RESEARCH ARTICLE

University-Industry R&D Alliances – An Exploration of Alliance Capabilities Measures [version 1; peer review: 2 approved with reservations]

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V1 First published: 22 Sep 2021, 10:959
<https://doi.org/10.12688/f1000research.73093.1>
Latest published: 22 Sep 2021, 10:959
<https://doi.org/10.12688/f1000research.73093.1>

Abstract

Background: Alliance capabilities studies have long emerged since the 1990s, focusing mainly on firm-to-firm collaboration. However, research on university-industry alliances only emerged from the 2000s. Alliance capabilities are portrayed as a crucial condition to achieve the targeted collaboration outcomes and sustainable relationships. As most alliance capabilities studies focus on firm-to-firm collaboration, research on university-industry research and development (R&D) alliance is still scarce. Thus, the measurement items for alliance capabilities in the university-industry R&D context are still under-developed. Thus, to investigate how alliance capabilities affect university-industry R&D performance in Malaysia, the relevant measures must first be defined. This paper intends to properly define the measurement items for alliance capabilities in the context of university-industry R&D alliances.

Methodology: The alliance capabilities measures are adapted from various literature to accommodate both university and industry perspectives. In finalizing the measurement, in-depth pre-testing was conducted by five strategic management subject matter experts in ensuring face and content validity.

Results: There are three alliance capability dimensions. The first dimension is alliance management capability which includes goal setting, process configuration, alliance structure, coordination, management support, and alliance evaluation. The second dimension is alliance integration capability which incorporates relational capabilities, inter-organizational communication, relational capital, and project team effectiveness. The third is alliance learning capability which measures alliance experience, knowledge articulation, knowledge sharing, knowledge codification, internalization, and relationship learning. Although this study successfully develops a set of measurement items for alliance capabilities in university-industry R&D, further statistical analysis is required to test this scale.

Conclusion: To date, quantitative measurement items for alliance

Open Peer Review

Approval Status ? ?

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version 1	?	?
22 Sep 2021	view	view

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capabilities in the context of university-industry R&D alliances are still at the infancy stage. Although the measurements are yet to be statistically analyzed, they can be used as a benchmark for future university-industry R&D alliances studies.

Keywords

alliance capabilities, university-industry, alliance management capability, alliance learning, alliance relationship, R&D

This article is included in the **Research Synergy Foundation** gateway.

This article is included in the **Research on Research, Policy & Culture** gateway.

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Author roles: **Kamaruzaman N:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Validation, Writing – Original Draft Preparation; **Asmawi A:** Conceptualization, Funding Acquisition, Project Administration, Supervision, Validation, Writing – Review & Editing; **Chew KW:** Supervision, Validation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This research is made possible by the Fundamental Research Grant Scheme (FRGS) Cycle 2018, by the Malaysian Ministry of Higher Education. This grant is assigned to Arnifa Asmawi, Faculty of Management, Multimedia University, Malaysia. *The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

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How to cite this article: Kamaruzaman N, Asmawi A and Chew KW. **University-Industry R&D Alliances – An Exploration of Alliance Capabilities Measures [version 1; peer review: 2 approved with reservations]** F1000Research 2021, 10:959 <https://doi.org/10.12688/f1000research.73093.1>

First published: 22 Sep 2021, 10:959 <https://doi.org/10.12688/f1000research.73093.1>

Introduction

Industry 4.0 has been the main agenda for many countries,¹ including Malaysia.² Industry 4.0 is the technological evolution and digitalization of the manufacturing processes to increase productivity and efficiency.³ However, it is observed that Malaysia is relatively slow in picking up the pace in transitioning into Industry 4.0.³ Hence, various Malaysian policies such as the National Transformation 2050 Policy, underscore the role that innovation and R&D can play to ensure a smooth transition into Industry 4.0.⁴ These policies clearly suggest that stronger alliances between universities and industries are crucial in accelerating R&D and innovation capabilities.^{5,6}

However, successful alliances between universities and industry are not without their own set of challenges.⁷ A glance at the strategic management study, particularly on alliance capabilities at the micro-level processes, opens the need to further investigate the level of alliance capabilities in Malaysian university-industry R&D alliances.⁸ The research on alliance capabilities, specifically at the micro-level processes (which include the ability to manage, integrate and learn from the alliance relationship), is crucial to achieve strategic benefits and sustainability.^{8,9}

Although research on alliance capabilities existed since the 1990s, extant literature primarily focuses on firm-to-firm collaboration.¹⁰ Studies on university-industry alliances emerged in the 2000s while specific research on knowledge-based alliance capabilities only started in 2008.¹¹ To date, studies on the university-industry alliance capabilities, primarily on quantitative analysis, are still limited. Thus, causing a hurdle for researchers in finding the measurement items on alliance capabilities that can fit both the university and industry R&D context.

Henceforth, this paper purports to develop a set of measurement items on micro-level processes of alliance capabilities in the context of university-industry R&D alliances. Based on the framework adapted from Kohtamäki *et al.*,⁸ alliance capabilities refer to the firm's ability in managing, integrating, and learning from the alliance relationship. Figure 1 illustrates the alliance capabilities dimensions used in this study.

Alliance management capability

Alliance management capability is the ability of university-industry R&D alliances to set targets, implement tasks, and perform alliance evaluation.⁸ Alliance target setting refers to the ability of a firm to establish goals,^{12,13} configure processes,¹⁴ and developing alliance structures.¹⁵ On the other hand, alliance task implementation denotes the ability of a firm to coordinate with strategic alliance partners¹⁶ and rally the support of the management team.¹⁷ Meanwhile, the third aspect of alliance management capability is the evaluation of the alliance tasks and activities.¹⁸

Alliance integration capability

Alliance integration capability looks at how R&D alliance partners develop their alliance capabilities through social and structural integration.⁸ The ability of alliance partners in utilizing relational capability,¹⁹ inter-organizational communication,²⁰ and relational capital¹³ are measured under social integration. Whereas structural integration can be measured through the firm's ability to achieve project team effectiveness.²¹

Figure 1. Conceptualization of alliance capabilities measurement items.

Alliance learning capability

Alliance learning capability is the third dimension of alliance capabilities. It evaluates R&D partners' ability to create, assimilate, and internalize knowledge from their relationship.⁸ In knowledge creation, the firm will assess how they can generate knowledge from experience,²² articulate and share the knowledge.²³ Knowledge assimilation, on the other hand, is measured through knowledge codification and combination.²³ While knowledge internalization can be assessed through the firm's ability to internalize knowledge²³ and acquire relationship learning.²⁴

Methods

Measurement items or scales are normally used to measure actions, behaviors, or feelings that cannot be measured using a single item or variable.^{25,26} This paper presents the measurement items for alliance capabilities in the context of Malaysian university-industry R&D alliances. Based on the item development method by Boateng *et al.*,²⁶ the first step is specifying the variable, dimensions, and constructs in measuring alliance capabilities. In this study, measurement items are carefully chosen from intensive review of existing literature. Due to limited alliance capabilities measures in the context of university-industry alliances, measurement items are adapted from various inter-firm collaboration studies to suit the context of this study.²⁷ All scales are measured in a 5-point Likert scale (1-Strongly disagree to 5-Strongly Agree). Once the measurement items were finalized, an in-depth pre-testing was performed with five subject matter experts in the field of Strategic Management. This process is necessary to ensure content validity and face validity of the measurement items.²⁶

The data for these measures will be collected through a survey. When investigating alliance capabilities in university-industry R&D alliances, the appropriate unit of analysis will be dyads. The survey forms will be distributed to university researchers and their respective industry partners who are working or have worked together in an R&D project. Reputational and snowball sampling will be used due to the inclusion criteria of the respondents. Subsequently, the data will be analyzed using the Multi-Group Analysis (MGA) technique using PLS-SEM.

In addition, as this type of study involves human participation, consent from the respondents will be acquired. Due to the Covid-19 pandemic, this study will be conducted using an online survey platform (Google Form). Hence, a statement of consent will be included on the first page of the survey information sheet. Respondents can opt to provide their consent by answering the survey (i.e., clicking the 'Next' button) and vice versa.

Results

Upon completion of the measurement development, and pre-testing for face validity and content validity,²⁸ the measurement items for alliance capabilities in Malaysian university-industry R&D alliances are presented below.

Goal setting is the ability of R&D alliance partners to align their common goals. Differences in respective organizational goals will impede the alliance success.⁷ Therefore, it is important for both parties to achieve common understanding and agree on shared project objectives and requirements prior to the establishment of the R&D alliance. Figure 2 shows the measurement items used in measuring goal setting.

Process configuration measures the ability of R&D alliance partners in combining internal and external factors that are important for successful project execution and developing relational capability.²⁹ Specifically, process configuration evaluates the R&D alliances' ability in configuring resources (planning tools, standard operating procedures, and technological expertise), team members qualification in problem-solving, and task fulfillment (the input of R&D alliance

Item Code	Items	Source
GS1	We shared the same vision/mission with our R&D partners.	Chen et al. (2008); Gu et al. (2013); Ritter et al. (2002)
GS2	We understand our R&D partner's strategic direction.	
GS3	We discuss with our R&D partners on our joint project requirements.	
GS4	We discuss with our R&D partners on our joint project objectives.	

Figure 2. Goal setting.

partners is also considered in completing the project).¹⁴ Measurement items for process configuration adapted from Jacob¹⁴ are as shown in **Figure 3**.

Alliance structure measures the readiness of dedicated supporting units and individuals in managing the R&D alliance relationship.¹⁵ The availability of dedicated functions or individuals in managing the alliance relationship is argued to be one of the crucial aspects in managing the collection of knowledge and alliance practices.³⁰ **Figure 4** illustrates the measurement items used in measuring alliance structure.

Coordination evaluates how R&D alliance partners achieve mutual project goals through individual roles and activities' specifications.³¹ As part of the control processes, coordination between alliances enables them to streamline their R&D activities, enhancing learning capability, and increase their communication quality.³² **Figure 5** illustrates the items to measure coordination.

Management support focuses on the leading capability of the R&D alliances' respective organizations in inspiring individuals to achieve the designated R&D outcomes.³³ Through this mechanism, researchers who are involved in the

Item Code	Items	Source
PC1	In our organization, we have the technological expertise needed to collaborate with our R&D partner.	Jacob (2006)
PC2	In our organization, we follow standard operating procedures when collaborating with our R&D partner.	
PC3	In our organization, we have proper project planning tools when collaborating with our R&D partners.	
PC4	Overall, we have the resources (i.e., technological expertise, SOP, planning tools) in ensuring collaboration with our R&D partners.	
PC5	We are sufficiently qualified in our technological field to develop individual problem solutions.	
PC6	We are also sufficiently qualified in our R&D partner's technological field to develop individual problem solutions.	
PC7	We possess acceptable project management skills that are required in this joint R&D project.	
PC8	Overall, we have sufficient qualification and skills required for this R&D project.	
PC9	In our organization, partner's projects are planned on an individual basis.	
PC10	In our organization, partner's projects are planned on systematic basis.	
PC11	Our partner's inputs are regularly taken into account for our project deliverables.	
PC12	In our organization, partner's inputs are integrated in the development of individual problem solutions.	
PC13	Overall, we are able to fulfil the R&D project tasks based on our R&D partners requirements.	

Figure 3. Process configuration.

Item Code	Items	Source
AS1	In our organization, there is a dedicated central unit to manage R&D alliances.	Schilke & Goerzen (2010)
AS2	In our organization, there are dedicated employees to manage R&D alliances.	
AS3	In our organization, there is a great deal of support for the management of R&D alliances through a central unit.	
AS4	Overall, in our organization, we have the appropriate alliance structure (i.e., dedicated unit, dedicated individual) in managing the R&D alliances.	

Figure 4. Alliance structure.

Item Code	Items	Source
CD1	Our activities with our R&D partners are well coordinated.	Ritter et al. (2002); Schilke (2013)
CD2	We ensure that our work tasks fit well with those of our R&D alliance partners.	
CD3	There is a great deal of interaction with our R&D alliance partners on most decisions.	
CD4	We assign people to various roles and responsibilities in the R&D alliance.	
CD5	We coordinate the people involved in the R&D alliance.	

Figure 5. Coordination.

R&D alliance will understand the strategic importance of the alliance to the organization and are aware of the management commitment to this collaborative arrangement.³⁴ The measurement items for management support are as shown in Figure 6.

Alliance evaluation is one of the control processes in alliance capabilities. Through alliance evaluation, R&D alliance partners will be aware if there are any problems in the relationship that may affect the alliance performance.¹⁸ This controlling and monitoring activity is essential to make sure the tasks were executed as planned to achieve the targeted outcomes.³⁵ Figure 7 illustrated the measurement items for alliance evaluation.

Relational capabilities are part of the social integration in the alliance capabilities framework. They focus on the relationship quality of the R&D alliance partners.¹⁹ The high relational capability will impact knowledge transfer intensity which also signals trust development.³⁶ Therefore, relational capability can be explained as the readiness of a firm in forming and sustaining the R&D alliance relationship with its partners.³⁷ Measurement items for relational capabilities are as shown in Figure 8.

Inter-organizational communication measures the effectiveness of information sharing and communication in both formal and informal ways between R&D alliance partners.³⁸ As R&D alliances are formed between two or more different entities, the ability to create effective communication and interaction will result in loyalty, enabling knowledge exchange,

Item Code	Items	Source
MS1	I feel that the management in both organizations want this R&D alliance to be a success.	Lambe et al. (2002); Wittman et al. (2009)
MS2	I feel that the management in both organizations place a great deal of significance on this R&D alliance.	
MS3	I feel that this R&D alliance is strongly supported by the management of both organizations.	
MS4	Both organizations have management commitment towards the R&D alliances to achieve strategic goals.	

Figure 6. Management support.

Item Code	Items	Source
AE1	We regularly assess how much effort our people put into the R&D alliance.	Ritter et al. (2002)
AE2	We closely monitor the extent to which the R&D alliance works to our advantage.	
AE3	We monitor the differences between expected and actual performance in the R&D alliance.	
AE4	We monitor the extent to which our R&D partners carry out the tasks they agreed to.	

Figure 7. Alliance evaluation.

and sustaining the relationship.²⁰ Figure 9 shows the measurement items used in measuring inter-organizational communication.

Relational capital in R&D alliance relationships is portrayed as the ability to create a sense of shared destiny, trust, and open interaction.³⁹ The ability to develop relational capital between R&D alliance partners is crucial mainly in the innovation value chain, as it promotes effective knowledge integration and innovative activities.^{13,40} Figure 10 illustrates the measurement items for relational capital.

Project team effectiveness investigates how the joint involvement of alliance partners in the R&D project positively influences the project outcomes.²¹ Petersen *et al.*⁴¹ has precisely emphasized project team effectiveness, enhancing problem-solving, decision making, and team functionality. Project team effectiveness measurement items are as shown in Figure 11.

Alliance experience is argued as a crucial knowledge generator in any alliance relationships.⁴² Apart from technical knowledge, experience gained from previous alliances will enhance the competency in managing future similar relationships.⁴³ Based on Emden *et al.*,²² learning from alliance experience can be evaluated through the organizational ability in acquiring, analyzing, and distributing knowledge gathered from the alliance relationship. Figure 12 shows the measurement items in measuring alliance experience.

Item Code	Items	Source
RC1	We identify potential R&D partners and initiate relationships with them.	Wang et al. (2015)
RC2	We design effective governance mechanism for managing relationship with our R&D partners.	
RC3	We develop and manage mutually beneficial relationships with our R&D partners.	
RC4	We establish effective working relationship with R&D partners through formal channels.	
RC5	We establish effective working relationship with R&D partners through informal channels.	
RC6	Overall, we are able to create and maintain relationship with our R&D partners through designing effective working relationship.	

Figure 8. Relational capabilities.

Item Code	Items	Source
IOC1	We share sensitive information (i.e., financial, production, design, research, and/or competition) with our R&D partners.	Paulraj et al. (2008)
IOC2	We provide our R&D partners with any information that might help them.	
IOC3	We keep each other informed about matters that may affect our R&D alliance.	
IOC4	We have frequent face-to-face communication with our R&D partners.	
IOC5	We exchange performance feedback regularly.	

Figure 9. Inter-organizational communication.

Knowledge articulation focuses on R&D partners' ability in externalizing knowledge gathered throughout the alliance relationship into a format that is accessible to others.²³ In an alliance relationship, knowledge can be garnered through the individuals' interaction with alliance partners. This type of knowledge is categorized as tacit knowledge, and thus, the ability to document this knowledge for others to access may increase the ability for others to learn from it.⁴⁴ Measurement items for knowledge articulation are as shown in Figure 13.

Knowledge sharing, on the other hand, measures the efficiency of knowledge distribution between individuals through personal interaction.²³ The ability to share knowledge among individuals who are involved in an R&D alliance will lead to better project performance.⁴⁴ Figure 14 presents the measurement items for knowledge sharing.

Item Code	Items	Source
RP1	We have mutual respect for each other.	Kohtamäki et al. (2013)
RP2	We mutually trust each other.	
RP3	In this R&D collaboration, we always treat each other fairly.	
RP4	We consider each other's interests when problems arise.	
RP5	In this relationship, we have mutual confidence in each other's capabilities.	

Figure 10. Relational capital.

Item Code	Items	Source
PTE1	My R&D project team functioned better as a result of our R&D partner's involvement in the project.	Petersen et al. (2005)
PTE2	Our R&D partner's involvement in this project led to faster problem solving.	
PTE3	Our R&D partner's involvement in this project led to greater consensus on decision making.	
PTE4	Overall, R&D partner's involvement influences the project team effectiveness.	

Figure 11. Project team effectiveness.

Item Code	Items	Source
AX1	We conduct periodic reviews of our R&D alliances to understand what we are doing right and where we are going wrong.	Emden et al. (2005)
AX2	We periodically collect and analyze R&D project experiences from our R&D alliances.	
AX3	We modify our R&D alliance related standard operating procedures as we learn from experience.	
AX4	We diligently transfer know-how on R&D alliance 'do's' and 'don'ts' to key managers.	

Figure 12. Alliance experience.

Item Code	Items	Source
KA1	We regularly record our experience in managing R&D alliances.	Kale & Singh (2007)
KA2	We maintain a proper documentation of all major events, decisions or actions associated with the R&D alliance.	
KA3	We have a regular report on the progress of the R&D alliance.	
KA4	We have a dedicated database which contains all relevant information on the R&D alliance.	

Figure 13. Knowledge articulation.

Item Code	Items	Source
KS1	We participate in various forums to learn more about managing R&D alliances.	Kale & Singh (2007)
KS2	We participate in forums such as meetings, seminars, or retreats to exchange alliance-related information, experiences, war stories, etc.	
KS3	We engage in informal knowledge sharing.	
KS4	Project managers with substantial prior experience in managing alliances are usually rotated across some of the organization's key alliances.	

Figure 14. Knowledge sharing.

Knowledge codification is the merging of explicit knowledge into a systematic and meaningful document that can be used as a guide in managing future R&D alliances.²³ The codification of valuable knowledge into a systematic documentation can assist alliance partners in knowledge assimilation and facilitate decision making.^{16,23} Measurement items for knowledge codification are as shown in Figure 15.

Knowledge internalization in an R&D alliance aims to assist individuals to better understand the needs and requirements of their partners.⁴⁵ Knowledge internalization focuses on developing the ability to internalize knowledge gathered from the alliance through proper training activities.⁴⁶ Figure 16 illustrates the measurement items for knowledge internalization.

Relationship learning focuses on joint activities between R&D alliance partners to improve the relationship through information sharing, creating common learning platforms, and modifying their teamwork behaviors.^{12,24} These joint activities are further interpreted and integrated into relationship-specific memory that can influence their behaviors and routines.⁴⁷ Through relationship learning, both R&D alliance partners will be able to re-evaluate and re-adjust their routines to achieve the expected outcomes.⁴⁵ Figure 17 shows the measurement items for relationship learning.

Discussion

In summary, quantitative measurement items for alliance capabilities in the context of the university- industry R&D alliances are still at an infancy stage. However, based on extant research on alliance capabilities in various inter-organizational contexts,^{8,10} it is possible to deploy these measures after appropriate content validity and face validity

Item Code	Items	Source
KC1	Project managers follow a standard operating procedure to guide the formation or management of any alliance.	Kale & Singh (2007)
KC2	Resources such as checklists and guidelines are developed to assist decision making in strategic alliances.	
KC3	Alliance manuals which contain tools, templates, or frameworks are developed to assist decision making in strategic alliances.	
KC4	Project managers updates the alliance checklists, guidelines or manuals that have been developed and are in use.	

Figure 15. Knowledge codification.

Item Code	Items	Source
KI1	Project managers attend 'in-house' training programs on 'alliance management' whenever they are assigned to manage or work with any R&D alliance.	Kale & Singh (2007)
KI2	Project managers attend externally conducted training programs on 'alliance management' whenever they are assigned to manage or work with any R&D alliance.	
KI3	Our organization provides opportunities for 'on-the-job' alliance training to individuals who are relatively new to managing alliances.	
KI4	Our organization provides project managers access to documented information on its prior and ongoing R&D alliance experience.	

Figure 16. Knowledge internalization.

assessment at the pre-testing stage. Therefore, this paper has successfully developed a comprehensive set of measurements items to determine the extent of alliance capabilities in the context of university-industry R&D alliances.

These measures will be deployed in a quantitative study which intends to develop a framework on how micro-level alliance capabilities affect university-industry R&D alliance success. This study will examine how alliance capabilities function at the micro-processes and relational level. This research will analyze the dyadic relationship between individual university researchers and their industry partners (dyads). It is hoped that this study will be able to develop a composite model to explain the interplay of the alliance capability dimensions and their influence on R&D alliance success.⁴⁸

Item Code	Items	Source
RL1	We exchange information with our R&D partners related to changes in market structure, such as mergers, acquisitions, or partnering.	Chen et al. (2009); Selnes & Sallis (2003)
RL2	We exchange information with our R&D partners related to changes in the technology of the focal project.	
RL3	We establish joint teams to analyze and discuss strategic issues.	
RL4	We frequently adjust our common understanding with our partners in terms of technological trends related to our R&D project.	
RL5	We frequently meet face-to-face with our R&D partner in order to strengthen our relationship.	
RL6	Overall, joint activities with R&D alliances partners improved the learning process.	

Figure 17. Relationship learning

Conclusions

This study aims to develop the measurement items for alliance capabilities which consist of managing, integrating, and learning from the alliance relationship. From the item development process, this study managed to produce a set of measurement items for alliance capabilities relevant in the context of Malaysian university-industry R&D. We would like to emphasize that these scales have not been statistically analyzed. Thus, further assessment on construct validity such as construct discriminant validity, convergent validity, and other reliability tests is required.²⁸

Data availability

Figshare. Alliance Capabilities Measurement items and framework.pdf. DOI: <https://doi.org/10.6084/m9.figshare.14872140.v1>.⁴⁹

This project contains the following data: This document contains the measurement items for alliance capabilities in the context of university-industry R&D.

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC BY 4.0 Public domain dedication).

Ethical approval

This research received an ethical approval from the Research Ethics Committee (REC) of Multimedia University (Approval Number: EA1302021).

Acknowledgments

We would like to thank the three (3) Subject Matter Experts (SMEs) in the Strategic Management field from two universities in Malaysia that contributed to the pre-testing of the measurement items discussed in this paper.

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Version 1

Reviewer Report 02 February 2022

<https://doi.org/10.5256/f1000research.76717.r100922>

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Ainurul Rosli

Brunel Business School, Brunel University London, Uxbridge, UK

It was a great pleasure to have had the opportunity to review this paper, focusing on developing the measurement items for alliance capabilities which consist of managing, integrating and learning from alliance relationships. There is a decent amount of prior contributions on this topic which the author(s) missed, and this need to be reflected in the literature cited. Nevertheless the title entices me to read further so somehow it illustrates it's potential. However, as I read through the manuscript, I found some sections or areas that require substantive improvement, with greater clarity to make the contribution clearer.

1. The introduction can be written in a much more convincing manner. Some statements in this section left me unclear about what to expect in the rest of the paper. The research gap hasn't been outlined, and it is not clear. Why is a new measurement needed? Is it due to the rise of Industry 4.0? Or perhaps because the framework of Kohtamaki *et al.* didn't include a clear measurement? More explanation is required on the need to focus on the development of the measurement. What is the problem or limitation of the current way of measurement? With limited information addressing these issues, readers are left wondering why the need for this paper.
2. The methods section is a bit misleading. The focus here should be about the methods of developing the measurement tool. Somewhere in the paper, it was mentioned that two specialists in the area reviewed the scale. This should be included in the section on the development of the measurement variables. What has been done to ensure the quality of the work? Perhaps the focus here is on the steps taken to ensure the validity and reliability of such data collection tools used to support the conceptualisation of alliance capabilities measurement items.
3. The conclusion is too simplistic. In fact, when the reader completes reading the conclusion, it then makes sense that this is a measurement development paper and not a full empirical paper. It should not happen that way. Despite the confusion (due to the very limited argument in the introduction and literature section), the conclusion should include some indication of the importance/contribution of the work. My suggestion is for you to draw

from the various paper on how your approach to the development of the measurement differs from others and how it can bring a new perspective to understanding the topic/area.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

No

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: University-Industry Collaboration

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 07 December 2021

<https://doi.org/10.5256/f1000research.76717.r101482>

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Antonio Messeni Petruzzelli

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The present study deals with a very interesting and fascinating topic. However, despite the potential relevance of its contribution, I believe that it presents some issues that need to be tackled.

In the following, you can find some suggestions and comments that I hope may be useful to improve the contribution of your study.

- First, research gap and contributions need to be better theoretically discussed in the introduction.
- Second, I suggest to develop an ad hoc section discussing the theoretical background of the study.
- Third, I suggest to consider recent and relevant contributions on the topic (For example these articles by the present reviewer: Messeni Petruzzelli, 2011¹; Messeni Petruzzelli and Rotolo, 2015²; Messeni Petruzzelli and Murgia, 2020³, 2021⁴).
- Fourth, the methodology needs to be theoretically justified.
- Fifth, the concluding section needs to be enriched by discussing the main theoretical and practical implications, as well as the main limitations and directions for future research.
- Sixth, the paper may benefit from a professional copyediting.

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Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Innovation Management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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