

THE MODELING OF THE INFLUENCE OF COLLABORATIVE LEADERSHIP AND CORPORATE CULTURE TOWARDS TEAM PERFORMANCE: CASE STUDY ON PT JASA MARGA

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Abstract— In response to rapid changes in business environment, PT. Jasa Marga has to improve the corporate performance by increasing team's capability. Company's management plans to build corporate leadership and culture to increase the team performance. This research aims to analyze the influence of collaborative leadership and corporate culture towards team performance based on personal values characteristic of employees. This research uses an agent-based modeling to accommodate the changing of task roles for each agents that influences the team performance. This research shows that PT. Jasa Marga must give the same priority in developing each factors of collaborative leadership and also in developing the types of corporate culture to optimize the team performance.

Keywords— team performance, collaborative leadership, corporate culture, personal values, agent-based modelling.

1. Background

PT Jasa Marga (Persero) is a state-owned company that becomes one of operator and also pioneer of toll undertaking in Indonesia. PT. Jasa Marga is still becoming main toll operator by operating 76.2% out of the whole

toll's length in Indonesia. This company operates toll network in Indonesia and keeps all the toll road under its corporation functioning well. PT Jasa Marga cooperates with other parties in building new toll road, increasing toll facilities, and other things that can maximize its utilities to the toll users.

The ratification of the laws no. 38 year 2004 opens the chance to private companies to be involved in the development and operation of toll. It increases the competition in Indonesia's toll undertaking. This improvement should certainly be able to be responded fastly by PT. Jasa Marga. Company should be able to compete by increasing its competitiveness. The efforts in winning the tender process of that toll building must be supported not only by company's financial ability but also the data of technical ability and the operation of toll undertaking. Related to the operation of toll undertaking, company should refer to Minimal Service Standard (MSS) that is determined by Toll Management Body (TMB). The components of MSS cover: (1) the quality of toll's condition; (2) the average velocity; (3) the accessibility; (4) the mobility; and (5) the safety. If company is not capable of fulfilling those MSS then the lowest consequence inside the company is the decrease of company's KPI. And the highest consequence is the cut off of temporary toll operational license in the lane that can not fulfill those MSS, by TMB.

Those challenges make company always empower the resources it has including the human resources. The company management in long term mapping in organization and human resources department stated that the company paid attention highly on dynamic and flexible organization, with high learning skill in each of its employee and companies. The long term plan of this company means a process to empower the human resource that is scoped in work units as a work team.

A work team in a company can be defined as a group of people that interacts each other, psychologically has connection feeling one another and work together as group (Schein 2004). Just like an individual performance, performance of work team also has a very significant role in a company's improvement. Team performance is a main determining factor and oftenly used as company's success indicator. (Stashevsky and Koslowsky 2006). There are many factors that can affect team performance, such as organization culture (Senior and Swailes 2004) and leadership style (Miles and Mangold 2002, Stashevsky and Koslowsky 2006).

Company's management realizes the effect of company's culture and leadership toward team performance. Therefore company also has improvement programs for these two factors in its long term plan mapping. Leadership has a significant role because a leader is a function of management, that can effect employees in working so that organization's aim can be achieved (Skansi 2000). There are many leadership theories but according to Hersey and Blanchard (1999) stated that there was no leadership style that went along with all condition in an organization but

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leadership style would be very effective if it could accommodate its surroundings (followers, superior, and colleague).

One of leadership that accommodates surroundings is collaborative leadership. Collaborative leadership is formed under the effort of Carnegie Commission on Preventing Deadly Conflict. This commission states that the strategy that is used in a leadership and the decision making process are very crucial in every conditions to face every problems (Hamburg, George and Ballentine 1999).

Organization culture gives influences on team performance through work satisfactory forming process and commitment on organization. Deal and Kennedy (2000) inferred that organization culture can be used to affect certain important factors in organization such as commitment and performance. It is strengthened by a research conducted by Lok and Crawford (2004) that showed that organization culture has a very significant impact towards work satisfactory and commitment to organization.

This research aims to help company in formulating sub factors of collaborative leadership and also the type of company's culture that is proper to be developed in PT. Jasa Marga. The indicator of influence of these two factors toward team performance is becoming a standard in giving recommendation of collaborative leadership's sub factor and company culture's type that are supposed to be developed by company. Team performance itself is a function of work role completion based on Belbin (1993).

This research contributes to 'the renewal' of agent based approach. Until now the researches about behavior are still dominant with linier approaches, in which that values or individual behavior is assumed to be constant even though that individual interacts with other individuals. The work systems that involve behavior pattern are complex systems and able to change once it interacts with other individual behavior pattern. The function of this complexity study is to explain on how this interaction occurs relatively stable and to explain the happening pattern (Srblijinovic and Skunca 2003). Agent based modeling (ABM) is found in some researches for example to estimate cellular operator market due to the change of marketing strategy (Putro et al 2009), strategy compiling to prevent avian influenza in Bandung (Putro et al 2008), etc. So far the modeling of agent based modeling that is connected team performance has not been found.

This research is focusing on the development of agent based modeling with the research's questions as follows:

- 1) How is agent based model that can accommodate work role change to every agent in a certain work team?
- 2) What are the sub-factors of collaborative leadership that are prioritized to be developed in company's management based on that agent based modeling?
- 3) What is the type of company's culture that is prioritized to be developed I company based on that agent based modeling?

2. *Research Methodology*

Formulating agent based model becomes an initial step in this research. Then every variable in the model is elaborated according to the theoretical base and derived to be a questioner as a tool to gain data from respondent. Based on personal values, the respondent is classified using Factor Analysis Method to be group of agents and inter-agent interactions in a certain environment compiled in programming algorithm form. In the end computer programming using NETLOGO software will be made, sensitivity test is conducted and simulation scenario is resumed to answer the research's questions.

2.1. *Agent Based Model Formulation*

Bonabeau (2006) stated that agent based modeling was the simulation technique to solve the real world business problems by modeling that system as a group of entities that can make decision which is called agent. So, in ABM method it is not the model that solves the problems but the agents in the model that will solve the facing problems. Axelroad (2003) explained that ABM was a method to study a certain system that consists of agents which interact each other and induce new nature due to the interaction.

The main focus in the ABM approach is the nature or property of individual agent. Bonabeau (2006) categorized agent as any components that stand alone (software, model, INDIVIDU, etc). Referring to Casti (1997) in Permadi (2009), agent is component that has basic rule and more advance rule. The basic rule is behavioral rule as a response towards its environment, and the more advance rule is the rule to change the rules, which is the rule to conduct adaptation. Jennings (2000) stated that the main characteristic of agent is autonomy, which is the behavior that makes agent able to make its own decision, based on its rules.

Agent based model formulation is a major focus in this research. The agent based model is given in this following Figure 1.

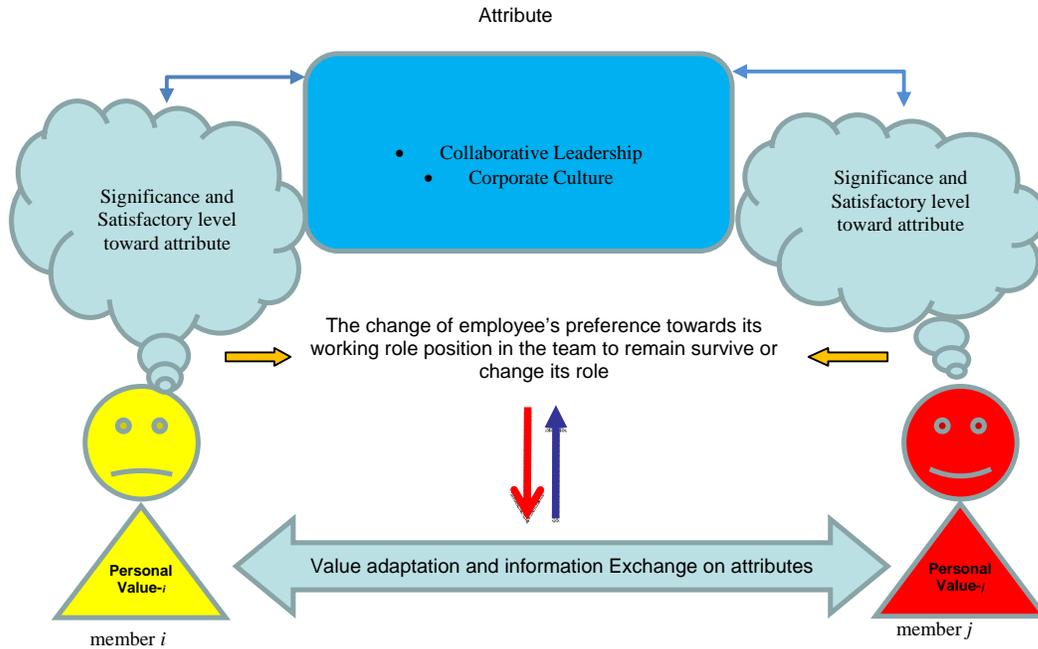


Figure 1. Agent based team performance model
(Source: adopted and developed from Putro et al 2009)

Two factors that affect team performance, leadership and organization culture, can be perceived differently by each employee due to the characteristic of each personal value. For example, an employee with power distance as personal value will consider that sharing power and influence dividing factor in collaborative leadership is a dominant factor in his/her leadership process. Inter agent interaction will cause information exchange and possibly change each perception towards the significance level of collaborative leadership sub factor and the type of company's culture. This significance level change in the end will also alter their work role position in the team which also means a change in team performance.

2.2. Research Variables

In the team performance improvement this research considers three variables, which are personal values, collaborative leadership, and the type of company culture. The research conducted by Gustomo et al (2010) shows that in the context of PT. Jasa Marga, out of twelve variables of personal values that are the combination of Hofstede (2005) and Trompenars et al (2000) personal values, only four variables that give significant influence to enhance team performance. The four variables are power distance, internal – external control, uncertainty avoidance, and neutral – affective.

Company culture variable takes the types of company culture according to Cameron and Quinn (1999) who divide it into four types, which are clan, adhocracy, market, and hierarchy. While the collaborative leadership variable covers six process steps which are assessing the

environment, creating clarity, building trust, sharing power and influence, developing people, and self reflection.

2.3. Sampling Method

The research is located in Surabaya Branch Office, Padaleunyi (Bandung) Branch Office, Jagorawi (Jakarta) Branch Office, Cikampek (Jakarta) Branch Office, Balmera (Medan) Branch Office, Palikanci (Cirebon) Branch Office and Central Office (Jakarta). These locations are chosen so that it can represent company's branch office (branch office typ A and B), and also accommodate environment diversity and the culture of local community (location).

3. Data and Analysis

3.1. The Formulation and Characteristic of Agent

The data collecting was conducted in the time period of July 2010 until February 2011. Out of 500 spreading questionnaire, 257 was obtained back. Using Factor Analysis Method (Principal Component Analysis) on personal values, the employees of PT Jasa Marga can be classified into three category with the composition is shown in the following Figure 2. In the context of agent based modeling then this three groups are called as agent.

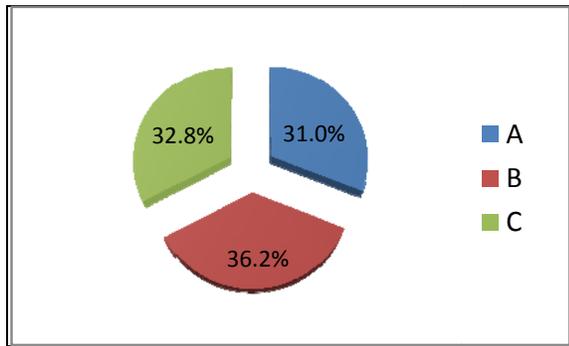


Figure 2. Composition of Agent

Generally it can be stated that based on the three groups of agent, the employees of PT. Jasa Marga have these following characteristics:

- Having moderate to high power distance. It means the characteristics of company's employees are accepting and considering the difference of power and status in the company quite much.
- Having dominantly moderate to high uncertainty avoidance (UA). It shows that most of the company's employees are in the comfort zone, characterized as not having the vision of changing the situation or business of company in the future.

While the special characteristics that differentiate each agent are as follow:

Agent A:

- Tending to have good self control skill (Neutral), tend to not showing their emotions.

- Showing the balance between internal and external control. It shows that employee who is included in this agent A tend to have balance between focus on themselves and others (customer and colleague).

Agent B:

- Having balance between neutral-affective characteristics. Employees in this group tend to have moderate emotion, meaning it is between impressive – expressive characteristics (not too explosive and not also keeping it inside).
- Tending to be dominant in external control. Employees in this agent B tend to keep the working relationship in harmony and being flexible and compromising in behavior.

Agent C:

- Tending to easily show their emotions (affective). Employees in this group tend to convey a statement clearly and strictly.
- Tending to be dominant in external control.

3.2. Algorithm Formulation and Scenario Simulation

This simulation aims to describe work role level that will be formed as a result of inter-agent interaction and each satisfactory and significance level of perception values towards the factors of collaborative leadership and the type of company culture. Agents in this context are agent A, B, and C proportionate with their own characteristics. Simulation algorithm is compiled with flow as in this following Figure 3.

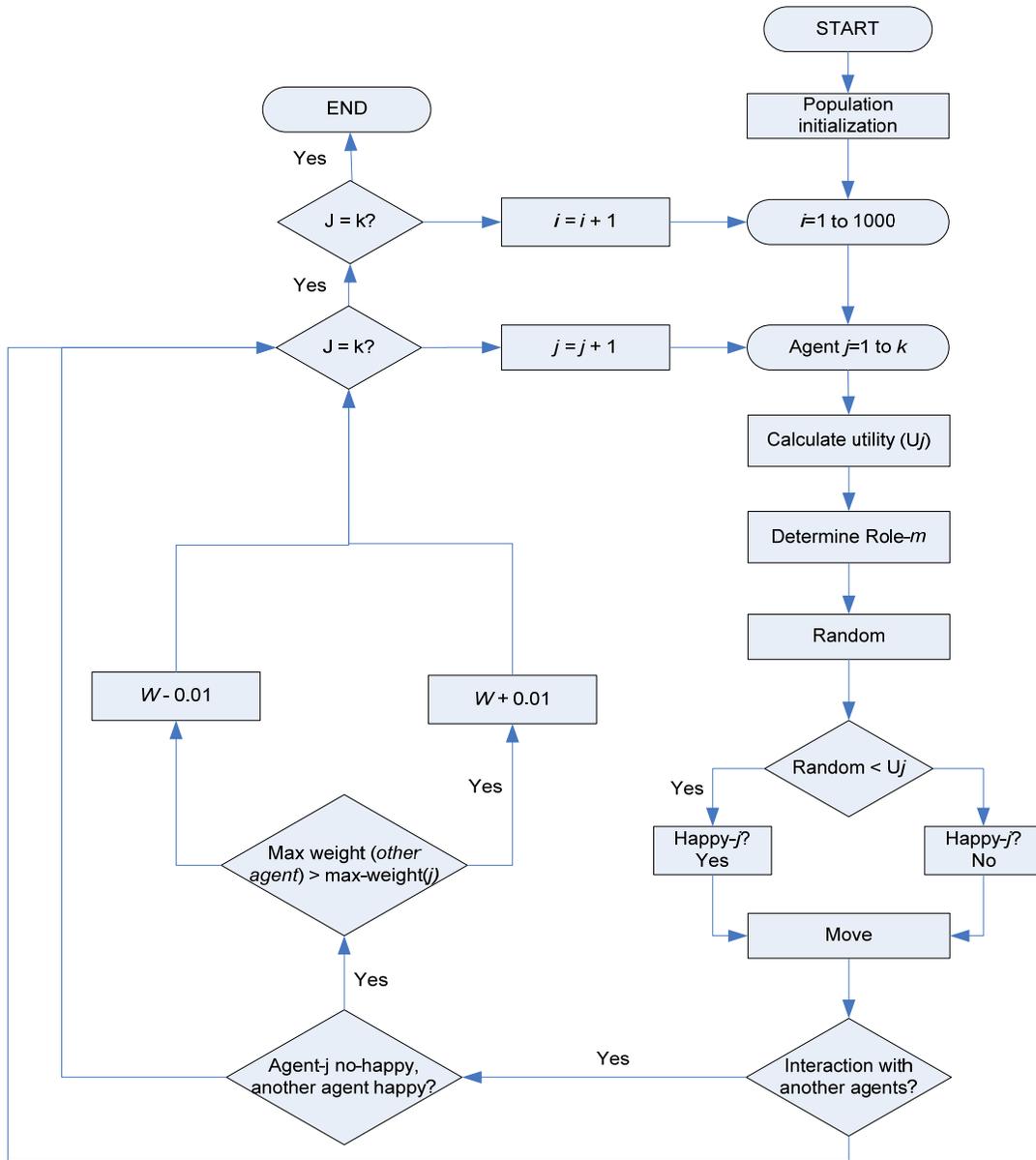


Figure 3 The flow chart of simulation algorithm

In each iteration agent will calculate the utility values they have. This utility value is obtained by multiplying each significance level on every collaborative leadership's sub-factor and also the significance level of corporate culture's type with each of its own satisfactory level. The obtained score is then being saved in matrix-score.

The calculation of utility value for agent-j is formulated as follows:

$$U_j = \frac{\sum_{k=1}^6 X_{Lk} w_{Lk} + \sum_{k=1}^4 X_{Bp} w_{Bp}}{200}$$

With :

- U_j = Utility of agent- j
- X_{Lk} = Perception of satisfactory level of agent- j towards the k-th factor of collaborative leadership
- w_{Lk} = Perception of significance level of agent- j towards the k-th factor of collaborative leadership
- X_{Bp} = Perception of satisfactory level of agent- j towards k-th factor of

$$w_{Bp} = \begin{matrix} \text{company culture} \\ \text{Perception of significance level of} \\ \text{agent}_j \text{ towards the k-th factor of} \\ \text{company culture} \end{matrix}$$

Inter-agent interaction is possible to happen with probability of 10% that cause the information exchange of each attribute's significance level. In this interaction process there are four probabilities of events as in this following Figure 4.

		Agent _j	
		Happy	No-happy
Agent _i	Happy	Do nothing	Do nothing
	No-happy	Browse and interpret Information	Do nothing

Figure 4. Process of information exchange among agent

In this process agent will look for its matrix-score element whose score is getting smaller. This element is assumed to be a factor considered by the least satisfying agent. Then this agent will check the weight of its neighbor in the conformity element. If the weight that is given by its neighbor is higher than the weight the agent owns, then agent will increase its weight in the number of 0.01. in the contrary if the weight owned by neighbor is smaller, then agent will decrease the weight it gives in the number of 0.01. To keep the total of weight owned by each agent has the value of 1, then the normalization process is being done by each agent after its interaction is finished. In every iteration, the value of utility of each agent will be put under linear regression into the value on each role taken by the agent.

In order to help implementing the desired model into computer language, the available ABM platform can be used. There are several types of platforms that have been developed and can be used freely, one of it is NETLOGO. Netlogo is a platform that can be run in various computer operation system. This platform was firstly developed by Uri Wilenski from Northwestern University USA in 1999, and up until now is still being developed by Center for Connected Learning (CCL) and Computer-Based Modelling Northwestern University USA. Netlogo was made in purpose of simple usage. Netlogo programme involves more advance level language programmes in a purpose of that previous simple usage, and it does not need the knowledge of computer programing as in Repast, Swarm, and Mason platforms.

Netlogo is also completed with highly complete document and also the examples of variative and informative makings of ABM model. Being seen from documentary point of view, Netlogo is a platform with the most complete documentation. Netlogo is aimed to the user

whose computer programming knowledge is not so deep. Netlogo gives a very proper platform for non-programmer to model the agent based system into computer language

3.3. Sensitivity Test of Algorithm and Programming

The scenario in sensitivity test is conducted by changing the value of satisfactory attribute in collaborative leadership and company culture and seeing the result or the difference on the value of work role. The result of sensitivity test shows that the algorithm and simulation program is sensitive already towards the changes of the attribute of satisfactory level towards collaborative leadership and company culture. The scenario of satisfactory level changes on the factors of collaborative leadership and the type of company culture also shows significant change towards the total value of performance in a certain work unit.

3.4. The Analysis of Variable's Significance Level and The Result of Scenario of Modeling Simulation

The perception of all employees towards the significance level for very factor in collaborative leadership to show whether there is a certain domination of perception towards one or some certain factor(s). The test using ANOVA is conducted with following hypothesis:

H₀: All leadership factor has the same average of significance level according to agent

H₁: At least there is one leadership factor that has different average of significance level according to all agents

The result of ANOVA test shows that due to the significant level that is less than 0.05, then it can be concluded to refuse hypothesis zero (H₀) and it is to be concluded that at least there is one leadership factor that has different average of significance level according to agents. Therefore the test is continued by looking for that different or similar factor by using Duncan's Multiple Range Test. The result of the test shows that according to the employees:

1. The biggest significance level that has to be developed in the company in the context of collaborative is 'creating clarity', with the weight of 25%. It means that the company's management should be able to translate the vision of the company into work unit's programs well enough and create a good condition of working environment so that every employee can express the opinion on strategic issues and the actions that need to be taken.
2. The second biggest significance level is 'building trust' with the weight of 21.43%. it means the company's management should be able to build a good communication process so that every employee can express their own opinions. In addition it also means that company's management is expected to be able to create the open minded and trusting nuance in the cooperation process among the employee.

3. The third significance level is 'assessing environment' with the weight of 15.85%, and then followed by two factors that are considered significantly indifferent which are 'developing people' and 'share power'. The last significance level according to the employee's perception is 'self reflection' with the weight of 9.73%.

The two biggest weights in the significance level of leadership factor, 'creating clarity' and 'building trust', go along with the dominant type of employee's personal characteristics, which are the high 'power distance' and 'uncertainty avoidance'. It means that they highly expect the leaders of the company to explain every program in details operationally and do not dare to make dramatically changes in the working program or company's business. This characteristic is supported by the working pattern especially in the branch office that is more likely to operation the management conduct of highway collecting and daily highway traffic management.

An interesting result is also shown by the measurement of each satisfactory level of collaborative leadership factor by the agents and employees. The employees give a whole adjudication is just in the level of **satisfied enough** and not significantly different to all factor of collaborative leadership. The two results of satisfactory and significance level toward this collaborative leadership's variable show that the company should start developing the conceptual thinking skill, which is the company's strategy in the future, and pushing down and also conveying the strategic idea from and to all company's employees.

While based on the agent's perceptions for the significance level of the type of company culture shows that:

1. The biggest significance level that has to be improved in the company in the context of the type of working unit culture is the 'market' type, with the weight of 28.9%, it means the company's management should be able to develop a certain competitive working program with high target and every employee and working unit is obliged to achieve the target with the perfect result. The company's management should also focus and aggressively on achieving its working target and

developing competitive pattern in that achievement progress.

2. The second biggest significance level are the type of 'adhocracy' and 'clan' with not too significantly different weight of 25%. It means that dominantly employees consider that the company also needs to develop the working situation that is possible to share each other, human development oriented, and the decision making is involving everyone. Those things are brought together with the balance in making dynamics so that the employees dare to take risk to conduct creative and innovative act and decision.
3. The last significance level is 'hierarchy', with the weight of 20.3%. This type of culture means the company should also habituate each working program to be conducted efficiently with a strict control along with the constituted formal procedure.

In the next step the agent based simulation is conducted for a further analysis whether the cause of the interaction and information exchange inter agent can also give the same conclusive description. Simulation scenario is arranged to see how far the change of satisfactory level towards the attributes of collaborative leadership and company culture affect the team performance. A certain combination set of this satisfactory level change is done with certain rules of:

1. The agent is satisfied with only one certain attribute, characterized by the scoring of satisfactory level in above 80 (in this case it is set at 90) and not satisfied with the other attributes characterized by the scoring of satisfactory level under 50 (in this case it is set at 20).
2. The agent is satisfied enough with all the collaborative leadership attributes (score 70), but only satisfied with only one type of company culture.
3. The agent is satisfied with two attributes of collaborative leadership and satisfied with one attribute of company culture's type, and satisfied enough with one attribute of company culture's type.

For every scenario it is arranged so that it has the combination of the total number of member in the working unit from various alternative of agents. Some results of the simulation are shown in the following Figure 5.

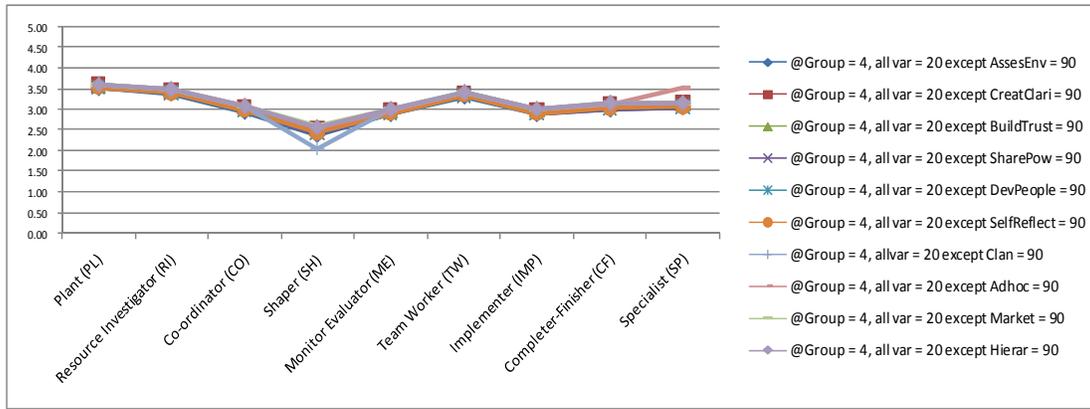


Figure 5. The outer of the average agent's working role in every simulation scenario

The results of programming simulation shows that all simulation scenarios give the increase of satisfactory perception on each attribute of collaborative leadership and or company culture's type gives the well distributed result. The hypothesis test using Analysis of Variance (ANOVA) proves that the influence of each attribute of collaborative leadership towards team performance is not significantly different. Same case also happens in the influence of each type of company culture, it also does not give significant influence on team performance.

Several things that cause no difference in the influence of each collaborative leadership factor is explained as follows:

1. Even though there is difference in significance level among collaborative leadership factor in total, the distribution of this significance level difference is well distributed among agent A, B, and C.
2. While the results of significance level towards collaborative leadership factor shows no difference from each factor for the current condition in the company.
3. A well distributed significance level of perception in agent A, B, and C will cause a certain mechanism for every member of the group to obtain information in order to maximize its utility level.
4. It causes the uniformity in the final utility value of each member, so that the influence of each factor will eventually be similar towards team performance.

The managerial implication of this analysis means that the company should give the same priority in developing each collaborative leadership sub-factors in order to achieve optimal result in the increase of team performance. The management should proportionally develop its skill in assessing the environment, creating clarity, building trust, sharing power and influence, developing people, and self reflection in the company's leadership.

As for the influence of company culture's type, several issues that cause no difference in the influence of each company culture's type are being explained as follow:

1. Even though in total there is difference in the significance level among company culture's types, the distribution of this significance level difference is well distributed among agent A, B, and C.
2. While the results of satisfactory level towards the corporate culture type shows no difference from each factor for the current condition in the company.
3. A well distributed significance level of perception in agent A, B, and C will cause a certain mechanism for every member of the group to obtain information in order to maximize its utility level.
4. It causes the uniformity in the final utility value of each member, so that the influence of each company culture's type will eventually be similar towards team performance

The managerial implication of this analysis means that the company should give the balance in the development of each company culture's type in order to achieve optimal result in the increase of team performance.

4. Conclusion

According to the aims of this research, several conclusions can be obtained, such as:

1. Agent based model is able to show the changes of each agent's working role due to the interaction and information exchange among agents towards the significance level of each sub-factor of collaborative leadership and also the types of company culture.
2. PT. Jasa Marga should give the similar priority in developing each sub-factor of collaborative leadership in order to obtain the optimal result in the increase of the team performance. The management should proportionally develop its skill in:
 - ✓ Assessing the environment: the efforts in digging the information and data from various trustworthy sources before making certain decisions or actions, and able to support subordinates to act based on the information obtained compared to the assumptions.

- ✓ Creating clarity: visioning and mobilizing; the good ability to translate the company's vision into work programs, and to create a condition of work environment so that every employee can opine about strategic things and the actions that need to be taken.
 - ✓ Building trust: the ability to build a good communication process so that everyone feels comfortable to opine their own opinions and also able to build the nuance of open minded and trusting each other in cooperation process among employees and the conductor of working activities.
 - ✓ Sharing power and influence: the ability to give authorities to take actions and decisions to their subordinates in balance, and also able to support and influence others to be able to set their minds in making decisions and taking actions.
 - ✓ Developing people: the ability to give chances to subordinate to develop and study the new skills and knowledge, and also able to arrange and implement the self development plan of each of the subordinate.
 - ✓ Self-reflection: the willingness to listen to the suggestions and criticism from others, and actively find for feedbacks from all subordinates about his own behavior and action in undergoing the work programs.
3. PT. Jasa Marga should also provide the proportional in developing each type of company culture in order to obtain the optimal result in the increase of the team performance. Culture should proportionally develop its values in:
- ✓ Clan: to share each other, orientating in personal development and the decision making that involves everyone and based on everyone's agreement.
 - ✓ Market: the courage of taking a risk to conduct the decision and the creative and innovative actions (dare to try new things)
 - ✓ Adhocracy: a competitive work program with the high target and always successful in achieving the work result perfectly, going along with the set target.
 - ✓ Hierarchy: to prioritize efficiency with strict control based on current formal procedure

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