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Geological Perspective for Geotourism Development in Uthai Thani Province, Thailand

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Abstract

Uthai Thani is a fascinating city in central Thailand and has the uniqueness of geodiversity, nature, culture, and history, which makes it ideal for geotourism development. The lifestyle of the local population is linked to nature and the river, making the area very interesting for tourist. It also has a fantastic mountainous region in the western part including karst topography, granite batholith, and numerous small hills. The study area consists of seven geosites, which are Sakae Krang River, Kao Pla Ra Mountain, Hup Pa Tat Cave, Samor Thong Hot Spring, Khuan Khun Kaew Reservoir, Saiber Waterfall, and Huai Kha Khaeng Wildlife Sanctuary. The Kao Pla Ra mountain is the highlight of this region, which has many prehistoric cliff-paintings. This geotourism announcement can educate the tourists to understand the geologic processes and has many advantages for the local and national sustainable development in the travel industry, economy, geology, history, and society.

Keywords: geotourism; geology; geodiversity; Uthai Thani Province; Thailand.

JelClassification: Q57; Z32.

Introduction

There are many global problems; one of the reasons occurred due to a shortage of promoting and educating people about earth sciences (geology, geography, geomorphology, and geoconservation) (Nonaka 1991; Demarest 1997; Liebowitz 1999). In addition, lack of strategies for geo-knowledge practices and unsustainable performances of governments also make these problems worse. Thailand has many geosites such as spectacular landform, fantastic phenomenon, and rock-mineral resources. However, Thai people do not focus on these geosites due to their lack of earth sciences knowledge. This research is a part of the project to announce the geotourism in Thailand. Geotourism is referred to as a form of nature-based tourism that focuses primarily on the geosystem (Gray 2011, Newsome and Dowling 2010). It is the new trend within the last two decades and promotes geological heritages to people (Ruban 2010, Henriques *et al.* 2011, Wimbledon and Smith-Meyer 2012; Gray 2013; Prosser 2013; Ruban 2015; Brilha 2016; Neches 2016; Mikhailenko *et al.* 2017). This geological concept has many benefits for local and national communities such as economic, geologic, historical, cultural, and social benefits (Gray 2005; GSA 2012; Newsome *et al.* 2012). Nowadays, Thailand is developing in geotourism knowledge, and the UNESCO certified the Satun Geopark as the first UNESCO Global Geopark of Thailand and fifth Global Geopark of Southeast Asia recently that make the Thai government ready to support this tourism type. The studied area consists of many outstanding natural attractions suitable for geotourism

expansion. The goal of this research is to announce geotourism in Thailand, which will make people realize the importance of the geoscienctific knowledge and conserve these areas for the next future generation. Moreover, they can manage their resources in sustainable development in term of economic, cultural, social, historical, natural, and geologic benefits. In addition, this publication will successfully affect both national and international travel industries.

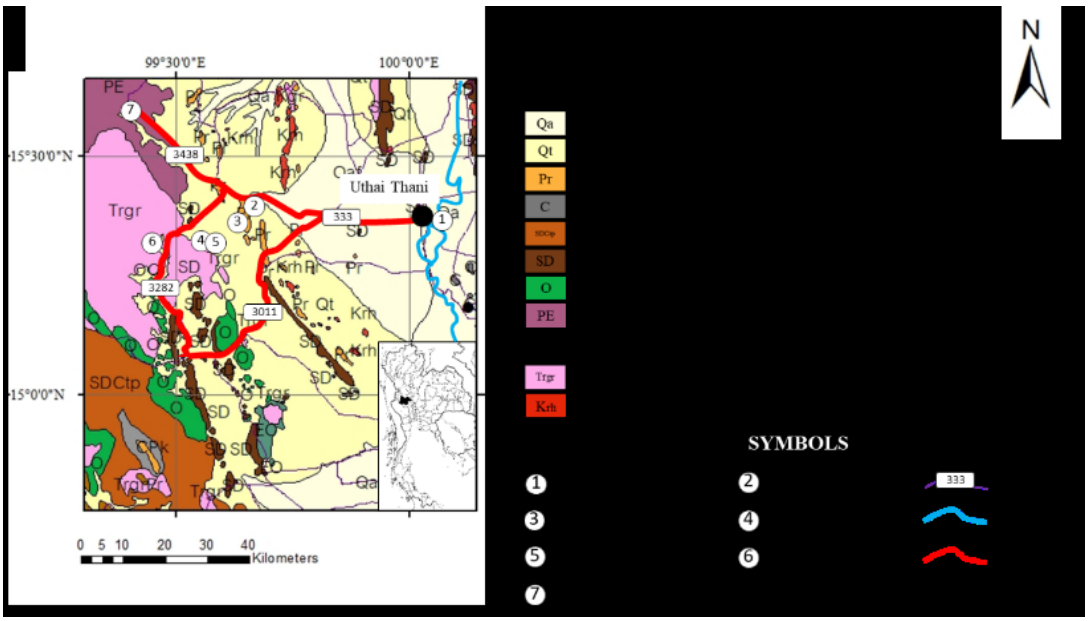
1. Materials and Methods

The diverse geologic features suggest this area consists of many geosites, which can be developed for tourism. The inventory of the potential geosites of Uthai Thani is essential for its efficient geotourism and geoconservation. Firstly, the researchers plan the field observation by geologic and topographic map. Secondly, we also make the route map in figure 1 to assist tourists. Thirdly, we list the location of the potential geosite, which based on the literature related to the topic and this area. On the field observation method, we locate the geosites on the maps by GPS and collect the data of these geosites such as photographs, rock types, mineral compositions, structural features, fossils, geomorphology, and tourism information. The investigation from fieldwork is the essential data to describe the characteristics and evaluation of geosites. The outstanding points and geologic story of each geosite make it is interesting for tourists.

2. Geology

The study area is in the northern part of Bangkok and grouped in central Thailand. Due to it is location on the western flank of the Chao Phraya River, it is covered by Quaternary sediments floodplain (Figure 1). Furthermore, there are Precambrian metamorphic rocks, Triassic granitoid, and Cretaceous felsic volcanic rocks in the western part, which is a part of Ban Rai Complex (Department of Mineral Resources, 2007). It also has a hot spring, which occurred by granite intrusion. In the south-western flank, it is created by Ordovician limestone and Silurian-Devonian low-grade metamorphic rocks. The Permian limestone in Uthai Thani has aged in 200 million years ago and lies in N-S direction on the central plane of Thailand (Chindamanee 2011). It is a southwestern part of Chainat duplex and below the Mae Ping fault zone. In addition, Uthai Thani limestone ridge formed cliffs and caves.

Figure 1. The geologic map describes the location of rock types and geosite of Uthai Thani Province (Modified from Department of Mineral Resources, 2007).



3. Characteristic of Geosite

Based on field observation, the area can be divided into seven potential geosites, which comprise 1) Sakae Krang River, 2) Kao Pla Ra Mountain, 3) Hup Pa Tat Cave, 4) Samor Thong Hot spring, 5) Khuan Khun Kaew Reservoir, 6) Saiber Waterfall, and 7) Huai Kha Khaeng Wildlife Sanctuary. The tourist can travel to all these geosites by following the travel route in Figure 1.

Sakae Krang River originates in the high mountain of the Mae Wong National Park, Nakhon Sawan Province. It is approximately 225 kilometers long and flows southward to join the Chao Phraya River in Uthai Thani city. There are many houseboats on Sakae Krang River that reflect the lifestyle of Uthai Thani people (Figure 2). Their lives have always been linked with water such as agriculture and fishery, that has become the primary occupation of this province. The tourists can take a boat to view the lifestyle of people living on Sakae Krang River. The ports for boarding are located at Lan Sakae Pier in Amphoe Muang and Lan Suphannika on Si Uthai Road. There are many tour boats serving tourists, which passes the most famous temple of this region "Wat Tha Sung Temple" and finishes at the point of the Sakae Krang River and Chao Phraya River meets.

Figure 2 The lifestyle of Uthai Thani people on Sakae Krang River

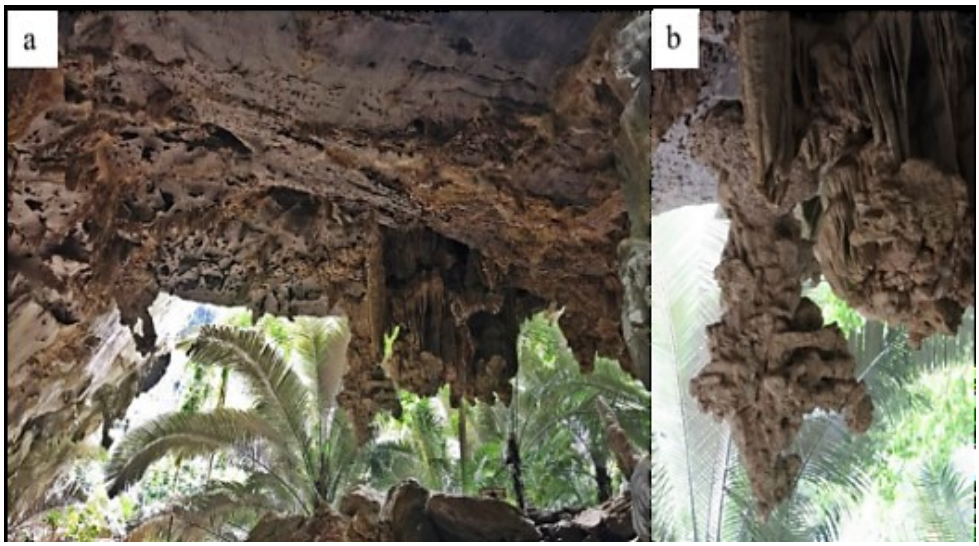
Khao Pla Ra Mountain is located on the western flank of Uthai Thani Province. It is a limestone mountain, which long 8 kilometers, wide 3.5 kilometers, and 400 meters in height. It contains many small fossils such as crinoid, bivalve, algae, and calcite crystals. The tourists can comfortably reach to this geosite by highway number 3438. The prehistoric cliff-paintings are the highlight of this area and lie on the top of the mountain, which is the steep cliff at 597 meters above sea level. In addition, these pictures are painted in red, black, and dark red colors and overlapped in many dimensions of art. Fine Arts Department (1990) suggest divided the picture into five groups based on the coloring technique; 1) Silhovette, 2) Pantial silhouette, 3) Outline, 4) Stick Fiqure, and 5) Sketch. Both human-life and animal paintings are at 4 meters to 7 meters from the ground and distributed along the rock wall, which approximately 38 meters (Figure 3). The story of the art and assembled with antiquities of the Khao Pla Ra Mountain such as hunting equipment suggest that these prehistoric cliff-paintings are aged around 3,000-5,000 years ago based on similarly archaeological evidence (Fine Arts Department, 1990). It is assumed these things are probably a job of the prehistorical communities such as agriculture, hunting, lifestyle, and belief (Fine Arts Department, 1990). The rain is the threat of these paintings. However, they also have natural conservation on the south side of the mountain, due to the durable limestone protrudes like a roof, giving the picture natural protection.

Figure 3. The prehistoric cliff-paintings; a(people parody trait of animals, b(the movement of prehistoric man, and c(portrait of a prehistoric cowboy.

Hup Pa Tat is a limestone cave and far from Khao Pla Ra Mountain approximately 300 meters in the southern flank. It is a high valley stretching over an area of about 48,000 square meters. The northeastern part of this area surrounds the Khao Huai Sok valley, which is connected to Khao Pla Ra mountain. Hup Pa Tat is the name referred the location of this area, which is the forest in the limestone valley. There is a cave mouth that

passes up about 50 meters from headquarters reaching to the margosa forest. The layering high cliff of limestone surrounds this area and preventing the sun rays shining to the ground anytime except midday time. This results in high humidity, which has contributed to a wealth of flora and small reptile. It also conserves the gigantic shrubs of the genus *Excoecaria* that are similar to ancient trees. Hup Pa Tat is classified to Solution caves, which are formed in carbonate rocks by the action of slowly moving ground water that dissolves the rock along joints and bedding planes (USGS, 1991). Most of the caves in the world as well as the largest are of this type. There are the beautiful stalactites, stalagmites, and columns (Figure 4).

Figure 4 The feature of Hup Pa Tat cave; a(stalactites and stalagmites and b(stalactites.



Samor Thong Hot Spring is the only one geologic phenomenon in Uthai Thani (Figure 5a). The tourists can get to this geosite by highway number 3282 from Amphoe Ban Rai. This hot spring is the effect of granite intrusion, which makes hot water bubbles to the earth surface from an underground heating source. There are mineral baths on offer for tourists (Figure 5b).

Figure 5 a(Samor Thong Hot Spring and b(mineral baths.

Khuan Khun Kaew Reservoir is a human-made geosite for agriculture and consumption. This geosite is created surrounding the Samor Thang Hot Spring. It is also a peaceful place that tourist can get recreation with nature and beautiful panoramic view (Figure 6). Meanwhile, the tourists can fish and camp overnight. The tourist can contact the headquarter for information about restaurant and accommodation.

Figure 6. The panoramic view of Khuan Khun Kaew Reservoir.

The Saiber Waterfall is one of only three points in Huai Kha Khaeng Wildlife Sanctuary, where tourists are permitted to visit (Figure 7). This waterfall is a peaceful natural area and has many waterfalls close such as Loi Choi and Hin Lat. It consists of granite and granodiorite and is resulted from fault movement. This geosite is an excellent place to relax and trek in natural surroundings. There are accommodations, and small local food stores serving the tourists. The tourists can get to this geosite, from Uthai Thani by highway number 3282 for about 79 kilometers.

Figure 7. Saiber Waterfall

Thung Yai Naresuan – Huai Kha Khaeng Wildlife Sanctuary is the full name of this site, which is the most famous natural site of Thailand and the South East Asia Region. It has a forest area about 5,775 square kilometers in the western part of Uthai Thani and other two provinces. This Wildlife Sanctuary was registered as a World Heritage Site by UNESCO in December 1991. There are five types of tropical forests and biodiversity, which comprises rare fauna including wild water buffalo, serow, leopard, Asiatic wild dog, red junglefowl cock, green peafowl and many species of forest insects. In term of geology, it consists of many rock types such as biotite granite, gneiss, Augen gneiss, and migmatite. This site does not open for the tourists, but they are permitted to visit only three points; 1) headquarters and Sueb Nakhasathian Memorial, 2) Saiber Waterfall, and 3) Huai Mae Di campgrounds and a nature study route (Figure 8).

Figure 8. Thung Yai Naresuan – Huai Kha Khaeng Wildlife Sanctuary; a(Sueb Nakhasathian Memorial and b(Nature trail at the Saiber Waterfall.

4. Discussion for Geotourism Development

The geodiversity comprises rock, mineral, fossil, landform, landscape, process, soil, and other resources (Gray 2005). So, Uthai Thani has many geodiversity based on the field investigation analysis of the previous geosite listing (Table 1).

Table 1 Classification of potential geoheritage resources in Uthai Thani Province

Geological Site	Geodiversity [a]	Scope [b]
Sakae Krang River	landform/ landscape, process, soil	GM
Kao Pla Ra Mountain	Rock, fossil, landform/ landscape	PT, STG, SP
Hup Pa Tat Cave	Rock, mineral, fossil, landform/ landscape, process	MN, PT, STG, SP
Samor Thong Hot spring	Rock, process	PT, HD
Khuan Khun Kaew Reservoir	Landscape, water resource	HD
Saiber Waterfall	Rock, landform/ landscape	PT, STR, GM
Huai Kha Khaeng Wildlife Sanctuary	Rock	PT

MN: mineralogical site, PT: petrological site, STR: structural site, STG: stratigraphic site, GM: geomorphological site, SP: speleological site, and HD: hydrogeological site

[a] Gray, 2005 [b] Brocx and Semeniuk, 2007; Predrag and Mirela, 2010

There are many geological sites, which are classified by their scopes such as mineralogical site, petrological site, structural site, stratigraphic site, geomorphological site, speleological site, and hydrogeological site (Brocx and Semeniuk 2007; Predrag and Mirela 2010). These geosites have the area between small to medium scales (10,000 square kilometers to 100 square kilometers), exclude Huai Kha Khaeng Wildlife Sanctuary is the large-scale (Brocx and Semeniuk 2007). The tourist can focus on rocks, landforms, processes in typical geosites such as a cliff, cave, waterfall, and hot spring. However, they cannot receive any explanation about the geological background of these geosites. The selected area for this research presents the characteristic of geosites to the travel industry. Uthai Thani consists of many interesting landforms and geology, which are managed as geosites and can be developed as potential geological attractions. In addition, the tourist has easy access to all of these geosites in Uthai Thani by good roads, which pass through the forest and agriculture area. There are many facilities, which are managed by local people such as restaurants and accommodations. The tourist can learn about their culture and society. Consequently, this new trend travel can generate more income to this area and increase the national economy. Furthermore, this purpose can make people and foreign tourists realize the importance of geology, nature, culture, and history that were interwoven in this region. Meanwhile, it can make people easily understand the geological processes and conserve them for the next generation in the future.

Conclusions

Uthai Thani is located in the Central part of Thailand and part of Chao Phraya floodplain and Ban Rai Complex. This area consists of many geodiversitities, which are river sediments, carbonate minerals, fossil, karst

topography, phenomenon of hot spring, igneous and metamorphic rocks. There are seven geosite including Sakae Krang River, Kao Pla Ra Mountain, Hup Pa Tat Cave, Samor Thong Hot spring, Khuan Khun Kaew Reservoir, Saiber Waterfall, and Huai Kha Khaeng Wildlife Sanctuary. Moreover, these selected geosites are classified as mineralogical site, petrological site, structural site, stratigraphic site, geomorphological site, speleological site, and hydrogeological site based on their scopes. The highlights of Uthai Thani are at the Karst Topographic areas of Permian limestone, which comprise the prehistoric cliff painting in Khao Pla Ra Mountain and the ancient forest inside the Hup Pa Tat Cave. The interesting geosites in this region can be managed as the potential geological attractions, which are the benefits for the national interest in geologic, historical, cultural, social, and economic developments.

References

[1] Brilha, J. 2016. Inventory and quantitative assessment of geosites and geodiversity sites: a review. *Geoheritage, 8*(2): 119-134. doi: 10.1007/s12371-014-0139-3

[2] Brocx, M., and Semeniuk, V. 2007. Geoheritage and geoconservation—history, definition, scope, and scale. *E-Journal of the Royal Society of Western Australia Abbreviation, 90*(2): 53–80. Available at: https://www.rswa.org.au/publications/Journal/90(2)/volume90part253-87l.pdf

[3] Chindamanee, P. 2011. *Structural geology of the Uthai Thani limestone ridge within the Chainat duplex, Thailand*. (Bachelor thesis, Chulalongkorn University, Bangkok, Thailand). Available at: http://cuir.car.chula.ac.th/handle/123456789/53344

[4] Demarest, M. 1997. Understanding knowledge management. *Long range planning, 30*(3): 374-384. DOI: 10.1016/S0024-6301(97)90250-8

[5] Department of Mineral Resources, Ministry of Natural Resources and Environment, Thailand. (2007). *Geologic Map of Uthai Province 1:100000 scale.* Available at: http://www.dmr.go.th/download/pdf/Central_East/Utail.pdf

[6] Fine Arts Department, Ministry of Culture, Thailand. (1990). *The Arts of Tham Khao Pla Ra Mountain, Uthai Thani* Available at: http://www.finearts.go.th/chiangmailibrary/index.php/2016-08-20-05-05-37/book/323-2017-02-02-07-14-14/5-2017-01-31-04-42-15

[7] Gray, M. 2005. *Geodiversity and geoconservation: what, why, and how?* Michigan: The George Wright Forum.

[8] Gray, M. 2011. Other nature: Geodiversity and geosystem services. *Environmental Conservation, 38*(03): 271 - 274. DOI: 10.1017/S0376892911000117

[9] Gray, M. 2013. *Geodiversity. Valuing and Conserving Abiotic Nature.* Chichester, England: Wiley-Blackwell.

[10] GSA (Geological Society of America). 2012. *Geoheritage.* Washington, DC: GSA Position Statement.

[11] Henriques, M. H., Pena dos Reis, R., Brilha, J., and Mota, T. 2011. Geoconservation as an emerging geoscience. *Geoheritage, 3*(2): 117-128. DOI: 10.1007/s12371-011-0039-8

[12] Liebowitz, J. 1999. *Knowledgemanagement handbook.* Boca Raton, Florida: CRC Press.

[13] Mikhailenko, A. V., Nazarenko, O. V., Ruban, D. A., and Zayats, P. P. 2017. Aesthetics-based classification of geological structures in outcrops for geotourism purposes: a tentative proposal. *Geologos, 23*(1): 45–52. DOI: 10.1515/logos-2017-0004

[14] Neches, I. M. 2016. Geodiversity beyond material evidence: a Geosite Type based interpretation of geological heritage. *Proceedings of the Geologists' Association, 127*(1): 78-89. DOI:10.1016/j.pgeola.2015.12.009

[15] Newsome, D., and Dowling, R. K. 2010. *Geotourism: The tourism of geology and landscape*. Oxford, England: Goodfellow Pub.

[16] Newsome, D., Dowling, R., and Leung, Y. F. 2012. The nature and management of geotourism: A case study of two established iconic geotourism destinations. *Tourism Management Perspectives, 2*(3): 19-27. DOI:10.1016/j.tmp.2011.12.009

[17] Predrag, D., and Mirela, D. 2010. Inventory of geoheritage sites – the base of geotourism development in Montenegro. *Geographica Pannonica, 14*(4): 126-132. DOI:10.5937/GeoPan1004126D

[18] Prosser, C. D. 2013. Our rich and varied geoconservation portfolio: the foundation for the future. *Proceedings of the Geologists Association, 124*(4): 568–580. DOI: 10.1016/j.pgeola.2012.06.001

[19] Ruban, D. A. 2015. Geotourism — A geographical review of the literature. *Tourism Management Perspectives, 15:* 1-15. DOi:10.1016/j.tmp.2015.03.005

[20] Ruban, D. A., Zorina, S. O., and Conrad, C. P. 2010. No global-scale transgressive-regressive cycles in the Thanetian (Paleocene): evidence from interregional correlation Palaeogeography. *Palaeogeography Palaeoclimatology Palaeoecology, 295*(1): 226-235. DOI:10.1016/j.palaeo.2010.05.040

[21] USGS (United States Geological Survey). 1991. *Geology of Cave. U.S. Geological Survey*. Available at: https://pubs.usgs.gov/gip/7000072/report.pdf

[22] Wimbledon, W. A. P., and Smith-Meyer, S. 2012. *Geoheritage in Europe and its Conservation*. Uppsala, Sweden: ProGEO.

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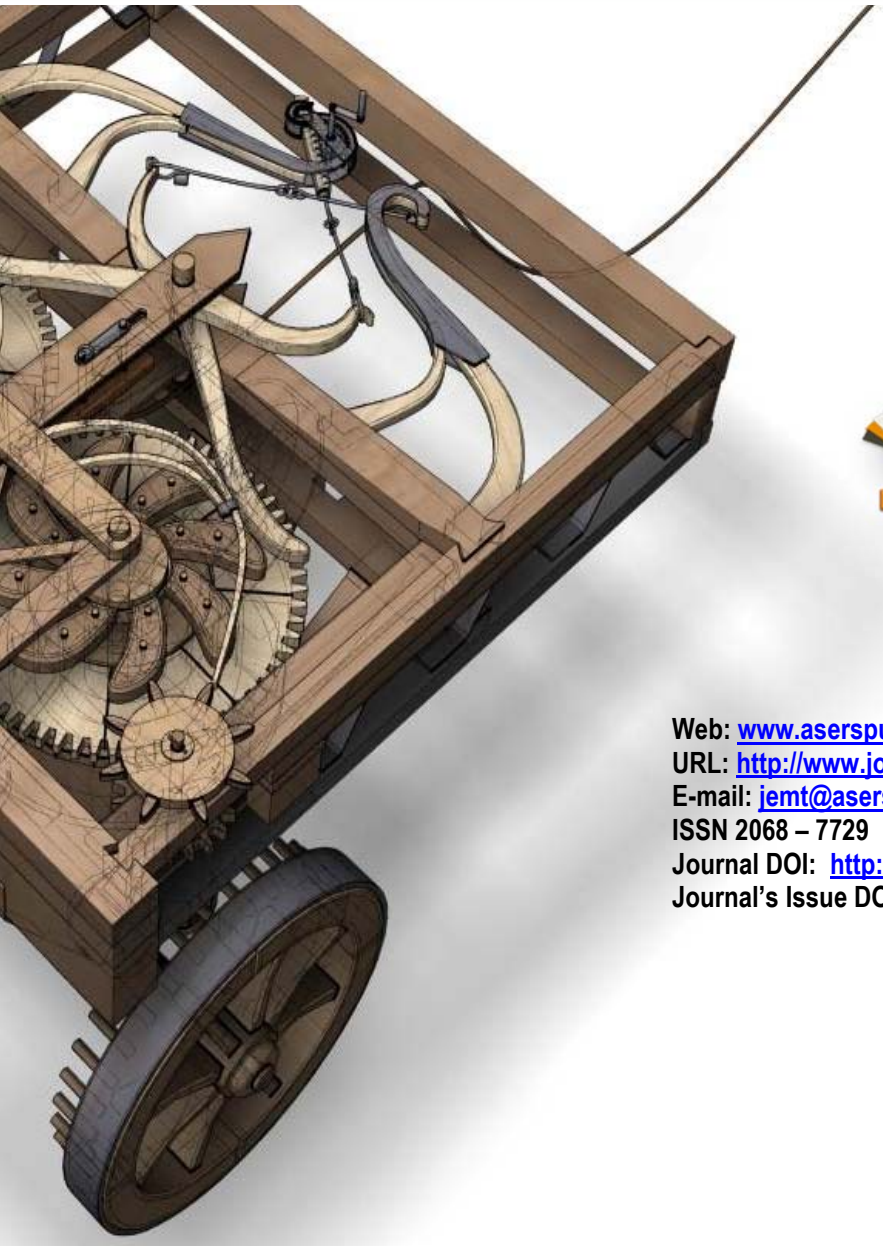

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