Geospatial Information and Regional Boundary Dispute in the Regional Boundary Demarcation during the Regional Autonomy Era in Indonesia

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Key words: geospatial information, demarcation, regional boundary, boundary dispute, regional autonomy era.

SUMMARY

The era of political decentralization in Indonesia, which began in 1999 is often called the era of regional autonomy. The broad of authority given to the region had triggered the formation of new autonomous regions (*Daerah Otonomi Baru* = DOB) in Indonesia. During ten years of the implementation of regional autonomy, 205 DOBs had been formed. Legally, DOB formation is stated in the law concerning formation of region which contains chapters on regional delimitation. It states that the region must be depicted in the map of the area. The map became inseparable attachment with the law UUPD that stipulates of the newly established autonomous region. One of the important activities following the establishiment of DOB is boundary demarcation that conducted by the Ministry of Home Affair. Since the border has significant meaning as the boundary zone management, there have been emerging phenomena concerning the accurence of positional boundary disputes during the demarcation process.

This paper describes and analyses on the role of geospatial information in the border dispute that occurred in Indonesia during the demarcation activities in the ten years following decentralization. Diagnosis to find the causes of border dispute was performed using Moore's approach of circle of conflict theory (1986). The results show that the geospatial information in the form of regional administrative boundary map attached to the Law regarding Regional Establishment generally do not meet the standards of quality of cartographic maps. As a result, the boundaries become unclear and these boundary ambiguities have contributed to causes of the dispute at the time of boundary demarcation.

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1. INTRODUCTION

The era of political reform in Indonesia that began in 1999 has changed the paradigm of decentralization from merely administrastive into a broader decentralization which includes political, administration and fiscal. This era is often called the era of regional autonomy (OTDA) (Suyanto, 2007). Since the era of OTDA, local authorities have a larger portion compared to the previous era. There are only six retained authority of the central government, namely: (1) foreign policy, (2) fiscal and monetary policies, (3) defense, (4) security, (5) legal and (6) religious affairs. The existence of a broad delegation of authority to the regions to manage the region creates a challenge and an opportunity for local governments to take advantage of opportunities for different reasons broad OTDA trigger the formation of new autonomous regions (DOB) in various regions in Indonesia. During the ten years of implementation of Regional Autonomy (1999 till 2009), 205 DOBs have been produced, consisting of 7 provinces, 164 districts and 34 cities (MoHA, 2010).

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Legally, DOB formation expressed in the Law Regional Establishment which among other things contains chapters on regional delimitation. It states that the newley established region must be depicted in the map of the region. The map is as an integral attachment of the law establishing the new region. The important activity after the establishment of a DOB is boundary demarcation conducted by the Ministry of Home Affairs and legally should be based on the Law Concerning Regional Establishment. This activity is followed by the stage of demarction. The demarcation of the border is the activity of determining the coordinates of the border points by geodetic field survey methods and the results are described in terms of the boundary map containing a list of coordinate points of the border. For the purposes of regional boundary demarcation, Minister of Home Affaris issued a technical guidance on regional boundary demarcation, which is Permendagri No. 1 of 2006.

The development of political, economic and cultural world as well as local culture in defining the boundary of a country, often leading to disputes between neighboring countries associated boundary (Prescott, 1987). Similarly, in Indonesia, since the OTDA, the boundary region has an important meaning as a boundary management authority for a region. There for the region so that each area requires certainty of the position of its boundaries. In fact,, in the phase of boundary demarcation many boundary disputes occurs. As of the end of 2012, there were 82 cases of boundary disputes that can not be resolved. Even 449 segments of 640 boundary segments that have not been confirmed should be assumed that there are potential boundary disputes (MoHA, 2012). Referring to the opinion of Blake (1995) that the map can be a contributing cause of the dispute, so it is possible that boundary dispute occurred in Indonesia can also caused by geospatial data and information.

This paper discusses the contribution of geospatial information in the border disputes that occurred in Indonesia during the demarcation border activities in ten years OTDA era. Diagnoses to find the cause of border dispute is done by using the circle of conflict theory proposed by Moore (1986).

2. JONES 'S BOUNDARY MAKING THEORY

In 1945, an American political geographer named Stephen B Jones published a book entitled Boundary-Making: A Handbook for Statesmen, Treaty Editors and Boundary Commissioners. In his book, Jones formulates a theory concerning the existence of the historical borders of a state. Within the theory, Jones suggests that there are four main stages of the existence of the borders of a state, namely: (1) allocation, (2) delimitation, (3) the demarcation of boundaries in the field, and (4) boundary administration. Jones gave a cautionary note that the boundary making is a continuous process, starting from the initial stage to the final stage of the administrative allocation, so that errors in one stage will affect the next stage.

After more than sixty years the theory of Jones (1945) published and applied, many questioned the relevance of the theory for the 21st century, especially associated with the borderless view, the development of geospatial technology and dispute resolution cases Eritrea - Ethiopia boundary (Donaldson and Williams, 2008). Then Donaldson and Williams (2008) conducted an analysis of the relevance of the theory of boundary making of Stephen B. Jones in 1945 for the 21st century. The results of the research that has been conducted is presented in the article entitled: Delimitation and Demarcation: Analysing the Legacy of Stephen B Jones 's Boundary Making and published in the journal Geopolitics, 13:4, 676-700. Donaldson and Williams conclude that the delimitation and demarcation stage is a fundamental stage in the boundary making, and practical is still used as a guideline in determining the boundary and resolving boundary disputes in various parts of the world. On the basis of the results of the analysis conducted by Donaldson and Williams in 2008, the boundary making theory proposed by Jones in 1945 and used as a framework of reference in this study.

3. BOUNDARY CONFLICTS AND DISPUTES

In general, the conflict is a form of competitive behavior between individuals or between groups of people. According to Moore (1986) the potential for conflict will exist when two or more actors competing to excess or lack of fitness for purpose under conditions of limited resources (Forbes, 2001). Moore suggested that for management or conflict resolution, the diagnoses is very important to look for the causes of conflict. Moore developed a model of conflict maps in the form of a circle (the Circle of Conflict) as presented in Figure 1. The Circle of Conflict is a model that diagnoses and categorizes the underlying causes of the given conflict (Furlong, 2005). In the Circle of Conflict, Moore identified five main causes of conflict, namely: (1) problems with people's relationship, (2) factors related to data, (3) actual or perceived competing values, (4) structural forces, (5) actual or perceived incompatible interests (Forbes, 2001; Furlong, 2005).

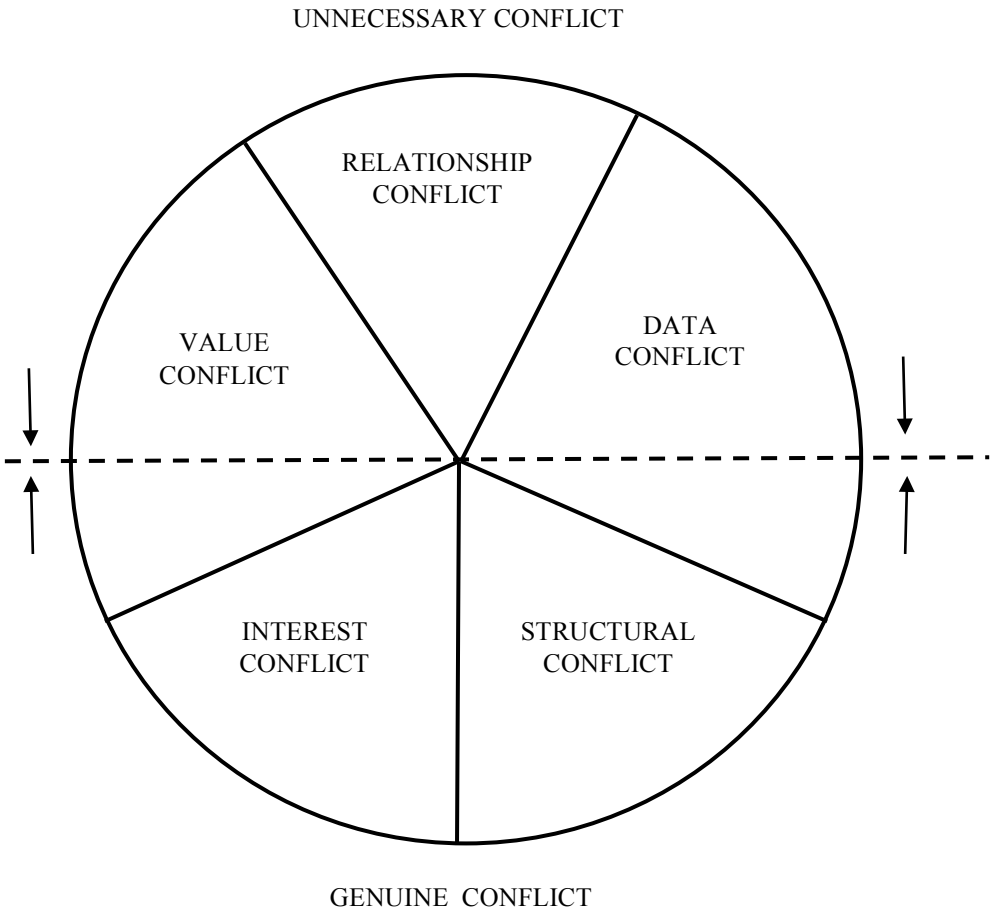

Fig. 1 The Circle of Conflict according to Moore in 1986 (Forbes, 2001; Furlong, 2005)

Data conflict, value conflict and relationship conflict is actually unnecessary conflict occurs (unnecessary conflict), it means that the data and information available as needed, the existing values are well understood and negative emotions and behaviors can be maintained, then there will be no conflict. Actual conflict (genuine conflict) are structural conflicts and potential conflicts of interest is almost always due to the factor of interest and structural factors are the two factors are interconnected and there is always a human life (Forbes, 2001).

Summary of the characteristics of each of the causes of conflict are presented in Table 1.

Table 1: The characteristics of each of the causes of conflict according to Moore, 1986 (Forbes, 2001; Furlong, 2005).

UNNECESSARY CONFLICT		
Relationships	**Values**	**Data**
– negative experience in the past – stereotype or misperception – poor or failed communications – repetitive negative behavior – strong emotions	– belief systems – right and wrong – good and evil – just and unjust	– lack of information – misinformation – too much information – collection problems – different view on what is relevant – different interpretation of data
GENUINE CONFLICT		
Interest	**Structural**	
– substantive issue (natural resources, time, finance) – procedural – psychological	– How a situation is set up – Geographycal/physical relationships (distance or proximity) – Time constrains – Unequal power/authority – Unequal control of resources – Role definition	

Beside the term of conflict, there is dispute, a word that has almost the same meaning. Dispute is defined as a specific disagreement. This is usually caused by the existence of a regulation or a policy where a claim or claims of a group are rejected by other groups that will lead to disputes. In terms of border conflict, disagreement is caused due to the existence of a policy, for example in the form of agreements between countries or regional autonomy in the form of regulations such as the formation of legislation in Indonesia. Therefore the term boundary conflict, by conflict experts, is more accurately referred to dispute of boundaries (Forbes, 2001).

According to Prescott (1987), border disputes can generally be grouped into three types: (1) territorial disputes are disputes that occur when there is an area that has not been allocated in the allocation process of a dispute at the level of politicians / state, (2) positional disputes that allocation disputes that occur after the delimitation of boundaries either before or after the delimitation often appear during the demarcation activities, (3) functional dispute is a dispute that occurred at the stage of border management as a valuable economic resource management and the cross - border management.

4. THE ROLE OF GEOSPATIAL INFORMATION IN BOUNDARY MAKING

Boundary making is essentially a process of partitioning or dividing the earth's surface. The surface of the earth can start from parcels (parcels of land) to administrative areas such as

village, district/city and province, even the country's sovereign territory. In practical terms, the division of earth surface can be done directly in the field by means of measurement and indirectly by performing on the map (O'Leary, 2006). Therefore the map is indispensable in the boundary making and is an important part of the infrastructure in each phase boundary making (Adler, 1995).

4. 1. Maps as Geospatial Information

Map is a graphical representation of the whole or in part of the earth on a flat surface (e.g. paper) with a scale and a specific map projection system. Map is a cartographic product. Cartography is the art, science and technology of making maps (Soendjojo and Riqqi, 2012). A map is not only the result cartographic work alone, but starting from the field measurements (surveying) to obtain topographic data to data processing, and production stages of delineation (Maling, 1989). In the map, elements of the earth's surface are described in symbols through genaralization process that is tailored to the goal of making maps (Adler, 1995). As a miniature model of the earth then there must be a definite geometric relationship between object drawn with real objects in the field. The relationship is depicted in the form of scale. Scale of 1:100.000 means a distance of 1 cm on the map is a display of objects on the ground a distance of 1000 m. It should be noted that the position error of 1 mm at a map scale of 1:100. 000 meaning in the field will shifted of 100 m.

Map is a two-dimensional model that has a scale that represents the three-dimensional surface of the earth to show and describe the objects selected. Maps are used to describe the facts that are geographically includes facts associated with political boundaries (Hyde, 1993). Map serves to (1) state the position/location of a place on the earth's surface expressed by planimetric coordinates (X, Y) and the height of the reference plane (sea level), (2) show the pattern of distribution and spatial patterns of natural and man-made phenomena, (3) record and store data and information as well as to visualize the planet earth (Soendjojo and Riqqi, 2012). Thus, a map is a geospatial information or information that has a spatial aspect that shows the location, layout, and position of an object or event in the earth, and it is expressed in a specific coordinate system. Therefore, it is not surprising that maps are always used as a tool in policy formulation, decision making, and/or implementation of activities related to terrestrial space. One of them is decision making concerning delimitation and demarcation boundaries.

4. 2. The Roles of Maps in the Delimitation Stage

In the delimitation stage, a map is used as a negotiating tool to reach an agreement on the boundary. the location of the map. Therefore, the map should be able to provide an overview of the terrain for the boundary architects about the boundary area that will be set (Adler, 1995). In this phase, the activity is to choose the boundary location and to precisely define the boundary line in the agreement (Jones, 1945). The scale and quality of the map become very important. Eventhough a map is not always able to bring the actual field conditions to the negotiating table. This is because a map is a two- dimensional graphical representation of the three -dimensional surface of the earth (Riqqi and Soendjojo, 2012).

A map is also used as a medium to display the results of the agreement in the delimitation stage. This map will be attached as an integral part of the agreement and will be used as a guide in the demarcation phase. Therefore, the boundary lines described in the attachments map should correspond with the narrative boundaries in the agreement. As an integral attachment of the agreement, then the map of boundary delimitation becomes a legal document and an essential evidence that play an important role in answering questions about the location of the boundaries (Akweenda, 1990).

4. 3. The Roles of Maps in the Demarcation Stage

The results of the delimitation treaty, which include narrative in the articles of agreement and boundary maps in annex agreement, will be transferred to the ground through demarcation. Demarcation is to determine the position of a point and the true boundary line on the ground which is done bilaterally. Boundary points that have been agreed in the delimitation process are transformed into the field and physically marked by a construction of a monument or boundary pillars, guard posts, walls or other facilities (Jones, 1945). This demarcation is done to determine the coordinates of the boundary points through measurement, survey and mapping activities using appropraite technology, equipment and methods. In the field surveys, geodetic surveyors' role is vital in order to generate accurate coordinates of the points. One thing to keep in mind that if there is no conformance with the boundaries between narrative boundary map in the agreement, then the narrative will replace the map boundary limit (Adler, 1995).
The results of the demarcation activities will be described in the demarcation of the boundary map. This map contains coordinates of the boundary point as a result of the field measurement which it will be used in the administration and boundary line management phase. Therefore, large -scale maps such as 1: 50. 000 or greater would be very helpful.

5. REGIONAL BOUNDARY MAKING IN INDONESIA

Referring to the th Jone's boundary making theory, boundary making phases that have been conducted in Indonesia in the era of regional autonomy are the delimitation and demarcation of the boundary regions. In this study, the discussion of boundary making regions in Indonesia is limited to ten years of implementation of OTDA. Boundary making of regions in Indonesia is a part of a larger process of forming DOB activity involving various aspects such as politics, law, economics and mapping.Figure 2 presents the implementation of demarcation in the OTDA era where phenomena of boundary disputes have occured. The figure also saws relationship between the role of geospatial information and activities of delimitation and demarcation as well as the border disputes in the OTDA era.

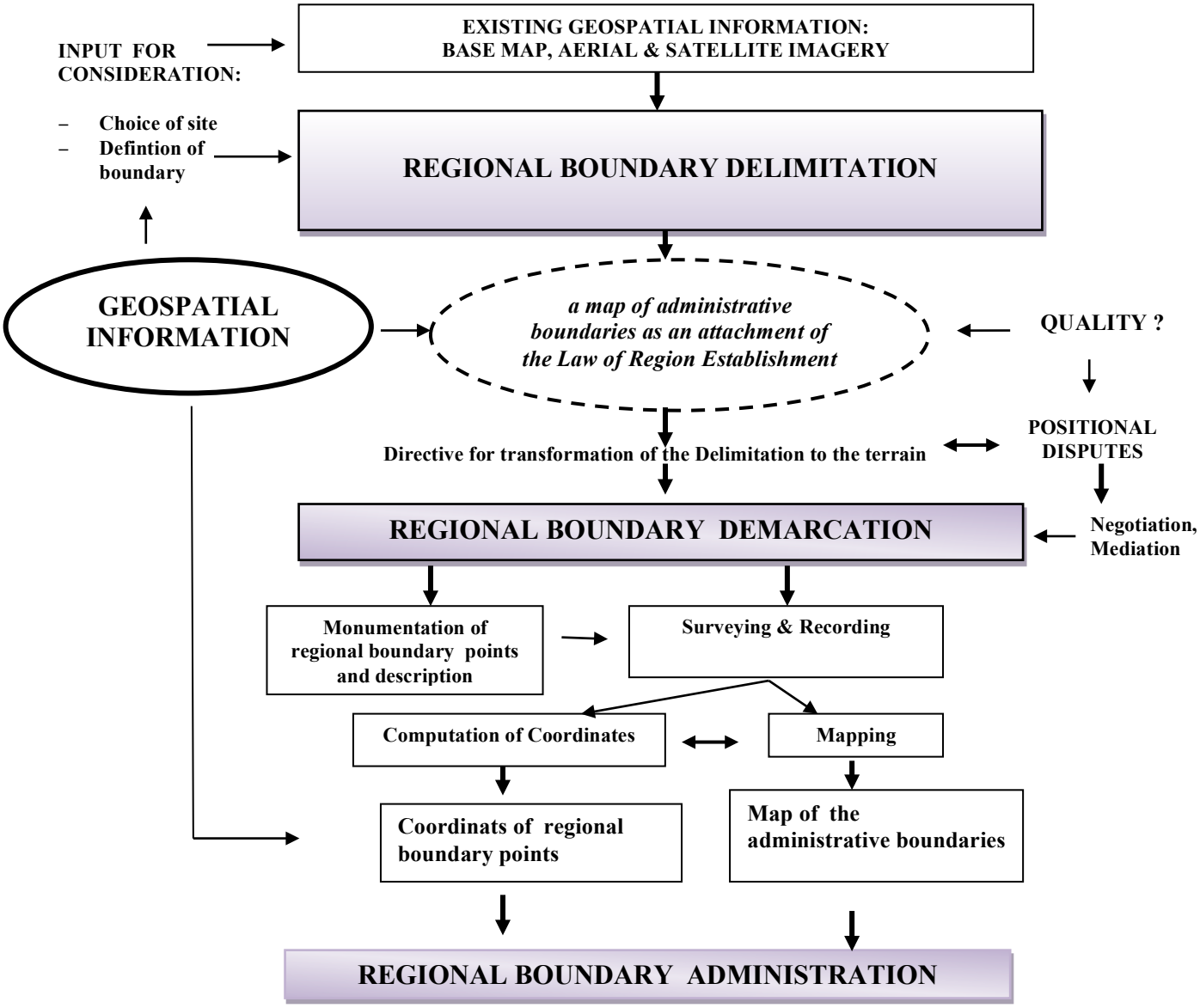

Fig. 2. The relationship between the role of geospatial information and activities of delimitation and demarcation as well as the border disputes in the OTDA era

5. 1. The Availability and Quality of Base Maps

The official base map in Indonesia is produced by the Geospatial Information Agency (BIG). Prior to the enactment of Law no. 4 in 2011.The agency's name was the National Coordinating Agency for Surveys and Mapping (Bakosurtanal) which produced base maps called RBI maps. These maps had been produced in a wide range of scales for the entire land area of Indonesia.

At the beginning of the formation of Bakosurtanal in 1969, only about 15 % of Indonesia's

land area was mapped into 1: 50.000 scale of topographic maps applying a geodetic controlled system. Within two decades after the establishment of Bakosurtanal, surveying and mapping activities continue to evolve following the development of geospatial technologies (Photogrammetry, Remote Sensing satellite, IFSAR, LIDAR and GPS). This has resulted that the mapping survey work can conducted faster with wider scope and greater scale. In 2009, the whole area of Indonesia had been mapped at a scale ranging from 1: 25. 000, 1: 50. 000, 1: 100. 000 to 1: 250. 000 (Ikawati and Setiawati, 2009). Thus the availability and quality of basic map (RBI map) to support the activities of boundary making are sufficient.

5. 2. The use and results of geospatial information in the process of regional boundary delimitation

To determine the use of geospatial information in the delimitation process, an assessment of the relevant articles in the Law of Regional Establishment boundaries is conducted. The assessment was done by using appropriate benchmarks delimitation stage of Jones' theory (1945). Referring to the Jones stages of the boundary delimitation, the UUPDespecially in the boundaries chapter paragraph (1) was interpreted as the stage of choosing the site. The choice of the boundary location generally is placed in an area which can be land or water areas. For the land area could be administrative area units ranging from village, district/city, province or state. While sea water area can be, straits, bays or lakes. In the case of choosing of the boundary line of an area, the boundary must be defined first. Placing the boundary in a certain area can be crucial if it is not clearly defined and is not followed by precise definition boundary line, because it can lead to different interpretation of the interested parties in the future.

Paragraph (2) of UUPD about borders area states: borders area as mentioned in the paragraph (1) shown in the form of map area, as an appendix, is an integral part of the act. Based on the Jones theory of boundary making, paragraph (2) basically can be interpreted as a stage to define boundary on the map attached on the act. To do that, according to Jones, borders are delineated on the map and further more point coordinates composing the agreed border are established. In order to achieve precise location of the borders, the map used to establish the boundary should fulfill mapping principle. In fact, in the process of boundary delimitation of an area as mentioned in the PP. No. 129 year 2000, basic maps (RBI map) were neglected. As a result, the quality of administrative area maps, the product of delimitation stage, is cartographically low, for example no map scale, no map projection, no coordinate system information as well as geodetic datum used. In addition, although the delineation process was executed, no point coordinates of the borders were established. Consequently, it is hard to transform border line from the map to the field. Table 2 shows the classification of administrative area maps in the period of 1999-2007.

Table 2. The quality of administrative map in term of the scale aspect

No.	Group	Number	Remark
1	Maps without scale	**64**	Administrative maps attached to the Law of Regional Establishment but with no scale
2	Maps with scale	**50**	Administrative maps attached to the Law of Regional Establishment with scale
	Sum	**114**	

Map scales play a very important role because it is basically a map is a model of the earth 's surface so that there should be clear geometric relationship between the elements depicted in the map with the actual elements in the field. The absence of scale information on a map means that the map can not be used to perform spatial analysis for measuring distance and areas. In the course of the delimitation and demarcation of the border, spatial analysis will always be done for example to measure the length of the segment limit or measure the area around the disputed boundary line.

Table 2 shows that only 50 (44 %) of maps that present the map scales. Referring to the PP. 8 of 2013 concerning accuracy of maps, the smallest map scale sufficient for a province is 1: 500.000, district 1: 100.000 and city is 1: 50.000. Of 50 maps of the area that provide map scales are shown in Table 3.

Table 3: Scales on maps of the administrative annex in the attachement of UUPD period 1999-2007.

No.	Scale	Number of attachment map	**%**
1	1: 25. 000 - 1:. 50. 000	0	0
2	<1: 50. 000 - 1: 100. 000	4	8
3	< 1: 100. 000 - 1: 250. 000	11	22
4	< 1: 250. 000 - 1: 500. 000	21	42
5	< 1: 500. 000 - 1: 1. 000. 000	15	30
6	< 1: 1. 000. 000 - 1: 3. 000. 000	9	18
	Sum	50	100

Map scales as presented in Table 3 show that the majority (92 %) of the administrative area map in the attachment UUPD districts/cities were made on a scale smaller than 1: 100.000, some even smaller than 1: 1. 000.000. Only 8 % were made on a scale greater than 1: 100. 000. When PP. No. 8 of 2013 concerning accuracy map for district/city is used as a reference, then those map are not in accordance with the accuracy requirements. There are 114 maps that have become attachmenet of UUPD in the period 1999-2007. However, they do not include informtion about geodetic datum and map projection system. In fact, as the attachment UUPD these maps have a strong legal power, and will be used as the infrastructure to transform boundaries on the map to the actual boundaries on the ground. Technically, this transformation task is called staking-out and commonly applying survey and mapping techniques. In order for a point or a line can be transformed, their coordinates and geodetic

datum must be known. If the coordinates of such points are known, but the geodetic datum is unknown, then it will be difficult to confirm the actual location in the field. In a case that the staking out is forced to be conducted, for example using estimated geodetic datum, there will be a displacement from the true location. The displacement can be either detrimental or beneficial to the neighboring regions, espcially where the areas are rich in natural resources such as mineral, oil or gas.

In contrast to the case described earlier, in the process of delimitation of newly autonomous region (DOB) in the period 2008-2009, geospatial information has been used since the begining to comply with the government regulation PP. No. 78 year 2007. Maps of the regions as a result of the delimitation in this period already meet the mapping principles and qualified for demarcation. The maps as attachment of UUPD in that period are 32 sheets. All maps of regions are completed with scales and were drawn according to the scales specified in the regulation. The scales are 1:50.000 and 1: 25.000 for the districts and cities, respectively. Boundary lines were delineated on the maps. Their locations on a map has been chosen and determined, but not yet in the form of well defined coordinates. However, because the coordinate system already defined, then the boundary points can be cartometrically determined. Therefore, technically the maps of regions in the attachment of UUPD issued in 2008-2009 can be used as a guide for boundary demarcation.
Administrative maps are graphically depicting the region boundary autonomous region. The maps are the attachment of UUPD. Thus, essentially they are legal product as they are an integral part of UUPD. In the judicial context, these maps are very strong legal evidence. In this case, Brownlie, (1979) states that: "... A map has a probative value proportionate to its technical qualities ". Thus the better the technical quality of a map, then the map has a stronger value as evidence.

5. 4. Geospatial Information and Positional Disputes of Regional Boundary

In this study, diagnosis of the cause of dispute conducted on 36 cases of boundary disputes which consists of 11 cases of boundary disputes between provinces and 25 cases of boundary disputes between districts/cities. Diagnosis of 11 cases of boundary disputes between provinces performed using the cicle of conflict theory according to Moore (1986). Diagnosis of the causes of conflict results are presented in Table 4.

Table 4. The result of the diagnoses boundary disputes between provinces.

No.	Causes of disputes	Number of causes	%
1	Interests	-	-
2	Structural	-	-
3	Data or geospatial information	5	45
4	Relationships	-	-
5	Value	-	-
6	Combination of geospatial information and interests (3+1)	6	55

Table 4 shows that 5 (45%) of the boundary dispute cases between provinces are caused by incomplete maps attached on the UUPD for example no map scale and no coordinate system.

This incomplete maps produce different interpretation of the borders when it was established on the field. While, six boundary dispute cases were caused by combination of two factors namely geospatial information and substantive interest factor. For example swiftlet's nests, land seizure, mining area seizure and the ownership of the islands. In addition there are also cases that were caused by combination of geospatial information and procedural interest factor such as the current local government don't agree to the borders that have been established by previous local government. To overcome this problem, re negotiation process is needed.

There are 25 cases of borders disputes on the district/cities level. To assess the factors causing the disputes, the circle of conflict theory proposed by Moore (1986) is used. The assessment results is shown in Table 5.

Tabel 5**:** The result of the diagnoses boundary disputes between districts

No.	Causes of disputes	Number of causes	%
1	Interests	-	-
2	Structural	-	-
3	Data or geospatial information	16	64
4	Relationships		
5	Value		
6	Combination of geospatial information and interests (3+1)	5	20
7	Combination of geospatial information, structural and interests (3+2+1)	4	16

Table 5 shows that there are 16 (64%) cases of boundary disputes among districts/cities due to geospatial problems. The problems are that either of UUPD are available but the quality are not goog or the maps are not attached at all. As a result, at the stage of demarcation, the parties filed claim of the boundaries according to the maps of their own versions. This is posible because Permendagri No.1 year 2006 concerning guidlines for Regional Demarcation stipulates that each district/city may submit evidence in the form of map showing their boundary claims.

6. CONCLUDING REMARKS

Boundary delimitation and demarcation in the establishment of new autonomous region in Indonesia has been executed for almost 10 years since 1999 when the era autonomous begun. In the first 8 years, boundary delimitation produced administrative borders maps in the low quality so that it can't be used as reference for area demarcation. It is due to the regulation PP No. 129 year 2000 doesn't put geospatial information specifically base map as a mandatory requirement. After the enactment of PP No 78 year 2007, new regulation on the establishment of the new autonomous regions, all delimitation processes produced administrative borders maps that cartographically have high quality and can be used as reference in the demarcation stage.

In Indonesia during autonomous era, the quality of geospatial information resulted from delimitation stage have significant contribution in the emergence of borders dispute particularly in the demarcation stage. Border disputes generally were ignited by the quality of appendix maps on the act of establishment of the new region that provide difficulties to assure the position of borders in the field. It is then followed by conflict of interest and structural conflict; and finally dispute because of claimed borders.

ACKNOWLEDGMENT

The authors would like to thank Mr. Eko Subowo, Mr. Heru Santosa, Mr. Halomoan Pakpahan from the Ministry of Home Affairs of Republic Indonesia and Dr. Khafid, Mr. Edwin Hendrayana, Mr. Anas Kencana, Mr. Lulus Hadiyanto, Ellyta Widyaningrum, Eli Yuniati from the Geospatial Information Agency (BIG) of Indonesia. They provide valuable data, documents and time for discussion.

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BIOGRAPHICAL NOTES

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