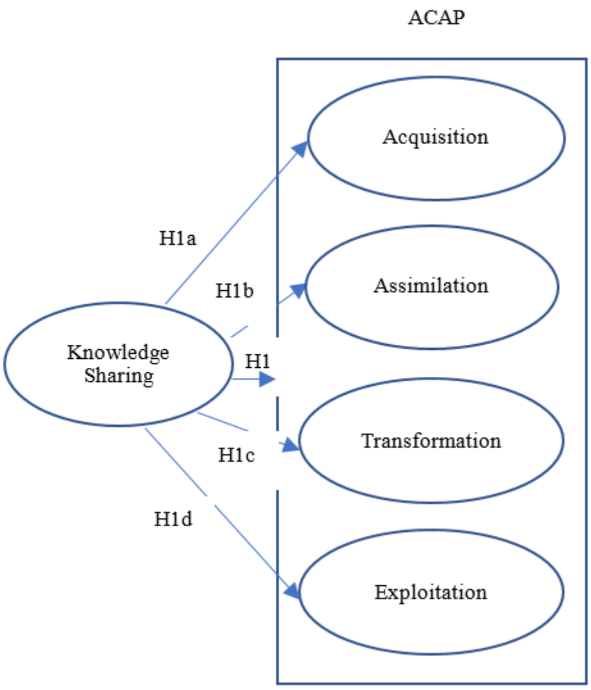

Figure 1. Research model of the relationship between knowledge sharing and ACAP

2.2. ACAP and Agile SPI Success

Software Process Improvement (SPI) refers to the continuous and systematic enhancement and customization of a company's software development methodologies to improve the maturity and quality of its software processes (Institute, 2010). Agile SPI approaches are centred around iterative and incremental product development, incorporating varying formal retrospectives (Poth et al., 2018). Lee & Chen (2019) and Lee et al. (2017) investigated the relationship between ACAP and SPI success among Chinese and Taiwanese firms certified with CMMI. They found that ACAP significantly affects SPI. Thus, the following hypotheses are proposed in this research:

H2. ACAP has a significant positive effect on agile SPI success.

As part of ACAP, PACAP has a significant role in recognising and acquiring useful external SPI-related knowledge and assimilating it based on what is particularly relevant to meeting the firm's ad hoc improvement goals. PACAP will likely contribute to SPI success (J. C. Lee et al., 2017). Therefore, PACAP's dimension may have contributed to the success of agile SPIs. Meanwhile, research by Lee et al. (2016), Lee et al. (2017), and Lee & Chen (2019) show that RACAP significantly influences SPI success. Therefore, RACAP's dimension also may provide support for agile SPI activities. Thus, using the dimension of PACAP, RACAP and SPI success, the following hypotheses are proposed in this research:

H2a. The acquisition has a significant positive effect on the perceived level of success.
H2b. The acquisition has a significant positive effect on organisational performance.
H2c. Assimilation has a significant positive effect on the perceived level of success.
H2d. Assimilation has a significant positive effect on organisational performance.
H2e. The transformation has a significant positive effect on the perceived level of success.

H2f. The transformation has a significant positive effect on organisational performance.
H2g. Exploitation has a significant positive effect on the perceived level of success.
H2h. Exploitation has a significant positive effect on organisational performance.

The research model of the relationship between ACAP and agile SPI success can be seen in Figure 2.

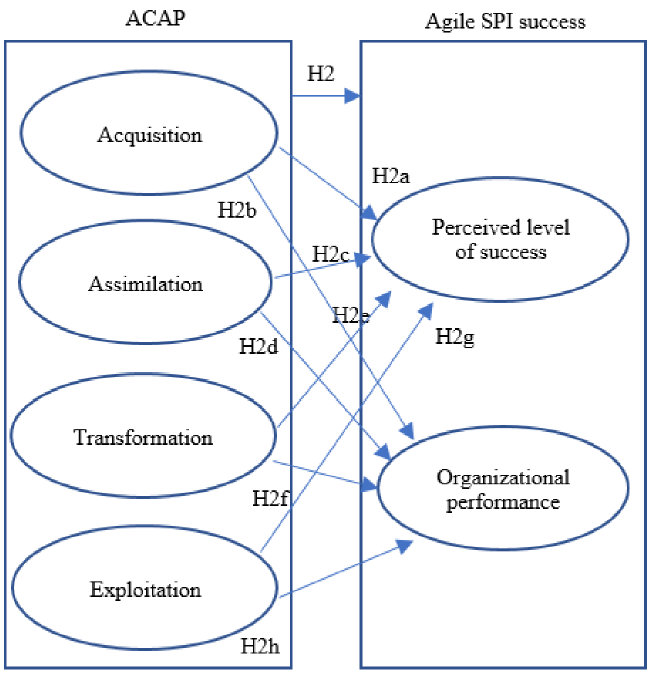

Figure 2. Research model of the relationship between ACAP and agile SPI success

2.3. Knowledge Sharing and Agile SPI Success

The strength of agile organisations is that the iterative and incremental mindset should always open the door for test improvements in procedures. Based on this insight, SPI knowledge sharing is necessary to achieve improvement (Poth et al., 2018). Feher and Gabor (2006) noted that knowledge leverage (share and transfer) activities are essential to decrease dependency on employees who are single owners of critical knowledge. Knowledge sharing is crucial during successful CMMI-based SPI implementation in specific organisational cultures (J. C. Lee, Shiue, et al., 2016). Therefore, it logically seems that SPI knowledge-sharing activities are crucial for ASD team members to gladly share their knowledge, which helps the team achieve expected agile SPI goals. Thus, the following hypotheses are proposed in this research:

H3. Knowledge sharing has a significant positive effect on agile SPI success.

Meanwhile, limited studies investigate the relationship between knowledge sharing and SPI success dimensions. Thus, based on the findings of Lee et al.'s (2016) study, the following hypotheses are proposed in this research:

H3a. Knowledge sharing has a significant positive effect on the perceived level of success.
H3b. Knowledge sharing has a significant positive effect on organisational performance.

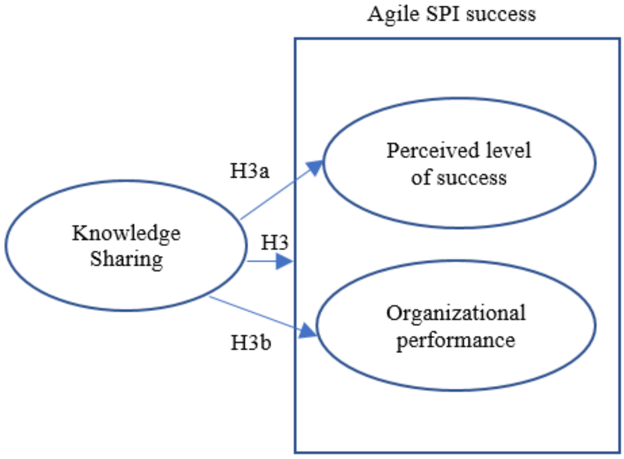

Figure 3. Research model of the relationship between knowledge sharing and agile SPI success

2.3. The Mediating Effect of ACAP on the Relationship between Knowledge Sharing and Agile SPI Success

Based on the conceptual framework which supported H1, H2, and H3, it seems that ACAP activities are crucial for ASD team member to help their knowledge-sharing process in achieving expected agile SPI goals. Thus, the following hypotheses are proposed:

H4. ACAP fully mediate the relationship between knowledge sharing and agile SPI success.

Using the dimensions of PACAP, RACAP, and agile SPI, the following hypotheses are proposed:

H4a. Acquisition fully mediates the relationship between knowledge sharing and the perceived level of success.

H4b. Acquisition fully mediates the relationship between knowledge sharing and organisational performance.

H4c. Assimilation fully mediates the relationship between knowledge sharing and the perceived level of success.

H4d. Assimilation fully mediates the relationship between knowledge sharing and organisational performance.

H4e. Transformation fully mediates the relationship between knowledge sharing and the perceived level of success.

H4f. Transformation fully mediates the relationship between knowledge sharing and organisational performance.

H4g. Exploitation fully mediates the relationship between knowledge sharing and the perceived level of success.

H4h. Exploitation fully mediates the relationship between knowledge sharing and organisational performance.

3. Methods

3.1. Sampling procedure

The study targets employees from two of the top three Indonesian telecommunication companies who have either previously participated or are participating in Agile Software Development (ASD) teams. Due to the difficulty in determining the number of individuals who meet these criteria, the research employs an 80% Statistical Power method to ascertain the sample size (Joseph F Hair, Hult, Ringle, & Sarstedt, 2014). According to this method, the model in the study includes a maximum of two paths leading to the SPI construct. Consequently, the minimum sample size required varies: 110 for a minimum R^2 of 0.10, 52 for an R^2 of 0.25, 33 for an R^2 of 0.50, or 26 for an R^2 of 0.75.

Assuming the study employs an instrument error tolerance of 0.05, these values are used. This study obtained a sample of 99 respondents. The study achieved an R^2 value of 0.622 from the measurement model test for SPI. With this value, the number of respondents obtained meets the 80% Statistical Power method requirements, exceeding the minimum of 33 respondents. The respondents are mostly male (78%), government-owned company staff (69%), generation Y (85%) and have experience in an ASD team between one and less than two years (54%). The detailed of respondents' characteristic can be seen in Table 1.

Table 1. Respondents' characteristics

Criteria	Frequence	Percent
Gender		
Female	77	78
Male	22	22
Experience		
Less than 1 years	27	27
1 year till less than 2 years	53	54
2 year till less than 5 years	4	4
5 years and more	15	15

3.2. Measures

To ensure reliability and validity, the questionnaire was examined by six senior IT professionals with ASD to ensure the survey items were clear, understandable, and consistent in meaning. A pilot test was conducted with 30 ASD professionals to ensure the survey questions were reliable and valid. All variables and their dimensions measured in the research were represented by 25 reflective items with the answer on a 5-Likert scale: 1(strongly disagree) − 5 (strongly agree). Adopted from Dyba (2005), Lee et al.(2016), and Lee et al. (2017), agile SPI success was measured using five items. This scale consists of two dimensions: perceived level of success (PLOS, for example, "Our SPI work has substantially improved our overall performance") and organisational performance (OP, for example, "We have greatly reduced the cycle time of software development").

ACAP was measured using 16 items adapted from Pavlou and Sawy (2006). This scale consists of four dimensions: acquisition (ACQ, for example, "We have routines to identify, value, and import new information and knowledge"), assimilation (ASM, for example, "We have adequate routines to assimilate new information and knowledge"), transformation (TRS, for example, "We are effective in transforming existing information into new knowledge") and exploitation (EXP, for example, "We are effective in transforming existing information into new knowledge"). Knowledge sharing was measured by four items, adopted by Faraj and Sproull (2000) and Lee et al. (2014). Examples of items are "Members in our team share their special knowledge and expertise with one another" and "If someone in our team has some special knowledge about how to perform the team task, he or she is not likely to tell the other member about it".

3.3. Data analysis technique

The PLS-SEM method was applied to analyse data using an embedded two-stage approach (Ringle, Sarstedt, & Straub, 2012; Sarstedt, Hair, Cheah, Becker, & Ringle, 2019). Specifically, using SmartPLS 3.0, the first stage was executed in three phases: developing the first-order model and testing the measurement and structural models. Using latent values generated from stage one, stage two started with the second-order model development, then measurement model testing, and the last structural model testing (Sarstedt et al., 2019). Besides that, this research also tested the mediating effect of ACAP on the relationship between knowledge sharing and agile SPI success in first-order and second-order models.

4. Results and implications

4.1. First-order Measurement Model Analysis

Using the PLS algorithm method by SmartPLS, this research tested the first-order measurement model by indicator reliability, indicator consistency, convergent validity, and discriminant validity (Joseph F Hair et al., 2014). The measurement properties are reported in Table 2. Indicator reliability was assessed regarding outer loadings. The outer loadings ranged from 0.725 to 0.936. Indicator consistency and convergent validity were measured regarding composite reliability (CR) and average variance extracted (AVE). Composite reliabilities in our measurement model ranged from 0.844 to 0.938, while the average variance extracted ranged from 0.644 to 0.852. In three cases, the outer loadings and composite reliability scores are above the recommended cut-off of 0.70, and the average variance extracted is above the recommended cut-off of 0.5 (Joseph F Hair et al., 2014). So it can be concluded that our items are reliable.

Table 2. First-order measurement model analysis result

Constructs	CR	AVE	Items	Outer loadings
KS	0.928	0.763	KS1	0.851
			KS2	0.869
			KS3	0.896
			KS4	0.877
ACQ	0.931	0.772	ACAP1.1	0.900
			ACAP1.2	0.864
			ACAP1.3	0.854
			ACAP1.4	0.895
ASM	0.922	0.704	ACAP2.1	0.725
			ACAP2.2	0.858
			ACAP2.3	0.851
			ACAP2.4	0.874
			ACAP2.5	0.878

Constructs	CR	AVE	Items	Outer loadings
TRS	0.938	0.790	ACAP3.1	0.914
			ACAP3.2	0.884
			ACAP3.3	0.898
			ACAP3.4	0.857
EXP	0.907	0.764	ACAP4.1	0.827
			ACAP4.2	0.880
			ACAP4.3	0.914
PLOS	0.920	0.852	SPI1.1	0.910
			SPI1.2	0.936
OP	0.844	0.644	SPI2.1	0.780
			SPI2.2	0.855
			SPI2.3	0.770

In the last test, discriminant validity was assessed by comparing the value AVE of each construct with variances shared between this individual construct and all the other constructs. This was done using the Fornell-Larckers criterion. A higher value of the individual construct's AVE than its shared variances implies sufficient discriminant validity (Joe F. Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). Based on the value shown in Table 3, the results indicated satisfactory discriminant validity. This shows that all constructs are valid.

Table 3. First-order Fornell-Larcker criterion

	ACQ	ASM	EXP	KS	OP	PLoS	TRS
ACQ	0,878						
ASM	0,775	0,839					
EXP	0,751	0,830	0,874				
KS	0,721	0,760	0,696	0,873			
OP	0,607	0,688	0,730	0,597	0,803		
PLoS	0,586	0,712	0,649	0,628	0,682	0,923	
TRS	0,823	0,864	0,839	0,789	0,703	0,664	0,889

4.2. First-order Structural Model Analysis

This analysis assessed the structural model, which predicted the R2 and T-statistics values. The R-square values measure` the structural models' predictive power, while the T statistics denote the strengths of the hypothesised relationships between the independent and dependent variables. Interpreted as multiple regression results, the R-square indicates the amount of variance the exogenous variables explain. As seen in Table 4, the result showed that all endogenous variables in the first-order model have a relatively moderate prediction power, except for exploitation.

Table 4. First-order coefficients of determination

Variable	R-square	Result
ACQ	0.519	Moderate
ASM	0.577	Moderate
TRS	0.622	Moderate
EXP	0.485	Poor
OP	0.566	Moderate
PLOS	0.532	Moderate

Using the bootstrapping technique, T-statistics were calculated to evaluate hypothesised relationships. Contrary to expectation, 57% of hypotheses were rejected. The results are shown in Table 5.

Table 5. First-order hypotheses testing

Hypotheses	Path	T-statistics	Result
H1a	KS -> ACQ	9,922	Accepted
H1b	KS -> ASM	11,847	Accepted
H1c	KS -> TRS	14,940	Accepted
H1a	KS -> ACQ	9,922	Accepted
H1b	KS -> ASM	11,847	Accepted
H1c	KS -> TRS	14,940	Accepted
H1d	KS -> EXP	8,743	Accepted
H2a	ACQ -> PLOS	0,198	Rejected
H2b	ACQ -> OP	0,246	Rejected
H2c	ASM -> PLOS	3,102	Accepted
H2d	ASM -> OP	0,910	Rejected
H2e	TRS -> PLOS	0,243	Rejected
H2f	TRS -> OP	1,159	Rejected
H2g	EXP -> PLOS	0,846	Rejected
H2h	EXP -> OP	3,008	Accepted
H3a	KS -> PLOS	1,139	Rejected
H3b	KS -> OP	0,375	Rejected

From the result of the hypothesised relationships evaluation, the mediating effect of all ACAP dimensions was tested. According to Hair et al. (Joe F. Hair et al., 2014), the variance accounted for (VAF) calculated the mediation effect. The VAF determined the value of the indirect impact relative to the total effect (i.e., direct effect + indirect effect). Table 6 shows that the VAF value for all paths is above the recommended cut-off of 0.80 (Joseph F Hair et al., 2014) for a full mediating effect, except for paths of H4a and H4e. It can be concluded that most of these hypotheses are accepted.

Table 6. First-order mediation effect

Hypotheses	Path	VAF Value	Result
H4a	KS -> ACQ -> PLOS	0,633	Partial
H4b	KS -> ACQ -> OP	0,867	Full
H4c	KS -> ASM -> PLOS	0,970	Full
H4d	KS -> ASM -> OP	0,966	Full
H4e	KS -> TRS -> PLOS	0,761	Partial
H4f	KS -> TRS -> OP	0,979	Full
H4g	KS -> EXP -> PLOS	0,867	Full
H4h	KS -> EXP -> OP	0,986	Full

4..3. Second-order Measurement Model Analysis

The data in the second-order measurement model is a latent value generated from the PLS Algorithm technique by SmartPLS in the first-order measurement analysis. Following the same method in first-order measurement model analysis, this model was tested by indicator reliability, indicator consistency, convergent validity, and discriminant validity with their threshold values (Joseph F Hair et al., 2014). The measurement properties are reported in Table 7. The outer loadings ranged from 0.899 to 1. Composite reliabilities in our measurement model ranged from 0.941 to 1, while the average variance extracted ranged from 0.841 to 1. In three cases, the outer loadings and composite reliability scores are above the recommended cutoff of 0.70, and the average variance extracted is above the recommended cutoff of 0.5 (Joseph F Hair et al., 2014). So, it can be concluded that all items are reliable.

Table 7. Second-order measurement model analysis result

Variable	CR	AVE	Item	Outer loadings
KS	1	1	KS	1
ACAP	0.961	0.861	ACQ	0.899
			ASM	0.937
			TRS	0.952
			EXP	0.922
SPI	0.941	0.841	PLOS	0.914
			OP	0.920

Using the Fornell-Larckers criterion, as seen in Table 8, the discriminant validity testing result was satisfactory because the individual construct's AVE value was higher than its shared variances (Joe F. Hair et al., 2014).

Table 8. Second-order Fornell-Larcker criterion

	ACAP	KS	SPI
ACAP	0.928		
KS	0.800	1.000	
SPI	0.786	0.667	0.917

4.4. Second-order Structural Model Analysis

This analysis assesses the structural model by predicting the R-square and T-statistics values. R-square measures the percentage of variance explained by independent constructs in the model (Joseph F Hair et al., 2014). R-square values were 62.2% (agile SPI success) and 64% (ACAP). Those values show all endogenous variables in the second-order model and have relatively moderate prediction power.

Table 9. Second-order hypotheses testing

Hypotheses	Path	T-statistics	Result
H1	KS -> ACAP	14,276	Accepted
H2	ACAP -> SPI	6,286	Accepted
H3	KS -> SPI	0,846	Rejected

Table 9 shows that the T-statistics calculation shows that H1 and H2 were accepted, while H3 was rejected. From this result, the VAF value of the relationship between knowledge sharing, ACAP, and agile SPI success is 0.99, above the recommended cutoff of 0.80 (Joseph F Hair et al., 2014). It can be concluded that H4 was accepted, and ACAP fully mediates the relationship between knowledge sharing and agile SPI success.

4.2. Discussion

The main purpose of this research is to investigate the mediating effect of ACAP on the relationship between knowledge sharing and agile SPI success using a sample of 99 ASD professionals in Indonesian telecommunication companies. This study is valuable for agile software development to improve its process, particularly in the Indonesian telecommunication industry. Various significant aspects of the results will be discussed below. Firstly, in a second-order model, ACAP fully mediates the effects of knowledge sharing on agile SPI success. This finding was supported by structural first-order model measurement among all its dimensions. This research combined the previous studies about the effect of knowledge sharing on ACAP (J. Lee et al., 2014; Rafique et al., 2018; Raharso, 2021) and the effect of ACAP on the success of non-agile-based SPI (J. C. Lee & Chen, 2019; J. C. Lee et al., 2017; J. C. Lee, Shiue, et al., 2016). Hence, the research found a new insight that ACAP is crucial in implementing the knowledge-sharing process to push forward the success of agile SPI, a different SPI framework.

Secondly, based on the testing findings in both first-order and second-order models, the effect of knowledge sharing on agile SPI success is not significant. Relating to the first finding above, this research found that knowledge-sharing could not enhance the success of agile SPI without being mediated by ACAP in Indonesian telecommunication companies' agile software development process. This finding is not aligned with that of Lee et al. (2016). These two research works may be due to the difference in country culture and SPI approach, as they were carried out with samples from IT professionals from a CMMI (non-agile SPI)-based Taiwanese firm and an agile SPI-based Indonesian firm. The difference in the use of research instruments between these two studies may also cause this difference. This research by Faraj and Sproull (2000) and Lee et al. (2014), while Lee et al.'s (2016) research adopted Van Den Hooff and de Ridder (2004) for knowledge-sharing instruments. The comparative study between those two instruments may explain the cause of the different findings between this study and Lee et al. (2016).

Thirdly, this research shows that knowledge sharing has a significant positive effect on ACAP. This finding was supported by the other finding, which indicates that knowledge sharing significantly positively affects all ACAP dimensions (acquisition, assimilation, transformation, and exploitation). These findings support Lee et al.’s (2014), Raharso’s (2021) and Rafique et al.’s (2018) findings. The predictive power of ACAP in this research is 0.640. This means ACAP can be predicted or explained by 64% through knowledge-sharing implementation in Indonesian telecommunication companies' agile software development process. It is significantly higher than Lee et al.’s (2014) finding of 0.384 and Raharso’s (2021) of 0.089 but a little lower than Rafique et al.’s (2018) of 0.680. The differences in these research works may be due to the differences in the SPI approach, country culture, and industry type.

Finally, the relationship between ACAP and agile SPI success differs in first-order and second-order models. ACAP significantly positively affects agile SPI success in the second-order model. However, only two of eight (25%) relationships between ACAP dimensions and agile SPI success dimensions are significant. Therefore, the significant positive effect of ACAP on agile SPI success might be significantly influenced by those two relations: the effect of assimilation on the perceived level of success and the effect of exploitation on organisational performance. Those may be crucial to operationalising ACAP to enhance the success of agile SPI in Indonesian telecommunication companies' agile software development process. The deep research which explores those two relations may explain the cause of this paradigm. In general, this result supports Lee et al.’s (2016), Lee et al.’s (2017), and Lee & Chen’s (2019) findings. The predictive power of agile SPI success in this research is 0.622. This means that the success of agile SPI can be predicted or explained by 62.2% through ACAP implementation in Indonesian telecommunication companies' agile software development process. It is significantly higher than Lee et al.'s (2016) of 0.445, Lee & Chen’s (2017) finding of 0.482, and Lee & Chen’s (2019) finding of 0.336. Similar to the third finding, the differences in these research works may also be due to the differences in the SPI approach, country culture, and industry type. The deep comparative study to explore those factors may reveal the cause of those findings.

5. Conclusion

The findings of this research show that the development of ACAP is essential for a firm because it helps the firm to develop the effects of knowledge sharing on agile SPI success. In particular, the significant positive impact of ACAP on agile SPI success might influenced by only two relationships among its dimensions, namely the significant positive effect of assimilation on the perceived level of success and the significant positive impact of exploitation on organisational performance. Meanwhile, the difference in culture, SPI approach and industry type might influenced the difference between this research and other research findings.

Although several contributions have been presented, there are some limitations and opportunities for further research. A large sample in one firm and Generation Y are the first limitations of this research. The questionnaire distribution was limited to one firm and generation and was therefore limited for broad generalisation. Further research that represents the other firms and age groups with a balanced composition is advised. Second, In addition to Faraj and Sproull (2000), other studies could be adopted for knowledge sharing. Further research could replicate this by adopting the other instrument for knowledge sharing, which is more appropriate with SPI- knowledge sharing.

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