

System Dynamics Approach to Ability of the Police for Solving Crime : Testing the Effect of Civic Cooperation with the Police

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Abstract

The purpose of the present study is to examine the effect of civic cooperation with the police on the number of crime that the police must solve by conducting simulation based on system dynamics. The study sets police oriented-policing model and police-citizen cooperative model to investigate the effect of civic cooperation with the police. As a result of the simulation, the police oriented-policing model shows that the number of crime that police must solve is increasing over time, while the police-citizen cooperative model shows that the number of crime that must be solved by the police is keeping it stable in the increase of crimes. Comparing both models, civic cooperation with the police is more effective in reducing or deterring crime than police oriented-policing activity. The study proves that building cooperative relationship between citizens and the police can become a strategic method for controlling crime effectively without a rapid increase in police finance. It is meaningful in terms of presenting a dynamic change of interaction for reducing crimes between civic cooperation with the police and policing activity of the police over time.

Keywords: *System Dynamics, Police Oriented-Policing, Police-Citizen Cooperative Policing, Civic Cooperation with the Police*

1. Introduction

There have been dynamic variations in the number of crime committed in Korean society, showing a few tendencies of crime. The most distinguishing characteristic of crime committed in Korea is that crimes are becoming increasingly intelligent and sophisticated, and it is enough to get police organizations into a dilemma in investigating offenses and arresting criminals. The methods and tools used in crimes have been continuously developed with a rapid advancement of informational technology. It is, however, hard for the police's investigations to follow advanced techniques used by criminals, which means that the criminal skills have a negative relationship with an arrest ability of the police.

We can find out another interesting point from criminal investigation statistical data published by Korean National Police Agency[1]. According to the data, there is a big gap between the number of criminal arrest and the number of non-arrest. The crime occurrences have been keeping a lull with small increases and decreases every year since 2008 setting the highest record, 2,063,737 cases. The number of crime committed

after 2008 dropped down up to about 1,770,000 cases on average. On the other hand, the number of criminal arrest has been keeping a downtrend with a little big drop every year since 2008 recording the highest crime clear-up rate, 87.8 %. The crime clear-up rate in 2012 was 76.4%, 76.5% in 2013, 78.3% in 2014, and 80.6% in 2015[2]. The difference between the number of crimes committed and the number of criminal arrest has a close relationship with the rapid changes of criminal trend forwards getting more sophisticated and planned, which has a negative influence on the arrest ability of the police.

One of the strategies for reduction or deterrence of crime is to increase the number of police, which includes a belief that the deterrence effect is one of the rationales behind the proposition that the police can reduce crimes[3]. This viewpoint seems to have a strong persuasion that an increase in the number of police can reduce or deter crime occurrence[4][5][6]. There are, however, different arguments on the viewpoint in empirical studies testing a causal relationship between an increase in the number of police and a decrease in crime occurrences[7]. That is to say, there are different evidences that increasing the number of police has a positive causality with deterrence or decrease of crimes and that it has no causal relationship or even a negative causality with them

Police patrol or arrest activity as the essence of police officers' job can be considered another strategy for criminal reduction or deterrence. There are also contrary arguments on whether the police activity for patrol and arrest has a correlation with deterrence or decrease of crimes[8][9][10][11][12]. Police patrol, motorized and foot, is a method used as an attempt to reduce and prevent crime and disorder. The theoretical expectation or proposition of an increased police presence would be crime reductions because of an increase in perceived risk by offenders. However, though recent researches have found a positive effect from police patrol, the history of this literature has been far from consistency[13].

Regardless of these arguments mentioned above, the increases in the number of police and police patrol and arrest activity have been used as the most popular method for crime reduction by police organizations. The increase in the number of police, in particular, is considered the most persuasive tool for enlarging the size of police organization by showing a high crime rate instead of highlighting a crime clear-up rate. Police agencies are likely to ignore the importance and usefulness of police patrol and arrest activity.

It is worth giving attention to civic cooperation with the police as an effective control method against crime, even if it is not authorized like the increases in the number of police and police patrol and arrest activity that police organizations can dogmatically take to reduce crimes. Many researches indicate that in order for the police to effectively control crime, it is quite important to secure citizens' voluntary cooperation with the police[14]. Citizens can report or offer the decisive evidences or clues for solving crimes that police officers look for. They can play an additional role of reducing crimes without being directly involved in criminal investigation. In this context, some countries including United State, England, Japan, etc. have been conducting a variety of criminal control strategies through enhancing civic cooperation with the police.

The purpose of the study is to examine the effect of civic cooperation with the police on the number of crime that the police must treat with through analyzing the changes in the number of crime from the simulation based on system dynamics. First of all, the study makes the model, named police oriented-policing model just including the number of police and police patrol and arrest activity, which is supposed to show the changes in the number of crime that the police must solve over time. This model also includes the number of CCTV and police budge as influential variables on an arrest ability of the police but both variables are less strategic in reduction or prevention of crimes than police manpower and police patrol. The study just uses the number of CCTV and police budget as variables to raise the appropriateness of the model base on the theory. Second, the study puts civic cooperation with the police in the model to identify the changes in the number of crime that the police must solve, named police-citizen cooperative model.

Third, the study identifies the effect of civic cooperation with the police on the reduction of the number of crime by comparing the police oriented-policing model with the police-citizen cooperative model.

2. A Causal Loop Diagram Development

This study develops a system dynamics model for predicting the changes in the number of crime that the police must solve. A causal loop diagram firstly is used to develop the model representing interrelation and feedback process in a system. That is to say, it is a circular chain of cause and effect which is used to represent relationships between variables that are often difficult to describe. A relationship with two variables is represented by an arrow showing the direction of influence. A positive sign on a link implies that a change in one variable results in a change in the same direction, whereas a negative sign denotes a change in the opposite direction. A feedback loop occurs when arrows connect a variable to itself through a series of other variables. A feedback loop may be reinforcing (R) or balancing (B). A reinforcing loop is defined as a positive feedback system that represents a growing or declining action, while a balancing loop is a negative feedback system that is self-regulating[15].

From searching present literatures, some variables are included in the causal loop diagram for the change in the number of crime that the police must solve. The study includes 2 rate variables, 1 level variable, and several auxiliary variables. The number of crime that the police must solve is a level variable, and the number of arrest and the number of non-arrest are respectively rate variables. The number of crime that the police must solve within a year is affected by the number of crime occurrence, arrest, and non-arrest. Crime occurrence happened within a year has a positive correlation with the number of crime that the police must solve. The number of crime that the police must solve has a negative correlation with the number of arrest, while it has a positive correlation with the number of non-arrest. The predictive model for the number of crime that the police must solve includes an average crime rate as a constant variable, the number of arrest, and the number of non-arrest (see Figure 1).

We need to find variables that can have an influence on the number of criminal arrest. These variables are auxiliary ones in the causal loop diagram. The causal loop diagram for predicting the number of arrest consists of the number of police, police patrol and arrest activity, police budget, and the number of CCTV. These variables are presented well in the existing researches[16]. Police budget among these variables can be controversial about appropriateness as the variable affecting the number of criminal arrest. There are some researches that have no significant causality with the criminal arrest[17]. The study, however, includes police budget in the simulation model based on system dynamics because police budget is one of the essential elements for maintaining or promoting an arrest activity of the police.

There is one interesting thing in the causal loop diagram which the number of crime that the police must solve has a positive correlation with civic cooperation with the police. The variable is a little far from the police's direct activity for criminal arrest but it is proved to be quite helpful and useful in supporting or triggering a criminal arrest of the police. The causal loop diagram presents one positive feedback system and one negative feedback system. The negative feedback system shows that the number of criminal arrest decreases the number of crime that the police must solve, while the positive feedback system shows that the number of non-arrest increases the number of crime that the police must solve (see Figure 1).

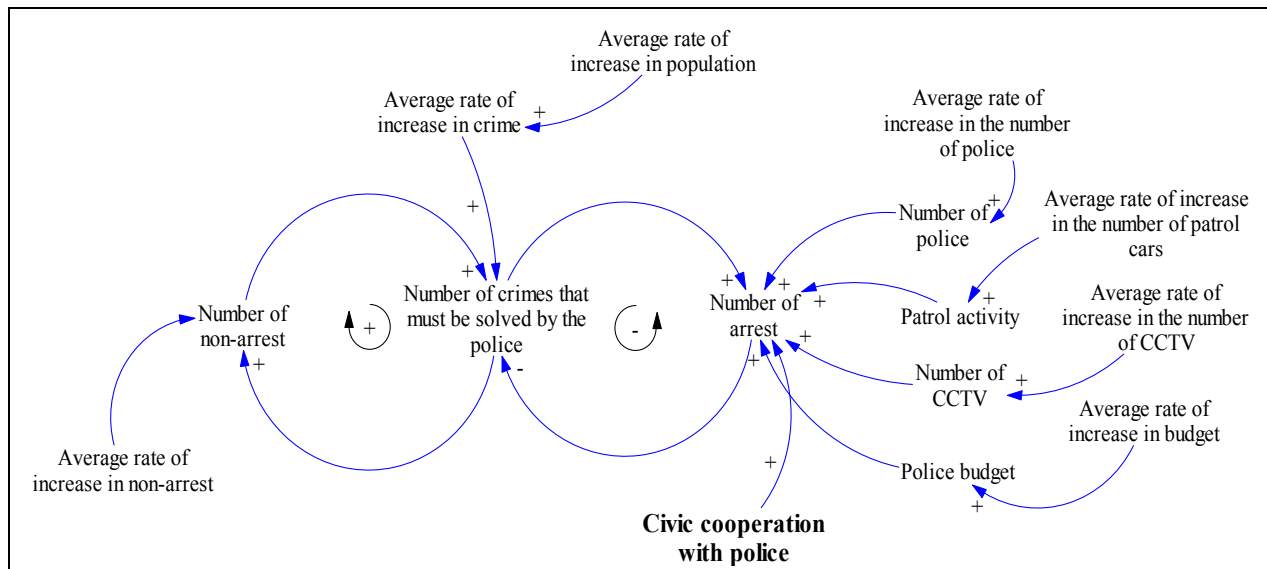


Figure 1. Causal Loop Diagram

3. Development of Simulation Model

This article employs Vensim PLE x32 to conduct the simulation for predicting the changes in the number of crime that the police must solve. The flow and stock variables are respectively calculated by means of the flow equation and the stock equation. The data used in the simulation is based on Police Statistical Yearbook 2015 published by Korean National police Agency.

The number of crime that the police must solve means the difference between the total number of crime committed in 2015 and the number of crimes solved by the police during the same year. The number of arrest means the number of crime that the police solved within 2015, while the number of non-arrest means the number of crime that the police did not solve. Average rate of increase in non-arrest means an average ratio of non-arrest increased from 2006 to 2015. Average rate of increase in crime means an average ratio of crimes increased for 2006-2015. Average rate of increase in population is an average ratio of increased population at the same period. The number of police is the total number of police in 2015 and average rate of increase in the number of police is an average ratio of increased police manpower from 2006 to 2015. Patrol activity is hard to be measured because we cannot use the data showing patrol activity of the police, so the study uses the number of patrol cars as proxy variable since Korean National Police Agency have preferred motorized patrol to foot patrol. Average rate of increase in patrol cars means an average ratio of the number of patrol cars increased 2006 to 2015. The number of CCTV is the total amount of CCTV installed in 2015 and Average rate of increase in the number of CCTV means an average ratio of the number of CCTV increased from 2013 to 2015. Finally, police budget is the total amount of budget spent in 2015 and average rate of increase in budget is an average ratio of budget increased for 2006-2015. Being different from those variables, civic cooperation with the police is not offered as an official data so that it is hard to input the value in the equation. Because of this problem, the research uses the data that is presented as the degree of civic cooperation with the police, 3.5 that was measured by the survey in 2015 targeting the citizens (1=strongly disagree to 5=strongly agree). With those variable definitions and data for the equation of simulation, the study develops the simulation model like Figure 2 by using Vensim PLE x32.

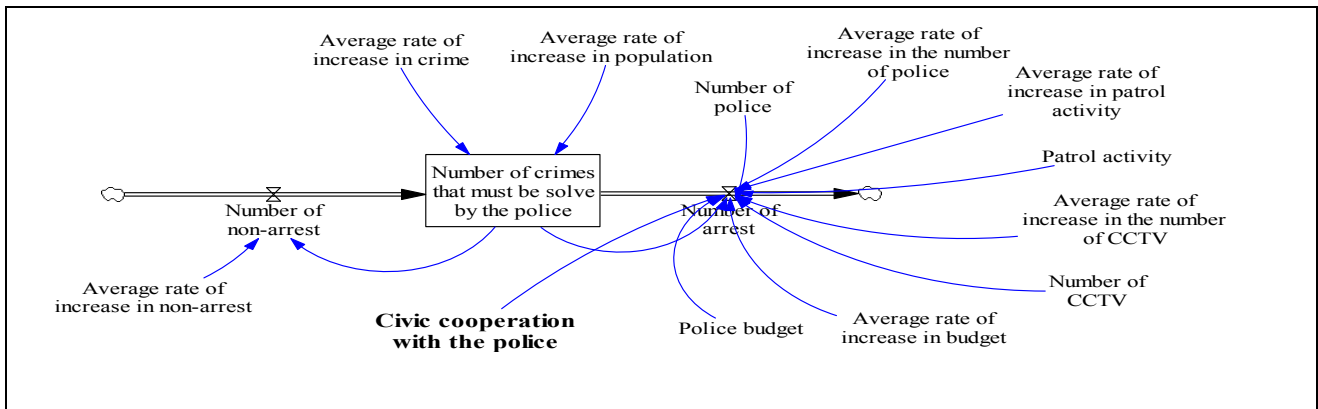


Figure 2. Model for Simulation

4. Model Simulation Results and Analysis

This study conducted the simulations twice including police oriented-policing model and police-citizen cooperative model. As the results of the simulations, there is a distinguishing difference between both models. As we can see from Figure 3, first of all, the number of crime that police must solve is increasing over time. The number, in particular, tends to be getting bigger across time. This simulation indicates that police organizations have no choice but to get into a dilemma in reducing and deterring crimes under their belief that the police are totally responsible with social security, maintenance of order, criminal prevention, etc. The logics that an increase in the number of police is the most effective in reducing and controlling crimes and that we need more police officers because crimes have increased seems that it is not to properly reflect modern characters of crimes highlighting the intelligence of criminal technique and the rapid appearance of new forms of crime. As can be seen in Figure 3, since the number of crime is increasing over time, it is able to be argued that we need more police officers and patrol activity in the near future. Judging from the result of simulation, however, it is a little hard to insist that we need to depend on the linear relationship between the number of crime and police activity including manpower, patrol, budget, equipment, etc. for controlling and preventing offenses to explain or understand the phenomenon on crime and police.

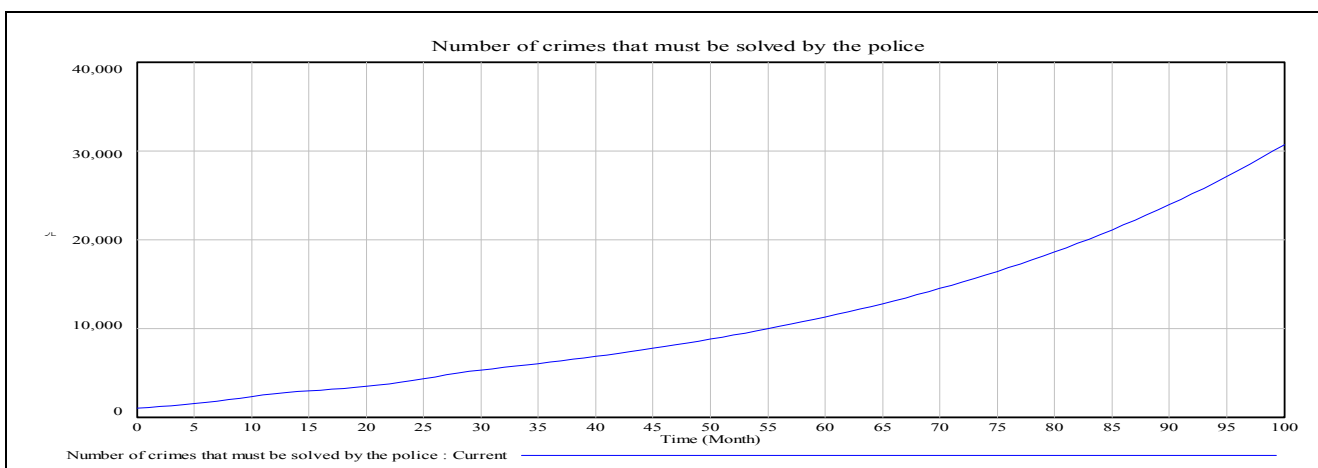


Figure 3. Simulation Result of Police Oriented-Policing Model

As we can see in Figure 4, there is a growing difference between the number of arrest and the number of non-arrest over time. The number of non-arrest (top line) is increasing much bigger than the number of arrest (bottom one). In the police oriented-policing model, the police have a limitation in solving all crimes committed, which can mean that there is a shortage of ability to solve crimes. According to the result of simulation, the number of non-arrest is exceeding the number of arrest. The tendency shows that police oriented-policing activity is not effective in reducing crimes and also in solving crimes. As the Figure 4 shows, the increasing difference in both the numbers estimated by the simulation can mean that our society has to pay social costs that we do not want to burden and get damaged from the increase in unsolved crimes.

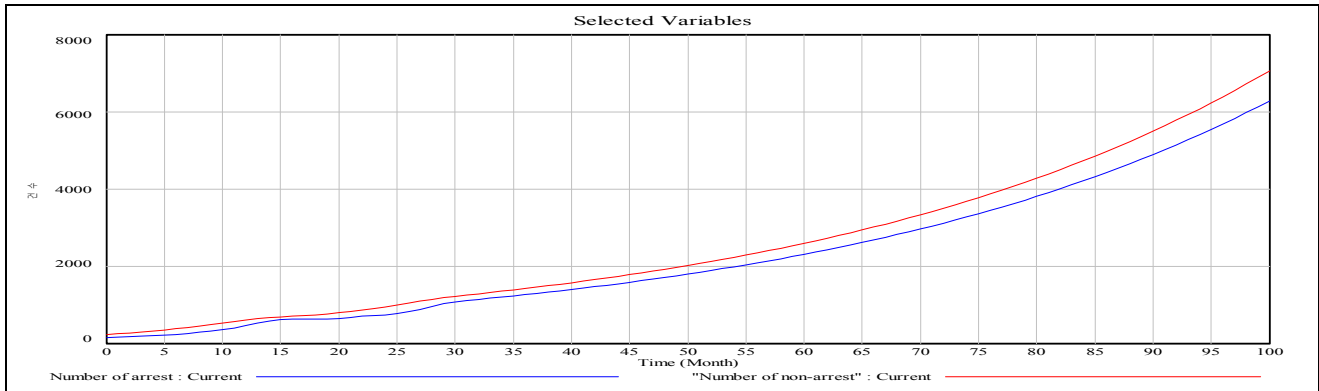


Figure 4. Changes of Number of Arrest and Number of Non-arrest in Police Oriented-Policing Model

As we can see from Figure 5, on the other hand, there is an evident difference in the number of crime that the police must solve comparing with the one in Figure 3 showing the simulation result of police oriented-policing model. In the police-citizen cooperative model, the number of crime that must be solved by the police keeps it stable in the increase of crimes after about 20 months. The simulation shows that police-citizen cooperative policing is much more effective in reduction or deterrence of crimes than police oriented-policing. In present literatures, civic cooperation with the police is being researched to investigate the effect on control or deterrence of crime. Some research have revealed that civic cooperation with the police has a positive causal relationship with reduction or deterrence of crimes[14].

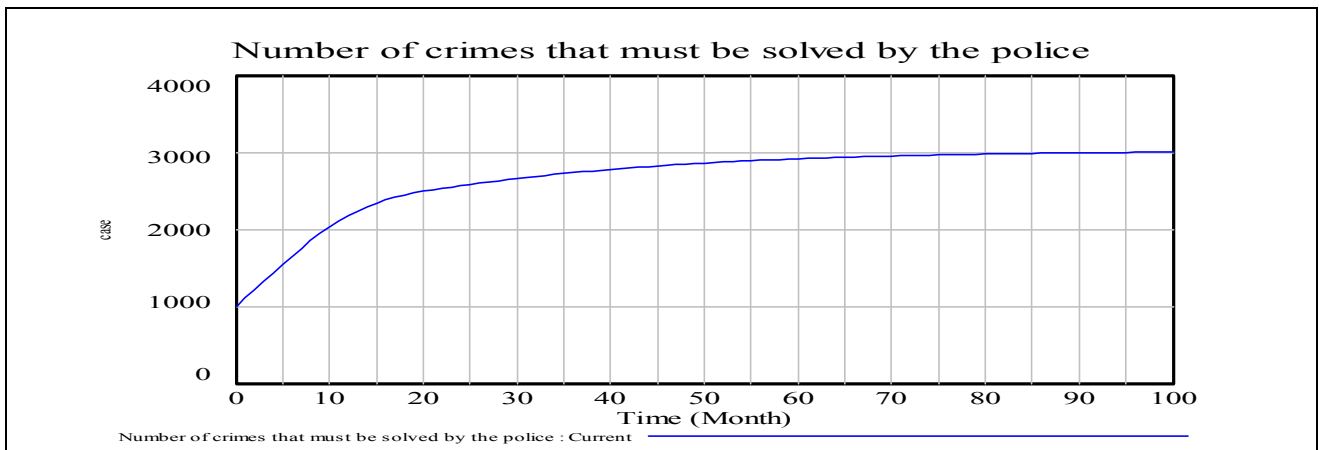


Figure 5. Simulation Result of Police-Citizen Cooperative Model

As can be seen in Figure 6, the difference between the number of arrest (bottom line) and the number of non-arrest over time (top line) is dwindling across time. There is almost no difference between both the numbers after about 60 months. In the police-citizen cooperative model, the number of non-arrest is also exceeding the number of arrest. It is, however, totally different from the police oriented-policing model. We can identify that civic cooperation can play a very important role in solving the crimes unsolved by the police.

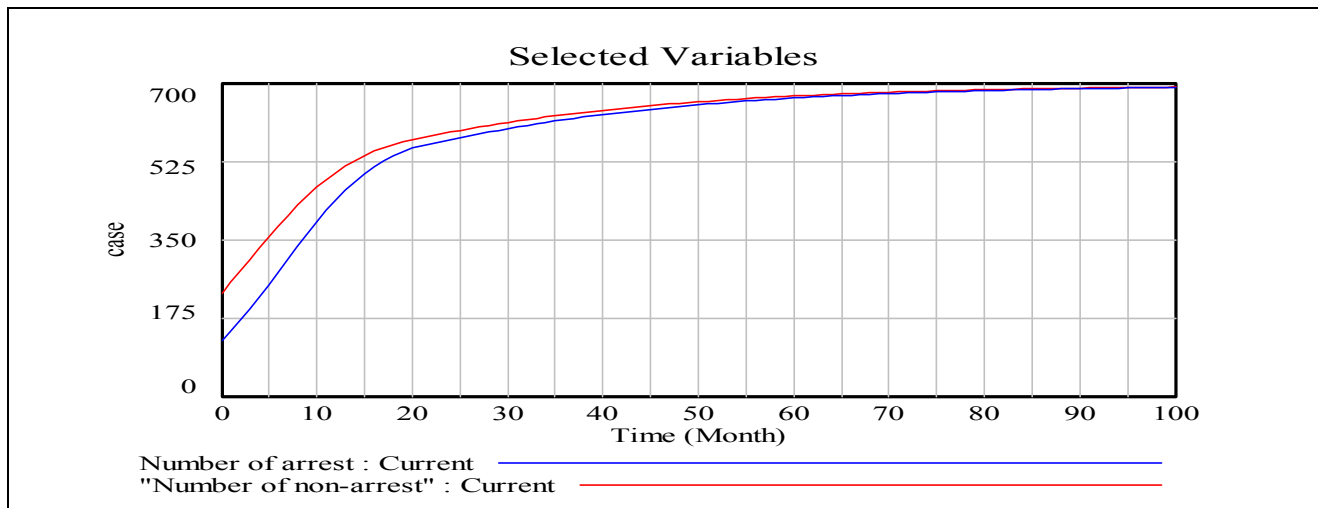


Figure 6. Changes of Number of Arrest and Number of Non-arrest in Police-Citizen Cooperative Model

4. Conclusion

The main purpose of the present study is to examine the effect of civic cooperation with the police on the number of crime that the police must solve by conducting the simulation based on system dynamics, including police oriented-policing model and police-citizen cooperative model.

Comparing the simulation results from both police oriented-policing model and police-citizen cooperative model, it is clear that civic cooperation with the police is more effective in reducing or deterring crime. Police oriented-policing activity is likely to depend on the official capacity of police organizations including police manpower, police equipment, investigation techniques, etc. The police's ability for solving offenses based on the resources has brought restrictive consequences in eradicating crime. The police, however, still tend not to accept this fact depending on the comparison of the number of police with the number of crime occurrence. The police have increased continuously the number of police and police equipment like patrol cars, CCTV, etc., and developed investigation techniques so far, but these things have not contributed effectively in dramatically reducing crimes.

The study proved that building cooperative relationship between citizens with the police can become a strategic method for controlling crime without a rapid increase in police finance. In fact, the importance of civic cooperation in solving crime has been highlighted by scholars experiencing the empirical researches. They do not show how civic cooperation with the police works in reducing crime with police activity for solving crime. The study tries to show a dynamic change of interaction between civic cooperation with the police and policing activity of the police over time. The results of the study are greatly helpful in understanding how the police should develop the cooperative relationship with citizens in order to control and reduce crimes with in an innovative way.

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