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Environmental Aspects of Participatory Budgeting in Selected Cities in Europe

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Abstract: This paper explores the integration of environmental priorities into participatory budgeting (PB) processes in selected European cities, with a focus on Poland, Spain, and Portugal. Participatory budgeting enables citizens to directly influence how municipal funds are allocated, providing a democratic platform for the development of sustainable urban projects. Through a review of literature and case studies, the paper examines how PB contributes to environmental initiatives such as green infrastructure, waste management, energy efficiency, sustainable transport, and climate resilience. Case studies from Warsaw and Gdańsk in Poland, Barcelona and Valencia in Spain, and Lisbon and Porto in Portugal illustrate the diverse ways cities have used PB to fund projects like community gardens, green roofs, riverbank restoration, and bike infrastructure. These initiatives not only address local ecological challenges but also promote civic engagement, environmental justice, and long-term sustainability. The findings highlight the transformative potential of participatory budgeting as a tool for inclusive urban governance and environmental planning in selected European cities.

The main objective is to examine how PB can serve as a democratic tool for environmental governance, promoting sustainability, resilience, and citizen engagement.

The study adopts a qualitative case study approach supported by literature review and document analysis. It evaluates municipal participatory budgeting initiatives with a specific focus on green infrastructure, waste management, energy efficiency, sustainable mobility, and climate adaptation. Academic sources, city budget reports, and environmental planning documents were analyzed to identify the environmental impact and governance models of PB in each city.

Participatory budgeting in European cities increasingly funds environmental projects, such as green roofs, urban gardens, tree planting, sustainable transport, and flood prevention. The active involvement of citizens in decision-making ensures that environmental solutions are locally relevant, socially inclusive, and ecologically impactful. Results show that PB contributes to improved urban resilience, environmental justice, and long-term sustainability by aligning ecological goals with democratic processes.

This study is among the first to comparatively examine environmental projects under PB frameworks in Eastern and Southern Europe. It offers new insights into how participatory governance mechanisms can shape urban environmental policy and increase community ownership of green transitions.

Policymakers and city planners can use participatory budgeting as a strategic instrument for environmental planning, ensuring that public investments are both citizen-driven and environmentally sound. The paper provides examples and recommendations for replicating successful PB-based environmental initiatives across diverse urban contexts.

Keywords: environmental sustainability; participatory budgeting; urban governance; green infrastructure; climate resilience; citizen engagement; Poland; Spain; Portugal.

JEL Classification: H72; Q56; R58; D72; Q01.

Introduction

Participatory budgeting (PB) allows residents of the cities to directly influence how municipal budgets are allocated, including how funds are spent on environmental projects and sustainability efforts, as highlighted by Bernaciak, Arnold, Rzeńca, and Sobol (2017). By integrating environmental aspects into the PB process, cities not only empower their citizens but also advance their environmental and climate resilience goals. This participatory model supports transparency, civic engagement, and more inclusive decision-making, all while addressing pressing ecological challenges.

Environmental initiatives within PB often focus on green infrastructure, which uses natural systems to manage urban challenges such as stormwater runoff, urban flooding, air pollution, and rising urban temperatures. Green infrastructure can be a central theme of participatory budgeting efforts, as it contributes significantly to both environmental health and social well-being.

1. Literature Review

One example of this is the funding of green roofs and living walls on public buildings, schools, and community centers. These installations help reduce the urban heat island effect, retain stormwater, enhance insulation in buildings, and improve air quality. Liberalesso, Cruz, Silva, and Manso (2020) discuss how green roofs have been incentivized worldwide and can be successfully incorporated into PB projects that aim to make public buildings more sustainable.

Another form of green infrastructure that aligns with PB priorities is the creation of rain gardens and bioswales. These are landscaped elements that capture and filter stormwater, reducing runoff and preventing pollution from entering water systems. Sharma and Malaviya emphasized the role of such installations in urban stormwater management, making them ideal candidates for PB proposals in flood-prone or highly paved neighborhoods (Sharma, Malaviya 2021).

Urban forestry projects also find strong support in participatory budgeting processes. Citizens often propose tree planting in streets, parks, and around public institutions such as schools and hospitals. This contributes to biodiversity, improves air quality, provides shade, and fosters a stronger connection between urban residents and the natural environment. In research conducted by Miller, Hauer, and Werner (2015), the benefits of urban trees are well-documented, and involving communities in selecting planting locations through PB ensures that projects align with local needs (Miler *et al.* 2015).

As Shane Epting (2020) notes, participatory budgeting can also play a crucial role in environmental justice by directing resources to underserved areas that are often more vulnerable to environmental degradation. Through PB, residents in these communities can propose and vote for green projects that directly improve their quality of life, such as converting vacant lots into community gardens, establishing small green parks, or installing solar panels on public housing. In this way, environmental participatory budgeting not only contributes to sustainability and resilience but also ensures a more equitable distribution of environmental benefits across the urban population.

Waste management and recycling are critical urban challenges that participatory budgeting can help address by empowering residents to shape sustainable and community-centered solutions. Through PB, cities can direct funds toward practical, grassroots waste initiatives that promote circular economy principles and reduce environmental impact.

One effective approach is the development of community composting programs. These initiatives allow neighborhoods to process organic waste locally, transforming food scraps and garden waste into nutrient-rich compost for gardens and green spaces. According to Lunag Jr and Elauria (2024), community-based composting systems have measurable environmental and economic benefits, including reduced landfill dependency and lower greenhouse gas emissions. When supported by PB, these programs can be tailored to local needs, encouraging resident involvement and environmental stewardship.

Another area where PB can make a significant impact is in the installation of public recycling stations. Accessible recycling bins placed in high-traffic areas like parks, transit hubs, and commercial streets make it easier for residents and visitors to separate waste properly. Doris Knickmeyer (2020) notes that the visibility and accessibility of recycling infrastructure are key factors in improving recycling behaviors. PB allows citizens to decide where these bins are most needed, increasing both usage and awareness.

Participatory budgeting can also support more technologically advanced solutions such as small-scale waste-to-energy initiatives. These projects involve converting non-recyclable waste into usable energy, such as electricity or heat, thus reducing landfill use while contributing to local energy needs. Cucchiella, D'Adamo, and Rosa (2016) highlight the social and environmental benefits of urban waste-to-energy systems, particularly when

communities are involved in their planning and oversight. Funding such projects through PB ensures public acceptance and integrates them into broader sustainability strategies.

By involving residents directly in decisions about how to manage waste and recycle more effectively, participatory budgeting fosters a sense of ownership and responsibility, making cities cleaner, greener, and more resilient.

Energy efficiency is a key environmental concern in urban areas and participatory budgeting offers a democratic avenue for residents to fund and prioritize energy-saving initiatives that align with both climate goals and local needs. By investing in energy efficiency through PB, cities can reduce emissions, lower operational costs, and increase energy resilience.

One impactful approach is upgrading public buildings such as libraries, schools, and community centers with energy-efficient systems. These upgrades might include LED lighting, improved insulation, smart energy management systems, or the integration of renewable energy sources like solar panels. Cano and others discovered that they emphasize that strategic investment in energy efficiency for public infrastructure not only cuts emissions but also improves cost-efficiency and risk management in public sector planning. When residents decide on such upgrades through PB, the projects often reflect shared priorities and provide direct benefits to the community (Cano, *et al.* 2014).

Community solar power is another area where participatory budgeting can drive change. By funding the installation of solar panels on public rooftops or developing shared solar farms, communities can generate clean, renewable energy while decreasing reliance on fossil fuels. Luke and Heynen (2020) frame community solar not only as an environmental solution but also as a form of energy justice, particularly in underserved communities where energy costs can be a burden. Through PB, residents can propose and support solar projects that make clean energy accessible to all, especially those historically excluded from green infrastructure investments.

Promoting green building standards is another crucial way PB can be used to enhance urban energy performance. Funds can be directed toward encouraging or incentivizing construction and renovation that meets environmentally friendly certifications such as LEED or BREEAM. Huang *et al.* (2021) discuss how adopting green standards and using tools like Building Information Modeling (BIM) contributes significantly to energy conservation and sustainability in construction. Participatory budgeting allows communities to support programs that offer guidance, training, or financial incentives for sustainable building practices, fostering long-term environmental and economic benefits.

By involving residents in energy efficiency planning through participatory budgeting, cities not only accelerate their transition to low-carbon futures but also cultivate a sense of ownership and environmental responsibility among the public. This bottom-up approach ensures that energy solutions are inclusive, equitable, and grounded in the real needs of local communities.

Sustainable transportation is a crucial focus for urban environmental policy, as cities around the world grapple with high levels of carbon emissions and air pollution generated by car-centric infrastructure. Participatory budgeting offers residents a direct voice in shaping more sustainable and equitable transportation systems by allocating funds to projects that prioritize clean, accessible, and safe mobility options.

One of the most effective uses of PB in this area is improving public transit. Citizens can propose funding for initiatives that expand bus networks, enhance subway services, or make transit more accessible and affordable for marginalized groups. These improvements not only reduce car dependency but also support social inclusion by making mobility easier for people with lower incomes or limited access to private vehicles. Wretstrand, Svensson, Fristedt, and Falkmer (2009) highlighted the benefits that come from improving accessibility in public transport systems, particularly for older adults and individuals with mobility challenges.

Cycling infrastructure is another popular area for PB-supported investment. Residents often advocate for safer bike lanes, public bike-sharing programs, and secure bike parking to encourage cycling as a daily mode of transport. Such projects not only reduce emissions and traffic congestion but also promote healthier lifestyles and foster a sense of community. According to Deenihan and Caulfield (2015), both locals and visitors value quality cycling infrastructure, which can enhance urban appeal while supporting environmental goals.

PB also empowers communities to design streets that are more pedestrian-friendly. This might involve transforming car-dominated roads into walkable public spaces, creating pedestrian-only zones, or improving sidewalks and street crossings. These changes increase safety, encourage active transportation, and contribute to more vibrant urban life. Research conducted by Tawil and others demonstrated how pedestrian-centered urban design revitalizes streets, making them more inclusive and livable for all age groups (Tawil, *et al.* 2014).

By incorporating sustainable transportation priorities into participatory budgeting, cities can develop mobility systems that are greener, more equitable, and more responsive to the needs of their residents. This

bottom-up approach ensures that transportation policies reflect real-world concerns and promotes long-term shifts toward sustainability and environmental justice.

Climate resilience and adaptation are increasingly vital priorities for cities facing the intensifying impacts of climate change, including extreme weather events, heatwaves, and flooding. Participatory budgeting offers a platform for residents to shape how their communities prepare for and respond to these challenges by funding projects that build local resilience and protect the most vulnerable populations.

Flood prevention infrastructure is a key area where PB can make a tangible difference. Residents living in flood-prone neighborhoods can propose investments in protective measures such as flood barriers, upgraded drainage systems, permeable pavements, and flood-resistant landscaping. These localized interventions help reduce the risk of property damage and displacement during heavy rainfall or storm events. Fekete (2019) emphasizes the importance of integrating local knowledge into critical infrastructure planning, as reflected in global frameworks like the United Nations Sendai Framework, the Making Cities Resilient campaign, and climate adaptation goals under the Paris Agreement and IPCC process.

Heat resilience strategies are another essential focus for urban adaptation. Through PB, communities can prioritize projects that mitigate the urban heat island effect, such as planting heat-tolerant trees, expanding green cover in dense neighborhoods, installing cool roofs on public buildings, and creating shaded gathering spaces. These actions not only provide relief during heatwaves but also improve public health and comfort for vulnerable populations including the elderly, children, and low-income residents.

Participatory budgeting can also fund public awareness campaigns that educate residents about the local effects of climate change and how to adapt. These campaigns may include community workshops, informational materials, school programs, or digital platforms that share practical tips on energy saving, water conservation, or emergency preparedness. By raising awareness and promoting proactive behavior, PB-funded initiatives build collective capacity for climate resilience and foster a culture of environmental responsibility.

When residents are given a voice in shaping climate adaptation strategies through participatory budgeting, cities benefit from more context-specific, inclusive, and sustainable solutions. This democratic approach ensures that adaptation efforts reflect the needs and knowledge of local communities, making cities more resilient, equitable, and prepared for the future.

Ronda and Gil-Jaurena analyzed in their work 38 Big cities which, in the 2015-2019 legislature, introduced Participatory Budgeting. The results of this study show that in 2019 Participatory Budgeting had been implemented by more than 60% of the analyzed cities (Ronda, Gil Jaurena 2021).

2. Method

The study adopts a qualitative case study approach supported by literature review and document analysis. It evaluates municipal participatory budgeting initiatives with a specific focus on green infrastructure, waste management, energy efficiency, sustainable mobility, and climate adaptation. Academic sources, city budget reports, and environmental planning documents were analyzed to identify the environmental impact and governance models of participatory budgeting in selected cities in Poland, Spain and Portugal.

3. Case Study

Participatory budgeting (PB) is a process where citizens are directly involved in decision-making about how public funds are allocated. This approach has been gaining traction across Europe, including in Poland, Spain, and Portugal, particularly for environmental projects. Specific examples of environmental projects funded through participatory budgeting in three countries - Poland, Spain and Portugal – will be presented.

The participatory budget was first applied in Poland in 2011 in Sopot. It quickly became one of the most popular local initiatives aimed at engaging citizens in city management within selected projects (Siemionek-Ruskań, Siemionek- Lepczyńska. 2024).

In Warsaw participatory budgeting has played a key role in advancing environmental projects with a particular emphasis on the development and maintenance of green urban spaces. One notable initiative focused on transforming underutilized or neglected public areas into vibrant green zones filled with trees shrubs and community gardens. Residents were actively involved in the decision-making process voting on the locations and designs of the new green areas to ensure that these improvements were made in neighbourhoods that lacked access to quality public parks. This approach not only enhanced local biodiversity and urban aesthetics but also promoted social cohesion by providing spaces for community gatherings and leisure activities The project reflects the broader goal of reclaiming neglected blue and green spaces for public benefit as explored by Wilczyńska,

Myszka, Bell, Słapińska, Janatian and Schwerk in their study on spatial potential in Warsaw (Wilczyńska *et al.* 2021).

In Gdańsk participatory budgeting has supported a variety of urban gardening initiatives aimed at revitalizing public land and promoting sustainable urban living. One key component has been the establishment of community gardens on previously unused or underutilized plots. These gardens not only contribute to local food production but also enhance biodiversity and foster a sense of community among residents. They serve as spaces for education relaxation and intergenerational exchange while helping to manage stormwater and improve urban microclimates. As noted by Kasprzyk, Szpakowski, Poznańska, Boogaard, Bobkowska and Gajewska (2022) the integration of green infrastructure solutions such as rain gardens in Gdańsk demonstrates how participatory approaches can effectively combine ecological benefits with community development.

In Barcelona participatory budgeting has supported a range of environmental projects including the creation of green roofs and urban gardening spaces on rooftops. These initiatives were designed to address environmental challenges such as the urban heat island effect and air pollution while also promoting sustainability and food sovereignty. Through the participatory process residents voted to allocate funds for the installation of green roofs on public buildings and the development of rooftop gardens in areas with limited green space. These projects not only improve the city's microclimate but also enhance urban biodiversity and provide opportunities for community engagement in sustainable food practices. As highlighted by Langemeyer, Wedgwood, McPhearson, Baró, Madsen and Barton the spatial planning of green roofs in Barcelona was guided by ecosystem service-based decision-making to ensure that these green infrastructures were developed where they were most needed (Langemeyer *et al.* 2020).

In Valencia participatory budgeting played a significant role in promoting green mobility by funding projects focused on expanding cycling infrastructure and supporting sustainable transportation. The city allocated PB funds to build new bike lanes enhance connectivity between different parts of the urban area and install bike-sharing stations to encourage non-motorized commuting. These efforts aimed to reduce the reliance on cars lower greenhouse gas emissions and improve air quality while also making the city more pedestrian and cyclist friendly. As noted by Feldman (2023) this approach to financing sustainable transport through local engagement represents an innovative model for urban mobility planning that aligns with broader climate goals and community needs.

In Lisbon participatory budgeting has been a key tool for advancing environmental sustainability through the development of community gardens urban reforestation projects and the creation of new green public spaces. These initiatives were designed to improve urban living by increasing access to fresh locally grown food, mitigating the urban heat island effect and enhancing the city's biodiversity. Citizens played an active role in identifying priority areas and selecting projects through a democratic voting process ensuring that the green infrastructure developments reflected local needs and preferences. As highlighted by van der Jagt Szaraz Delshammar Cvejić Santos Goodness and Buijs (2017) these types of nature-based solutions rely on inclusive governance and community participation to be successful and sustainable.

In Porto participatory budgeting was used to support riverbank restoration and broader sustainability projects aimed at revitalizing the ecological integrity of the Douro River. The funded initiatives included erosion control efforts improvements in water quality and the transformation of degraded riverbank areas into accessible recreational spaces for the public. A key component of the restoration involved planting native vegetation along the river to stabilize the soil support local wildlife and strengthen natural ecosystems. This approach not only addressed environmental challenges but also fostered stronger connections between urban residents and natural landscapes as discussed by D'Orey de Sousa Aragão Costa and Duarte (2023) in their review of urban river restoration practices.

4. Research Results

Incorporating environmental aspects into participatory budgeting offers cities a powerful tool to foster inclusive, sustainable urban development while empowering residents to actively shape their communities. This process strengthens democratic engagement and enables citizens to directly influence how public resources are used to address pressing environmental challenges.

One of the key benefits of environmental participatory budgeting is increased civic engagement. When residents are given the opportunity to propose and vote on sustainability-focused projects, they become more invested in the future of their neighbourhoods. This active involvement helps align local sustainability initiatives with community needs and values, creating a sense of ownership and responsibility among citizens. As highlighted by Bartlett and Schugurensky, participatory budgeting also serves as a form of civic education,

especially when integrated into schools and local institutions, fostering democratic values and environmental awareness from a young age.

Environmental projects funded through participatory budgeting can have significant social and ecological impacts. These projects often address climate change mitigation and adaptation while simultaneously improving the quality of urban life. Whether through the expansion of green spaces, improved waste management systems, or renewable energy initiatives, PB enables communities to implement solutions that restore local ecosystems and promote public health. According to Sintomer and others (2013), the participatory process brings visibility and legitimacy to environmental concerns that might otherwise be marginalized in traditional budget planning.

Beyond immediate impacts, environmental PB contributes to long-term sustainability by embedding ecological thinking into the financial and planning practices of cities. When public funds are directed toward reducing emissions, conserving resources, and building climate resilience, cities strengthen their ability to adapt to future environmental pressures. The process encourages a shift from reactive to proactive governance, where citizens and policymakers collaborate to create enduring solutions for both people and the planet.

As Wampler, McNulty, and Touchton suggest, the global expansion of participatory budgeting reflects its transformative potential. By weaving environmental priorities into the fabric of participatory decision-making, cities can make green investments that not only enhance urban resilience and equity but also inspire a culture of collective responsibility for sustainable development (Wampler *et al.* 2021).

The main benefits of applying environmental aspects in participatory budgets in selected cities in Poland, Portugal and Spain were presented in table 1.

Table 1. Main benefits of applying environmental aspects in participatory budgets in cities

Poland	Spain	Portugal
transforming underutilized or neglected public areas into vibrant green zones	improving air quality	advancing environmental sustainability
providing spaces for community gatherings and leisure activities	reducing the reliance on cars and choosing bikes	supporting riverbank restoration
the founding of community gardens to enhance city's biodiversity	mitigating the urban heat island effect	support local wildlife
improving urban microclimate	promoting sustainability	increasing access to fresh locally grown food
creating spaces for education and relaxation	creating green roofs	enhancing the city's biodiversity
Creating "Gdańsk Charter for Trees" and "Charter for Trees" in Warsaw		

Source: Authors own research based on: https://www.gdansk.pl/budzet-obywatelski, access date 13.04.2025, https://um.warszawa.pl/waw/bo, access date 13.04.2025; https://www.decidim.barcelona/processes/pressupostos2024, access date 13.04.2025; Falanga.2024.

6. Discussions

The selected cities for this study from Europe show how participatory budgeting can directly fund environmental projects that improve urban living conditions, promote sustainability, and help cities adapt to climate change. The success of these projects mainly depends on the active participation of residents, who help shape their city's environmental future by prioritizing and voting on initiatives that directly impact their quality of life.

Participatory budgeting can serve as a valuable tool for policymakers and urban planners to support environmentally conscious planning, making sure that public expenditures reflect community input and supports sustainability. This paper highlights case studies and offers guidance for applying successful PB-focused environmental projects in a variety of urban settings.

Conclusions and Further Research

Warsaw, like many large cities in Europe, faces urban challenges such as air pollution, limited green spaces, and the "urban heat island" effect, where the temperature in the city is significantly higher than in surrounding rural areas due to extensive concrete and asphalt surfaces. In response to these issues, the city's participatory budgeting system has provided residents with the opportunity to propose and vote on projects that can address such challenges.

Gdańsk introduced in February 2025 "Gdańsk Charter for Trees". The order highlights that the process of investment planning, the maximum preservation of existing tree canopies, including trees from self-sowing,

should be sought in each case. In justified cases, such as valuable tree canopies, avenues, trees of monumental dimensions, aged and veteran trees, it is necessary to provide investor supervision in the field of greenery protection for the commissioned works. This plays a vital role in city planning as Gdańsk is a rapidly growing agglomeration with numerous numbers of new investments from year to year. What is worth mentioning, is also the fact charging financial penalties in contracts involving construction work, for deterioration of tree habitat, damage or destruction of greenery and soil in areas to be developed in the form of greenery.

Across Poland, Spain, and Portugal, participatory budgeting has allowed citizens to directly influence environmental projects, with many initiatives focusing on urban green spaces, sustainability, and the promotion of green infrastructure. These projects not only improve the local environment but also engage communities in the decision-making process, ensuring that the projects meet the needs and desires of the residents.

Credit Authorship Contribution Statement

Małgorzata Siemionek-Ruskań: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition;

Anna Siemionek-Lepczyńska: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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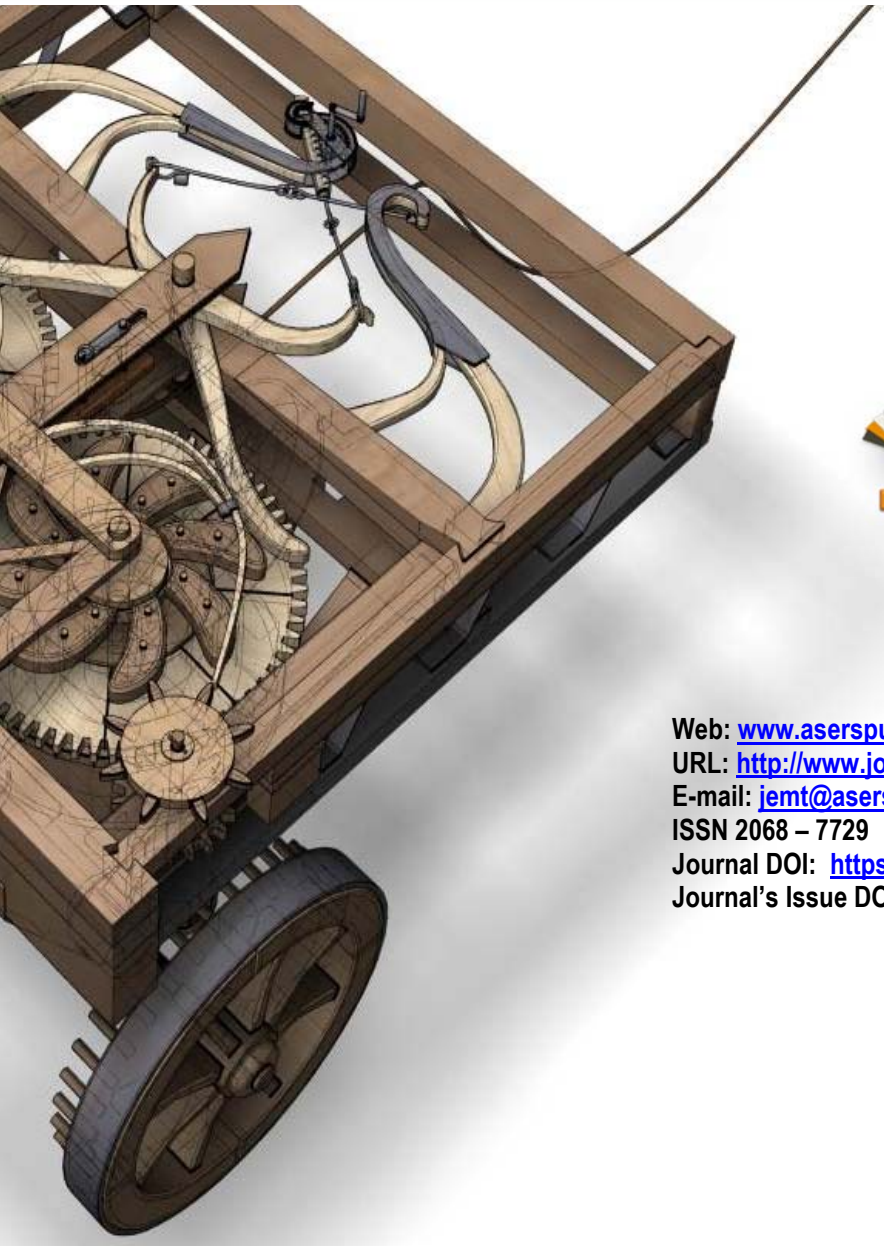

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