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Roles of Emotion in Negotiation Process: An Application of Drama Theory in Citarum Riverbasin Problem

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Abstract

Citarum was a clean river which local people enjoyed fishing and recreation, however now its condition has already changed totally. Currently, the river can not provide its social services, such as clean water, electricity, fishing, tourisms, transportation, and public recreation. In rainy season, the color of river is brown because it contains mud from bald lands erosion along the river. In dry season, the color of river has changed to black and full of household wastes. In spite of many seminars were held, classical problems always arise. There are floods in rainy season but changes drastically to drought in dry season. There are some factors which cause the problem, i.e.; illegal lodging and the population exploding in upper stream, pollution from industries in down stream, etc. This paper tries to see the Citarum problem from a different point of view, and starts from the belief that if stakeholders (or agents) in the Citarum problem collaborate to solve the problem, then Citarum river will be better and better. This paper analyzes negotiation process among the agents, and tries to describe how the negotiation process can end with collaboration. In the first step, drama theory framework is applied to model the negotiation process. Then, we simulate model by using SOARS (Spot Oriented Agent Role Simulator). Finally, simulation results show that emotion of agents has important role to encourage collaboration; that is, the more the agents who have positive emotion (or tend to compromise), the less the number of impediments (or dilemma) to achieve collaboration.

Keywords: Confrontation, Negotiation, Dilemma, Drama Theory, Emotion, Negotiation

Introduction

Citarum River basin is a region with 6,080 km2 area in the three provinces, i.e., West Java, Banten and Jakarta. There are some causes of the Citarum riverbasin problem, such as illegal lodging and deforestation in upper streams river. Household waste also decreases the quality of Citarum. Nowadays, at least 200 tons of household wastes are thrown away into Citarum. Also, many of industries do not perform waste treatment before throwing them away into Citarum (Pikiran Rakyat, 17 April 2005). Lack of coordination among local governments in upper and down streams area also makes the Citarum becomes worse and worse.

Stakeholders in the Citarum problem have different interests and positions. In negotiation process, agents may change their position and interest, accordingly, the situation is dynamic. There are some impediments (or dilemmas) to achieve common position and trustworthy (i.e., collaboration). Behaviors of an agent in the negotiation process depend on his/her dilemma toward another agent. He/she will negotiate based on his/her strategy and emotional state (positive or negative emotion). The positive emotion means that the agents want to make compromises; otherwise negative emotion means that the agent tends to convince others that he/she is very serious with his/her threat.

In order to analyze the dynamic of conflict among participants, this paper uses agent based modeling simulation based on drama theory by using SOARS. The objective of this research is to simulate and analyze the interaction among the agents who have strategies and emotion in negotiation process. This paper analyzes the effect of emotion in the negotiation process to encourage collaboration in the Citarum problem.

Citarum River Basin Problem

There are several agents who participate in Citarum river basin, i.e. local people in downstream, local people in upstream, textile industries, environmentalist (green), regencies in upper stream and cities in down stream (Putro, 2005).

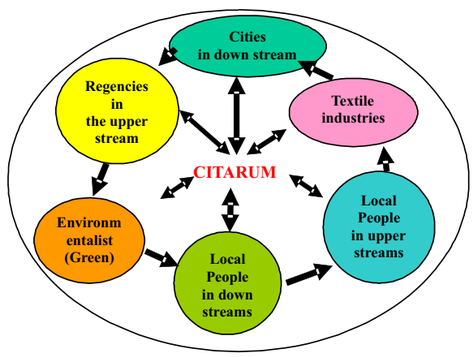

Figure 1. Agents in Citarum River Basin Problem (Putro, 2005)

Each agent in Figure 1 pursues its own purposes (Putro, 2005). They have partial proposals for the problem, such as, a proposal of stopping deforestation which makes upper local government unhappy; or stopping illegal lodging will make local people in upstream unhappy; if government is authoritarian then the community is not happy; if upstream people are egotistic then people in downstream will suffer; if we blame industries then there are unemployment; etc. Accordingly, partial proposals for the problems could not change confrontation into collaboration.

Drama Theory

Different from Game Theory, Drama Theory focuses on how the conflict that happens during pre-play game changes because of the parties want to e*liminate dilemmas using positive or negative emotions*. Drama theory can explain *how an irrational behavior arises*. Briefly, drama theory depicts human interaction as each involved 'character' seeks simultaneously to have others adopts his/her 'position' in collaborative situations. The dilemmas represent the challenges that each party seeks to overcome either to manage conflict and establish a shared solution, or to manage dilemmas they faced in repeatable ways. This research will analyze the human interaction and describe how that conflict change into collaboration.

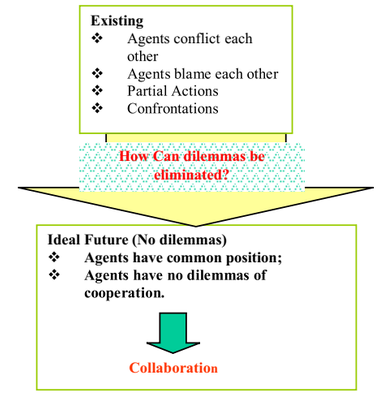

Figure 2. Transformation system using Drama Theory

Drama Theory is a metaphor of confrontation process as described by Fig. 3. Its first stage begins when each agent has several frames for the situation called a Scene setting stage. The next stage is called build up that results a common reference frame among agents. Based on the common reference, each agent may have dilemma toward another agent, then he/she will enter the next stage, that is, climax stage. If each agent's position is not united and trustworthy, then it will return to the build up stage. But if the position is united and trustworthy, then it will generate resolution, i.e., it means that the conflict has been resolved. The last stage is denouncement in which agents may conclude the confrontation. It results collaboration or tragedy. This paper applies drama theory to understand how the conflict can change in the Citarum riverbasin problem.

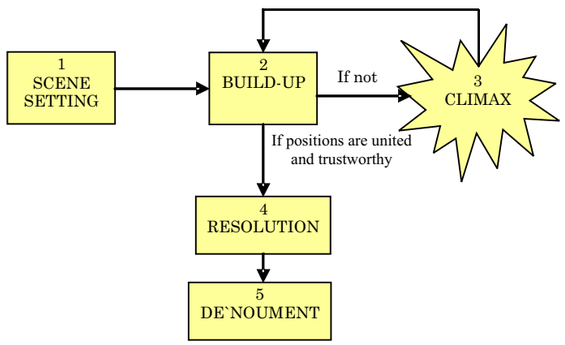

Figure 3. Drama metaphors for the dynamic of conflict (Howard, 1996)

Dilemma in Climax

According to Bryant (2003), there are two groups of dilemma in climax stage:

a) Confrontation Dilemma

- Threat dilemma

  Party 1 has threat dilemma with respect to party 2, if party 1`s threat is not credible according to party 2, because party 2 knows that party 1 prefers another scenario than the threat.

  To eliminate this dilemma, each must either give up the threat or, inspired by negative emotion, make others believe that carrying out the threat is more attractive or inevitable than party 2 suppose.

- Rejection dilemma

  Party 1 has rejection dilemma with respect to party 2, if party 1`s rejection of party 2's position is not credible according to party 2, because party 2 knows that party 1 prefers party 2's position than the threat.

  To eliminate this dilemma, Party 1 may adapt his position by becoming compatible with Party 2 trough positive emotion (conciliation/compromise), or try to make Party 2 believes that Party 1 prefer the threatened future to Party 2's position by negative emotion (rejection).

- Positioning dilemma

  Party 1 has positioning dilemma with respect to party 2, if Party 1 can not persuade Party 1 to accept his/her position because he/she prefers Party 2's position than his own position.

  Party 1's dilemma is whether to adapt by taking a position compatible with Party 2's, or to try to make Party 2 believes that it (Party 1) prefers its position to Party 2's.

- Persuasion dilemma

  Party 1 has persuasion dilemma with respect to Party 2, if Party 1 can not persuade Party 2 to accept Party 1`s position because Party 2 prefers threat position than Party 1`s position.

  Party 1's dilemma is whether to adapt to this by making itself compatible with Party 2 (conciliation/compromise), or whether to try to change it by making Party 2 prefer its (Party 1's) position to the threatened future (pressure by rational arguments or negative emotion).

b) Collaboration Dilemma

- Trust dilemma

  Party 1 has trust dilemma with respect to Party 2, if Party 1 can not believe that Party 2 commit with the common position, because Party 1 knows that there is another scenario preferred by Party 2 than the common position.

  The (Trust) dilemma for Party 1 in either case is whether to accept its own doubt by abandoning the common position or whether to try to eliminate its doubt by sending messages that change Party 2's incentives.

- Cooperation dilemma

  Party 1 has cooperation dilemma with respect to Party 2, if Party 2 distrusts with Party 1, because Party 1 has incentives to not commit with the common position, because another scenario is better than the common position.

  Party 1's (Cooperation) dilemma is whether to accept Party 2's doubt by abandoning the common position or, alternatively, to try to eliminate Party 2's doubt.

Drama Theory Framework in Citarum Riverbasin Problem

This paper begins with build up stage of interaction among agents in Citarum riverbasin problem (Putro, 2005). The common reference frame resulted from the stage is described by Figure 4.

The common reference frame consists of agents/participants, their options, positions (proposals), and threat. The agent has at least an option. Position or proposal offered by an agent to another agent is represented a column of each agent. For example, Up Stream Regencies' proposal is represented by a column below "USR". It is a combination of "Yes", "No", and "Yes/No". "Yes" or "No" means respectively that the agent proposes an action to implement (i.e., adopt) or to not implement (i.e., reject). "Yes/No" means that the agent is indifferent with an action to adopt.

OPTIONS OF PARTICIPANTS	THREAT	POSITIONS					
		USR	G	TI	DSP	USP	DSC
Up Stream Regencies (USR)						<	<
Stop deforestation	**No**	**Yes**	**Yes**	***Yes/No***	**Yes**	No	**Yes**
Green (G)				>	<	>	<
Protest	**Yes**	No	No	No	***Yes/No***	No	No
Textile Industries (TI)			>		>		>
Stop un-treatment waste disposal to river	**No**	***Yes/No***	**Yes**	No	**Yes**	***Yes/No***	**Yes**
Down Stream People (DSP)			<	<		<	<
Stop waste disposal to river	**No**	***Yes/No***	**Yes**	***Yes/No***	No	***Yes/No***	**Yes**
Up Stream People (USP)		>	>		>		>
Stop illegal lodging	**No**	**Yes**	**Yes**	***Yes/No***	**Yes**	No	**Yes**
Down Stream Cities (DSC)		>	<	>	<	>	
Strict penalties for illegal waste disposal to river	**Yes**	***Yes/No***	**Yes**	No	No	***Yes/No***	No
Maintenance River	**No**	***Yes/No***	**Yes**	***Yes/No***	**Yes**	***Yes/No***	No
Revenue sharing to Up Stream Regencies	**No**	**Yes**	***Yes/ No***	***Yes/No***	***Yes/No***	***Yes/No***	No

Figure 4. Common Reference Frame for Citarum River Basin Problem

Dilemma of	with respect to: USR	G	TI	DSP	USP	DSC
USR					RD, PD	PD
G			PD	RD	PD	RD
TI		PD				PD
DSP		RD	RD, PD		RD, PD	RD
USP		PD				PD
DSC	PD	RD	PD	RD	PD	

Figure 5. Dilemmas in the Existing Common Reference Model

Therefore, the position of USR means that Up Stream Regencies will adopt "stop deforestation" if Green rejects "protest", Up Stream People will adopt "stop illegal lodging", and Down Stream Cities adopt "revenue sharing to USR"; USR is indifferent with actions of Textile Industries and Down Stream People; and finally, USR is also indifferent with several Down Stream Cities' actions, these are, "strict penalties for illegal waste disposal to river" and "maintenance river".

Threat is a situation when all agents adopt their fallback. For example, in the threat situation, USR is threatening to reject "stop deforestation".

The symbols "<" and ">" represent an agent's preference between his/her position and threat. The symbol "<" means that the agent prefers his/her position to threat. In the opposite, if the agent prefers threat to his/her position, then it is represented with ">". Accordingly, USP in Figure 4 prefers his/her position to threat.

Based on the existing situation described by Figure 4, and the definition of dilemma, then there are rejection dilemma and positioning dilemma as described by Figure 5 (Putro, 2005).

The Role of Emotion in order to Change Frame

Every agent who has a dilemma will negotiate based on his/her emotional state (positive or negative emotion). Positive emotional state is more conducive to a person acting in a friendly and sociable manner with others; Conversely, a negative emotional state tends to heighten chances that the individual will be unfriendly, inconsiderate, or even rude to others.

In this model, negotiation process involves bargaining strategy and emotional state of each agent. The value offered by an agent to another agent is determined by the strategy and emotional state of the agent. Strategy will determine how much he/she plans to offer to another agent. The emotional state will determine how much the agent realizes his/her offer to another agent.

The objective of this negotiation process is to bring another agent to change his/her mind to one or some conflicting option. Negotiation will proceed at each time t = {1,2,3,...}. To bring a drama theory problem into simulation, then we need some definition which deals with framework of problem.

Definition 1:
o_{ki} is a k^{th} option of agent *i*. Agent *i* could acceptance (A), rejection (R), or abstain (NA) to the option for each time t.

Definition 2
$c_{ki}^t : o_{ki} \rightarrow \{accep\tan ce, rejection, abstain\}$, is an optional for agent *i* toward k^{th} option at time *t*. It is based on payoff defined by agent *i* at time *t* as described by Definition 3.

Definition 3:
$Vo_{ki}^t : c_{ki}^t(o_{ki}) \rightarrow \Re$, is a payoff given by agent *i* toward his own options (k^{th} option), at time *t*, as follows.

$$Vo_{ki}^t(c_{ki}^t(o_{ki})) = \begin{cases} a; & if\ \ c_{ki}^t(o_{ki})\ accep\tan ce(A) \\ x-a; & if\ \ c_{ki}^t(o_{ki})\ \ rejection(R) \end{cases}$$

x is maximum payoff (in this paper x=100).
If an agent abstain (NA) toward k^{th} option then we don't assign payoff.

Definition 4:
$c_{kij}^t : o_{kij} \rightarrow \{accep\tan ce, rejection, abstain\}$, is an optional for agent *i* toward k^{th} option which had owned by agent *j* at time *t*.

Definition 5:
$Vpo_{kij}^t : c_{kij}^t(o_{kij}) \rightarrow \Re$ is a payoff given by agent *i* toward another agents *j*'s options (kth option) at time *t* that is

$$Vpo_{kij}^t(c_{kij}^t(o_{kij})) = \begin{cases} a; & if\ \ c_{kij}^t(o_{kij})\ accep\tan ce \\ x-a; & if\ \ c_{kij}^t(o_{kij})\ \ rejection \end{cases}$$

x is maximum payoff. (in this paper x=100). If an agent abstain (NA) toward k^{th} option then we don't assign payoff.

Therefore, position of agent i at time t, is
$p^t = \{p_1^t, p_2^t, p_3^t, ..., p_n^t\}$ *n* = number of agent,
with
$p_i^t = \{c_{ki}^t(o_{ki})\} \cup \{c_{kij}^t(o_{kij})\}$

Definition 6:
$Vp_i^t : p_i^t \rightarrow \Re$ is total payoff of an agent *i*'s position at time *t*, that is

$$Vp_i^t(p_i^t) = Vo_{ki}^t + \sum_m Vpo_{kij}^t$$

m = number option and $(i \neq j)$

Definition 7:

$Vpp_i^t : p_j^t \rightarrow \Re$ is total payoff of another agent's position which doing by agent *i* based on definition 5 at time *t* that is

$Vpp_i^t(p_j^t) = Vo_{ki}^t + \sum_m Vpo_{kij}^t$ m=number option and $(i \neq j)$

Definition 8:

For each agent *i* give a threat t_i^t as follow.

For each option o_{ik} of agent *i*, then agent *i* will see agent *j*'s option toward option o_{ik} (agent *i*'s option) that is $c_j^t(o_{ik})$ so that:

1. If option agent *i* to option o_{ik} is acceptance and if number of acceptance toward option o_{ik} by agent *j* greater than or equal to number of rejection toward option o_{ik} which had been done for each agent *j*, then $t_i^t(o_{ik})$ =rejection.
2. If option agent *i* to option o_{ik} is rejection and if number of rejection toward option o_{ik} which had been done by every agent *j* is greater than or equal to number of acceptance toward option o_{ik} which had been done for each agent *j*, then $t_i^t(o_{ik})$ =acceptance.

For threat t^t, each agent *i* give the payoff of threat Vpt_i^t that is:

$$Vpt_i^t : t^t \rightarrow \Re$$

Definition 9:

Payoff of threat Vpt_i^t which had been done by agent *i* based on option payoff Vo_{ki}^t and payoff of option Vpo_{kij}^t which had been owned, that is:

$$Vpt_i^t(t^t) = Vo_{ki}^t + \sum_m Vpo_{kij}^t$$

For each position agent *i* p_i^t will form a dilemma at time *t* which deal with position of agent *j* p_j^t and t^t that is d_{ij}^t.

Agent Based Model of Drama Theory

Emotion model that will be used in this paper is the development from emotional negotiation model PAD (Jiang, 2004). Emotional state model (PAD) involves three dimensions, *i.e.*, Pleasure (*p*), Arousal (*a*) and Dominance (*d*).

- Pleasure (r_p); it represents the direction of emotions; *i.e*; positive emotion (Pleasure)/negative emotion (Displeasure).
- Arousal (r_a); the degree of effects from environment that strengthen (Arousal) or weaken the pleasure (Non-Arousal).
- Dominance (r_d); the degree of agent`s ability to control the pleasure and arousal.

During negotiation, a more pleasant agent tends to compromise with others. We can reflect this relationship to the value system by assuming that pleasure influences the agent to increase the value offered to another agent during negotiation process.

The second dimension, ArousalNon-arousal, means to rouse or to stimulate action or to physiological readiness for activity. We can reflect this to the value system of negotiation by assuming that this measure magnifies or minimizes P's affection. For example, if an agent is in pleasure status this emotion makes the agent increase the evaluation value a little; if the agent is also on arousal, it increases even more. But, if the agent is in displeasure, then arousal will make the agent decrease the value more. The third dimension D: DominanceSubmissiveness. This estimates the degree of the ability of being commanding, controlling, or prevailing over all others, or degree to yield oneself to the authority or will of another.

Each agent has the emotional state, *i.e.*:

$$Es_i = \{r_p, r_a, r_d\}\ r_p, r_a, r_d \in (-1, 1)$$

The values have negative meaning if close to -1 and have positive meaning if close to 1.

Definition 10

For each agent *i* have the function of emotional state, that is:

$$Se_i(r_p, r_a, r_d) = r_p.(1 + r_a) - r_d$$

Definition 11

The strategy (bargaining strategy) space for agent is the set of positive integer number *st*= {1,2,3,4,5,6,7,8,9,10}.

Modeling Dilemma

Agent`s perception value (payoff) toward options:

- If agent *i* accepts an option of *j*, then he/she will perceive higher payoff over the option than reject it; and
- Perception payoffs of agents are defined so that they can represent the dilemmas in the existing common reference model.

Agent *i*`s dilemma will be determined as follows:

1. Persuassion Dilemma (PD) with respect to agent *j*:
   If agent *j*`s perception value (payoff) over the threat is greater than his/her payoff toward agent *i*`s position.
2. Rejection Dilemma (RD) with respect to agent *j*:
   If agent *i*`s perception value (payoff) over the threat is less than his/her payoff toward agent *j*`s position.

Modeling Negotiation Process

For each time of negotiation *t* = {1,2,3,...}, agent *i* and agent *j* will negotiate if there are dilemma among them. From the present position p_i^{t-1} and p_j^{t-1}, they will negotiate in option which had been difference in their option (agent *i* reject and agent *j* accept or vice versa). Agent *i* with bargaining strategy $st_i = s$ and emotional state $Es_i = \{r_p, r_a, r_d\}$ will offering with value:

$$Ov_i = Se_i \times st_i + st_i$$

This equation shows how much the effect of negotiation which had been done by agent *i* with involving strategy and emotional state. The value of bargaining strategy $st_i = s$ will reduce a perception value of agent *i*'s choice to perception value which had been choose. Also, it will add a perception value of agent *i*'s choice to perception value which had not been choose at the option was not deal (option agent *i* and agent *j* is not suitable).

Agent *j* have an emotional state $Es_j = \{r_p, r_a, r_d\}$ which influence agent *j* in order to accept the offer from agent *i*. With emotional state of agent *j* $Se_j(r_p, r_a, r_d) = r_p.(1 + r_a) - r_d$, agent *j* will assess the offer of agent *i* with level of offering which was felt by agent *j*, that is

$$Ov_j = Se_j \times Ov_i + Ov_i$$

The effect of negotiation value will reduce the option of perception value agent *j* to his perception value which had been chose and will add a perception value of agent *j* to his perception value which had not been choose at the option was not deal (option agent *i* and agent *j* is not suitable).

This negotiation process will occur for agent *j* who will negotiate with agent *i* or vice versa. If agent *i* negotiate with agent *j*, then agent *i* will act as bargainer party who has a strategy and agent *j* act as an offer receiver.

This negotiation process will run until time *t*, which is for each time *t*, each agent will update his preference value and make the choice again based on his present preference value. In this paper, the analysis is to measure level of emotional state, so the agent could negotiate in order to reduce dilemma.

Simulation of the Model Using SOARS

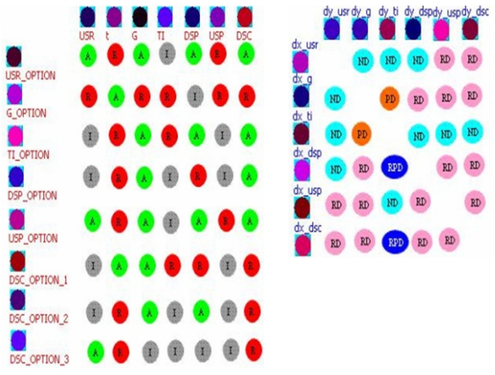

Figure 6. Existing Common Frame by SOARS

First Scenario

In this scenario, all of agents have a negative emotion. USR have a negative emotional, so USR tends to reject other's offer. Green has a negative emotional, so Green tends to not compromise with the other, TI have a negative emotional, so TI tends to not make compromise with other to stop un-treatment waste disposal. DSP have a negative emotional, so DSP tend to not make compromise with other agent (to stop waste disposal to river). USP have a negative emotional, so USP tends to not accept other's offer or tends to cooperate with other agent to stop illegal lodging. DSC have negative emotional, so DSC tends to not accept other's offer or tends to cooperate with other agent in order to make strict penalties for illegal waste disposal, maintenance and sharing revenue.

We use the following parameters in this scenario as described by Table 1.

Table 1. Parameters for Scenario 1

	USR	G	TI	DSP	USP	DSC
r_p	1	1	1	1	1	1
r_a	-0.8	-0.4	-0.1	-0.5	-0.4	-0.2
r_d	1	1	1	1	1	1
$Se_i(r_p, r_a, r_d)$	-0.8	-0.4	-0.9	-0.5	-0.4	-0.2

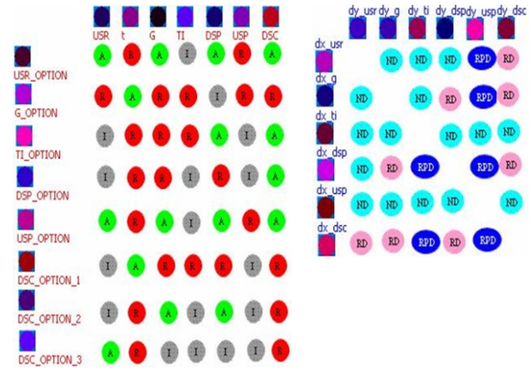

Figure 7. New Common Frame in Scenario 1 by using SOARS

From the above figure, could be seen that there are some dilemmas in this new common frame. It was caused by effect of negative emotional state from whole agents like USR, G, TI, USP, DSP and DSC. Each agent tends to not make compromise with their option, so the number of dilemma in this scenario couldn't be reduced as could be seen in Figure 8.

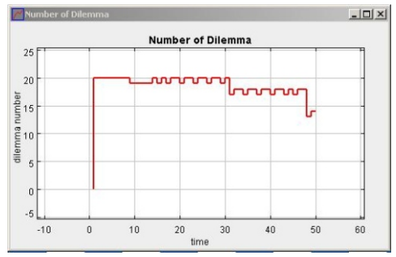

Figure 8. Graphic of Number Dilemma in Scenario 1

Second Scenario

Agents (USR,TI, USP,DSC) have positive emotion, and (Green and DSP) have negative emotion. In this scenario, USR have a positive emotional, so USR tends to accept other's offer. Green has a negative emotional, so Green tends to not compromise with the other, TI have a positive emotional, so TI tends to make compromise with other to stop untreatment waste disposal. DSP have a negative emotional, so DSP tend to not make compromise with other agent (to stop waste disposal to river). USP have a positive emotional, so USP tends to accept other's offer or tends to cooperate with other agent to stop illegal lodging. DSC have a small value of positive emotional, so DSC tends to accept other's offer or tends to cooperate with other agent to make strict penalties for illegal waste disposal, maintenance and sharing revenue.

We use the following parameters in this scenario as described by Table 2.

Table 2. Parameters for Scenario 2

	USR	G	TI	DSP	USP	DSC
r_p	1	0.5	1	0.2	1	0.8
r_a	0.5	0.6	0.7	0.6	0.5	0.5
r_d	0	1	0.5	1	0	0.9
$Se_i(r_p,r_a,r_d)$	1.5	-0.2	1.2	-0.68	1.5	0.3

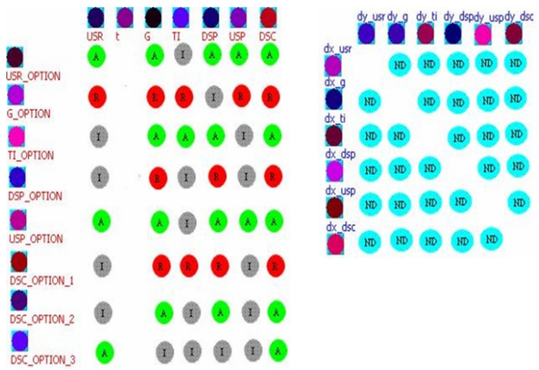

Figure 9. New Common Frame in Scenario 2 by using SOARS

From the above figure, could be seen that there are no dilemmas in this new common frame. It was caused by effect of positive emotional state from agents like USR, TI, USP and DSC. The number of dilemma in this scenario was reduced as could be seen in following figure. The time of reducing a dilemma was slow moving, but finally dilemma can be reduced.

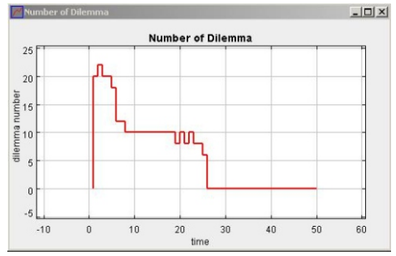

Figure 10. Graphic of Number Dilemma in Scenario 2

Third Scenario

In this scenario, only DSP has negative emotion. USR have a positive emotional, so USR tends to accept other's offer. Green has a positive emotional, so Green tends to compromise with the other, TI have a positive emotional, so TI tends to make compromise with other to stop untreatment waste disposal. DSP have a negative emotional, so DSP tend to not make compromise with other agent (to stop waste disposal to river). USP have a positive emotional, so USP tends to accept other's offer or tends to cooperate with other agent to stop illegal lodging. DSC have positive emotional, so DSC tends to accept other's offer or tends to cooperate with other agent to make strict penalties for illegal waste disposal, maintenance and sharing revenue.

We use the following parameters in this scenario, as described by Table 3.

Table 3. Parameters for Scenario 3

	USR	G	TI	DSP	USP	DSC
r_p	1	0.5	1	0.2	1	0.8
r_a	0.1	0.6	0.1	0.6	0.5	0.5
r_d	-0.5	0	0.8	0	0.7	0.1
$Se_i(r_p,r_a,r_d)$	1.6	0.8	0.3	0.32	0.8	1.1

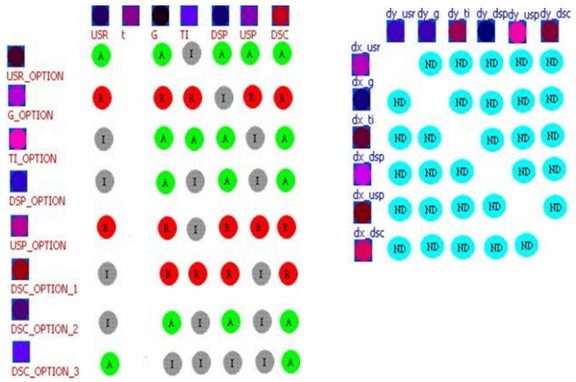

Figure 11. New Common Frame in Scenario 3 by using SOARS

From Figure 11, it could be seen that there are no dilemmas in this new common frame. It was caused by effect of positive emotional state from whole agents like USR, G, TI, USP, DSP and DSC. The number of dilemma in this scenario was reduced as could be seen in following figure. The time of reducing a dilemma was fast moving rather than scenario 1. It causes of the effect of positive emotional from whole agents.

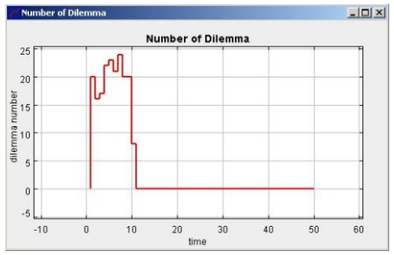

Figure 9. Graphic of Number Dilemma in Scenario 3

Conclusion

In the work above, we showed how the emotional states of agents affect their negotiations strategy. In our simulation, the effect of positive emotional state of agent is important to make negotiation and the result from simulation show that the number of dilemma between agents who involve in Citarum River basin problem could be reduced significantly.

Positive emotion means that the agent is willing to participate and compromise (or try to find ways so that his/her position becomes more and more compatible with another agent). This emotion must be own by each agent in Citarum River basin problem, so the confrontation changes into collaboration.

From the results of simulation, if every agent has a negative emotion, then the dilemma can not be eliminated. So the suggestion for this problem is each agent must have a positive emotion which consists of three dimensional, that is pleasure, arousal and dominance in order to negotiate. For this purpose, it is needed a leader who can influence the emotions of agents.

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