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# EXPLORATORY FACTOR ANALYSIS OF TEAM CLIMATE INVENTORY (TCI) ON TECHNOLOGY START-UP

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**Abstract:** Team climate in organization is an important element to make the innovation process in an organization works. Study on team and its behaviour is done extensively around the world. It shows the importance of a team. Team climate is one of the characteristics of an innovative team. Team Climate Inventory is a measurement scale to examine the climate factors in a team. Earlier TCI was developed by West in 1990 and then extended in 1995 and 1998. Kivinaki and Eloainio made a shorter version of West's which consists only 14 items. The shorter version is administered to a total five teams of co-working space start-up. The technology start-up has an intensive program every day within a month under a supervision of tutor from international wellknown company and an entrepreneurial-based university. The quantitative survey was followed by interviewing some of the member and leaders of the start-ups. The item analysis shows that all items are accepted with CITC value are above 0.3. And high reliability with Cronbach's alpha value is above 0.8. The analysis shows that TCI has 3 factors, which consist of vision, participatory safety, and support for innovation.

**Keywords:** *Team Climate, Innovation, Technology start-up*

## 1. Introduction

In the industrial dynamic challenges, business organizations need to overcome ineffective traditional method in order to develop and fulfil the customer satisfaction. Many researches highlight the importance of introducing innovation in organization as important keys for company success (Lagrosen,2014) since it gives a competitive advantage to the organization to sur pass competitors and customer needs.

On the other hand, although innovations is seen as the spearhead of company development, there still a dark side of innovation. Waterson et al. (1999) found that approximately 50–60% companies at UK only met "moderately" or "a little" of their innovation objectives. The study shows that focusing on the product innovation is not a guarantee for a company to reach their own achievement expectation. Innovation should be embedded in the people. It is the people that enhance the effectiveness in the process, the ability to implement new project and the adaptability to new innovations (Akhmetshin et al., 2018).

West et al. (1990) proposes two kinds of innovation: product innovation and process innovation. Product innovation is the innovation in production process that emphasize the attempt or effort that the company do to develop more suitable product and service for the customer Process innovation is the innovation in the working process that can help the company to develop innovative idea in any processing line (West et al. 1990).

Baer and Frese (2014) recommended that process innovations, as an organizational attempt to change production and service processes, need to be accompanied by climates that complement the adoption and implementation of such innovations. They proposed two climate dimensions for supporting the team innovation: organizational environment and work environment. The organizational environment has to be supportive toward work while the work environment has to guarantee people are safe to take interpersonal risks and value as individual's contribution to the work process.

## Theoretical Review

*Technology start-up*

Technology Start-ups can be defined as "an investment in a project that assembles and deploys specialized individuals and heterogeneous assets that are intricately related to advances in scientific and technological knowledge for the purpose of creating and capturing value for a firm". (Bailetti, 2012). It is clear that the ultimate outcome of a technology start-ups is to create and capture value through collaboration and experimentation. Some successful entrepreneurs gave more simple definitions. Paul Graham, co-founder of Airbnb and dropbox said:"startup is growth", a project that develop extremely fast and scalable. It is defined by its development with rapid increase in revenues and customers. Peter Thiel, CEO of PayPal, said that "a company is a startup as long as it creates new solutions". He emphasized on the innovation and problem solution. Clayton Christensen, one of the visionaries of innovative entrepreneurship, proposed the concept of disruptive innovation (Christensen, 2015) and seeing startups as an organisations that create breakthrough innovations and able to change market paradigms in the long run.

The most popular definition of a startup was formulated by Steve Blank which is "a startup is a temporary organisation formed to search for a repeatable and scalable business model" (Blank 2003, 2013). "Temporary organisation" can be any form of entity to achieve the common goal (Leten and Van Dyck 2012). The word "search" may represents all the effort or innovation to response to the uncertainty, while the technology product innovation elements appear implicitly in the definition since the scalability of the business model can be achieved only by the support of technology and their algorithmisation. Eric Ries, an entrepreneur-in-residence at the Harvard Business School, continues the definition of Steve Blank by giving more emphasis on the product innovation and organization operation risk. He believes that a startup is "a human institution, founded to create a new product or service in the conditions of extreme uncertainty" (Ries, 2011).

According to the Global Entrepreneurship Monitor (2016), start-ups are enterprises which are in the preparation stage and those that already exist but are managed only by the founders. In turn, the European Commission mentions that a start-up is an entity operating in the field of technology entrepreneurship, on the digital market, offering services in the field of web services

and ICT. OECD defines a start-up as an innovative technological company attempting to face the most difficult civilizational challenges (Breschi et al. 2018). While Kauffman Foundation reports two definitions of start-up. Firstly, start-up is IDE: Innovation-Driven Enterprises. Secondly, a start-up is any business that employs at least one person apart from the owner and has been operating for no longer than one year (Fairlie et al. 2015).

From all definition above, it can be summarized that start-up is a small independent entity that creates technology-based product innovation to search for a scalable business model and able to change market paradigms.

*Team Climate Inventory (TCI)*

Organizational climate is an important element in organizational system (King et al, 2007). There are two different perspectives on the nature of organizational climate (Glick, 1988). First, organizational climate is an aggregated psychological climate as conceptualized by James (1988). James define psychological climate as a set of perceptions that reflect how work environments, including organizational attributes, are cognitively appraised and represented in terms of their meaning to and significance for individuals (James et al., 1988). Second, organizational climate is a broad class of organizational variables that provide contextual environment for individual actions. (Glick, 1985). Climate is understood as an intervening variable between the context of an organization and the behaviour of its members (Patterson et al., 2005).

West (1990) proposed a four-factor model of team climate inventory. The model was developed later by West and Anderson (1995, 1998). The model is based on researches on climate and innovation by West and Farr, (1990), West, (1990), Anderson and King, (1993) and King and Anderson, (1995). The four factors are: vision, participative safety, task orientation and support for innovation.

The Vision in team climate is defined as an idea of a valued outcome which represents a higher order goal and a motivating force at work (West, 1990). The vision of the team should represent clarity, visionary nature, attainability and sharedness. Clarity shows how the vision is understood by the team. Visionary nature shows how the value of the vision can be extended to every individual in the team and increase their commitment to achieve the goal of the team. Shared goal shows how the vision, and the goals, can be accepted by every individual in the team. The goals should be relatively attainable. The unreachable goals will demotivate the team.

Participative safety shows how safety the team member when they involve in the decisionmaking process. It relates to the active involvement of the team member feel trusted and supported and not being threatened. it is argued that participative safety exists when team member proposes idea and creative solution to the team problem (Roger, 1983).

Task orientation is the factor that describes a general commitment to excellence in task performance in relation to the shared vision. In a team context, task orientation factor is evidenced by emphasis on individual and team accountability; control systems for evaluating and modifying performance; reflecting upon work methods and team performance; intra-team advice; feedback and cooperation; mutual monitoring; appraisal of performance and ideas; clear outcome criteria; exploration of opposing opinions; constructive controversy (Tjosvold, 1982).

Support for innovation is defined as the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment' (West, 1990, p. 38). The degree of support may vary across teams. The support may be found in printed matter such as policy statement or conveyed by word of mouth, but the most important support is the innovatory behaviour of leader. It should be available to develop innovation (Daft, 1986).

The robust psychometric properties of the Team Climate Inventory (TCI) developed by Anderson and West has of high reliability and validity. It is accepted and well applied across different kind of team however, the length of the TCI may, in certain circumstances, create problems for researchers. The Team Climate Inventory consist of 61 questions to answer. 12 items for vision, 23 items for Psychology safety. 17 items for Task Orientation and 8 items for Support for innovation. This long question created another problem for researcher therefore Kivimaki and Elovainio (1999) constructed a shorter TCI that has 14 question but still accommodate the four-factor defined by west and Anderson. The shorter TCI has four items for Vision, four items for participation safety, three items for task orientation and three items Support for innovation.

## 2. Research Method

*Methodology and sample.*

It is a mixed method research with quantitative method taken for all the start-up member and followed by interview of the representative of the start-ups group and one program leader. There are 23 start-up members divided into five groups of technology start-ups as the sample for quantitative study and five start-ups representative and one facilitator for the interview. All start-ups join an intensive incubation program provided by a world class digital company and mentored by an entrepreneurship-based university. The incubation program lasts for one month with 4 your intensive working hour every weekday. The program is well structured and well-designed following the Challenge Based Learning System. The objective of this program is to generate creative and innovative apps with IOS developer standard. The program also aims to find give problems solution to everyday life issues.

*Scale of measurement.*

The scale of measurement used is short version Team Climate Inventory (TCI) developed by Kivimaki and Elovainio (1999). The scale is a short version of Team Climate Inventory (TCI) of Anderson and West's (1994). The items cover four dimensions: (1) Vision (V) with four items of question, (2) Participatory Safety (PS) four items of question, (3). Task Orientation (TO) with three items of question and (4) Support for Innovation (SI) with three items of question. The TCI was translated to Bahasa Indonesia by referring to the original long version.

## 3. Results and Discussion

### 3.1.Results

*Reliability Analysis*

The result of the TCI shows: Cronbach's alpha for vision was $\alpha$ = 0.818, participatory safety $\alpha$ = 0.779, task orientation $\alpha$ = 0.857, and support for innovation $\alpha$ = 0.859. For the full scale of 14 items, the Cronbach's alpha was $\alpha$ = .911. The internal consistency of this short Indonesia version of TCI was above the level of acceptance.

*Validity Analysis*

The validity of TCI was measured using *correlated item-total correlation* (CITC) both seen from each factor and full questioner. The item correlation value for the full scale range from 0.404-0.822 with no item was below 0.3. When each factor was analysed separately (see Table 1), vision CITC range from 0.544-0.720, participatory safety range from 0.470-07.45, task orientation range from 0.693-0.771, support for innovations range from 0.672-0775. From both calculation, no item was found below 0.3, thus we can conclude that all 14 items from this scale can reflect team climate construct.

**Table 1**

Corrected Item-Total Correlation (CICT) of Items in Short Version Team Climate Inventory

| Scale | CITC Value |
|---|---|
| Vision | |
| Team members agree with the the objectives | .598 |
| Team objectives are clearly understood by the other members | .713 |
| Team's objective can actually be achieved | .720 |
| Team's objective is useful for organization | .544 |
| Participatory safety | |
| Team has "we are in it together" attitude to achieve team's objective | .745 |
| Members keep each other informed | .586 |
| Members feel understood and accepted | .534 |
| There are real attempts to share information throughout the team | .470 |
| Task Orientation | |
| Team members are prepared to question the basis of what the team is doing | .771 |

| | |
|---|---|
| Team critically appraise potential weakness in what it is doing to achieve best possible outcome | .639 |
| Member of the team build on each other's ideas in order to achieve the best possible outcome | .710 |
| Support for Innovation | |
| People in the team are always looking for fresh, new ways of looking at problems | .672 |
| Out team take the time needed to develop new ideas | .775 |
| Members in the team co-operate in order to help develop and apply new ideas. | .740 |

*Exploratory Factor Analysis*

Exploratory factor analysis was performed to confirm TCI's factors. With the KMO value reach .679 ($p<0.001$), exploratory factor analysis result showed that the data was pretty much suited for factor analysis. However, instead of four factors extracted like the original measure (e.g. Anderson & West, 1998; Kivimaki & Elovainio, 1999), three strong factors with no less than 0.4 factor loading value were found. Only five items had $r>0.4$ in more than one factor. While in the original scale task orientation and support for innovation stood separately, in this study these two factors were detected as one factor supporting TCI. Both vision and participatory safety were extracted as different factor with only one item of vision. Table 1 shows the CICT result had bigger factor loading value in other factor and one *participatory safety* item was detected to be part of *task orientation* and *support for innovation* factor combined (see Table 2). In the present study, the amount of variance of each factor was ordered from *vision, participatory safety*, and *task orientation-support for innovation* with *vision* support 77.89% of total variance. Table 2 gives the summary of the exploratory Factor Analysis.

Table 2

Exploratory Factor Analysis for the Short Version of Team Climate Inventory

| Item Number | | Component 1 | Component 2 | Component 3 |
|---|---|---|---|---|
| 11 | Task Orientation | .856 | | |
| 12 | Support for Innovation | .851 | | |
| 10 | Task Orientation | .770 | | (.489) |

| | | | | |
|---|---|---|---|---|
| 13 | Support for Innovation | .677 | | |
| 9 | Task Orientation | .673 | | (.421) |
| 6 | Participatory Safety | .654 | | (.476) |
| 14 | Support for Innovation | .653 | | |
| 4 | Vision | (.651) | .479 | |
| 2 | Vision | | .837 | |
| 1 | Vision | | .825 | |
| 3 | Vision | | .821 | |
| 8 | Participatory Safety | | | .809 |
| 5 | Participatory Safety | (.405) | | .671 |
| 7 | Participatory Safety | | | .648 |

### 3.2.Discussion

In this study, TCI was examined among participants of tech start-up incubation program and the result indicated that TCI can be used to examine team climate in team that focuses on the development and innovations of technology as the value of the company. The reliability analysis shows that TCI has very high consistency and well accepted items validity with no item was excluded from the analysis. As for the factor analysis there are three, instead of four, factors extracted from this scale. *Task orientation-support for innovation* combined support 48.4% of cumulative value with Eigenvalues >6.5, followed with *vision* supporting 14.5% (Eigenvalues = 2.0), and *participatory safety* support 8.2% of cumulative value (Eigenvalues = 1.1).

Three out of four items of *vision* shows high factor loading value (r>0.8) and one item score higher than 0.4 in two factors indicating that those items are well describing *vision* as a degree of how members have the same perception and context of their team's goal. The item "*team objectives are clearly understood by other members of the team*", "*members agree with these objective",* and *"team objectives can actually be achieved"* are very relatable for those who works in a team, especially in this case the participants of tech start-up incubation program. This also confirmed by MA as he explained about his team's objective in the interview, "Well, as I see, every member in my team agree, the idea also arise because we want to meet up but always fail, so everyone in my team experiences it [the problem]", then JA also elaborate how he at the

end agreed on his team's idea that even though their idea was far different from his, "Because for me, if the idea proposed [by team members] were already similar, why would I force my idea. We could wok and prepare to improve the current idea.

As for the achievable objective, AG explain how their facilitator help them to specify their idea and to make it achievable: "My member suggested this idea because as a motorcycle user, he was uncomfortable and thought that he's not healthy [because of air pollution]. So because he brought out that idea we were all agree because we thought that it was important. What made us kept on working on this idea was new insight we got after the mentoring session with facilitator, like we have another idea for our apps feature, even more specific on what makes our apps different from other application. Because of that we start to look at new ideas to answer it". For the item about how useful the idea was for organization, factor loading value is bigger than 0.4 in the original factor and reach >0.6 in the *support for innovation* factor. We argue that this happens because all of the team in tech start-up program grounded their idea to solve social problem using application. In this case, the benefit for organization could be extended to a degree whether their innovation idea could be useful for society.

Participatory safety factor was found to be supported by three out of four items. *"We're in it attitude"*, *"feel understood and accepted"* and *"real attempts to share information throughout the team"* can also be found among members of teams tech start-up program. MA explained, "Because we're all the thinker type. sometimes when [team members] didn't have the same goal, it's very hard to work together, but in our team [right now], we have agreed on that" then he also added that his team members were actively give opinions and suggestions in discussions session, "We were all give contributions to ideas. Probably there were some members who were more quiet than the others but that wasn't because they were afraid, it was because they wanted to listen. But the point is when it comes talking, everyone talked and well understood by the others.". Another participant also shared her experience, saying that members in her team have already known each other before the program, if there was miscommunication or trouble, they would request for help and the other members would back them up. While for the *"keep each other informed"* item from *participatory safety* is found to be part of *support for innovation* factor from the extraction result. We see possibilities of participants seeing "how each members make sure the other members were not missing out any information" as an effort to support group innovation.

The analysis shows there is a merged factor between *support for innovation* and *task orientation*. We argue that these two factors are extracted as one because the program focuses to support the innovation process to find better solution for social problem using the apps. Furthermore, *Task orientation* items such *"critically appraised potential weakness in what it is doing in order to achieve the best possible outcome"* and *"build on each other's idea in order to achieve the best possible outcome"* can be seen as behavior that will enhance the effectiveness of the innovation. JA said that "Everytime we do presention, we get the feedback from facilitators and followed by our own internal review. At the end, we built critical thinking. Even our app changed a lot. When [the idea] was implemented in coding, there are some things

that can not be done as fast as we want, so we criticize ourselves to find how to the app can work better. We keep reviewing and fixing until we reach the best performance to present".

## 4. Conclusion

It can be concluded that the Climate Inventory Team can be used to measure team climate in tech start-up groups in Indonesia. The short version finds three factors with one of them is a merging factor compared to the four factors in the original version,

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