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Halkos, George and Aslanidis, Panagiotis-Stavros

Department of Economics, University of Thessaly

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The Role and Importance of EU Institutions
in Advancing the Circular Economy

Authors **Professor Dr. George Halkos
Panagiotis – Stavros Aslanidis**

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George Halkos & Panagiotis – Stavros Aslanidis

Laboratory of Operations Research, Department of Economics, University of Thessaly,
38333 Volos, Greece

Abstract:

The European Union (EU) needs to embrace more circular economy (CE) principles in order to achieve a complete transition from the Fordic (linear economy) archetype to a sustainable paradigm. The central challenge is to deploy sustainable waste management (SWM) as the policy lever for the achievement of sustainable development goals (SDGs), especially SDG11 and SDG12. This report aims to: (i) map the EU's institutional architecture alongside global waste conventions (Basel, Rotterdam, Stockholm, OECD); (ii) promote a coherent common waste framework (e.g., Waste Framework Directive); and (iii) address hazardous and special streams (e.g., ELVs, etc.). The report concludes that there are rising material footprints, hazardous-waste burdens, health externalities, and financing and cultural barriers; therefore, there is a need to further extend the waste hierarchy. The report presents relevant policy implications and guidance for CE implementation toward the Agendas 2030 and 2050, the European Green Deal and other related frameworks such as the Circular Economy Action Plan.

Key Words: Circular economy; Sustainable waste management; Waste-to-energy; European Green Deal; Critical raw materials; Waste hierarchy.

Disclaimer: The present report summarizes the key results and implications for the following publications:

1. Halkos, G.E. and Aslanidis, P.S.C. (2024) "How Waste Crisis altered the Common Understanding: from Fordism to Circular Economy and Sustainable Development." *Circular Economy and Sustainability*, 4, 1513–1537.
<https://doi.org/10.1007/s43615-023-00337-3>
2. Halkos, G.E. and Aslanidis, P.S.C. (2024) "Reviewing the integrated institutional waste-related framework for circular economy in the European Union." *Waste Management Bulletin*, 2 (3), 28-35.
<https://www.sciencedirect.com/science/article/pii/S2949750724000518?via%3Dihub>



1. Introduction

Environmental pollution has long been an open debate in the academic community (Halkos, 1993, 1994). The present report argues that *waste crisis* demands a shift from Fordist linear production to a circular economy grounded in strong sustainability. In order to achieve this transition from Fordism to Circular Economy it is important to build national action plans on sustainable waste management (SWM) policies in order to also achieve the prerequisites of sustainable development goals (SDGs) 11 on sustainable cities and 12 on sustainable production and consumption (Halkos & Aslanidis, 2023, 2024c).

Initially, the linear (Fordist) production, amplified by urbanization, industrialization, and globalization, is breaching earth's carrying capacity and the ecological limits. For this reason, only a CE aligned with strong sustainability (non-substitutable natural capital) can make SWM genuinely sustainable (Al-Mulali et al., 2015; Ehrlich, 1968; Koop & van Leeuwen, 2017; Lambie-Mumford, 2015; Secondi et al., 2015). Moreover, the debate over weak vs. strong sustainability into a socioeconomic framework for SWM can offer substantial policy implications for EU policy framework as it is framed by the European Green Deal (EGD), the Circular Economy Action Plan (CEAP), and the 8th Environment Action Programme (EAP), highlighting the underused role of waste-to-energy (WtE) within the waste hierarchy (Halkos & Aslanidis, 2024c, 2024b, 2024a).

2. Pitfalls and obstacles in circular economy transition

The transition towards a circular economy touches all SWM stages, especially separation and collection but faces social blind spots. For example, there are enormous issues regarding rebound effects as the adoption of greener solutions might need more energy in order to operate efficiently. Moreover, CE is constrained by local governments' weak planning and/or regulatory gaps; additionally, immature tech/finance can also impede the efforts of policymakers in paving the way towards a pure circular economy.

Furthermore, CE solutions might be also linked to health-related externalities. To exemplify, poor municipal solid waste management (MSWM) can generate disease, and also contamination of the air, soil, and water (e.g., e-waste, leachate, etc.). Another key issue



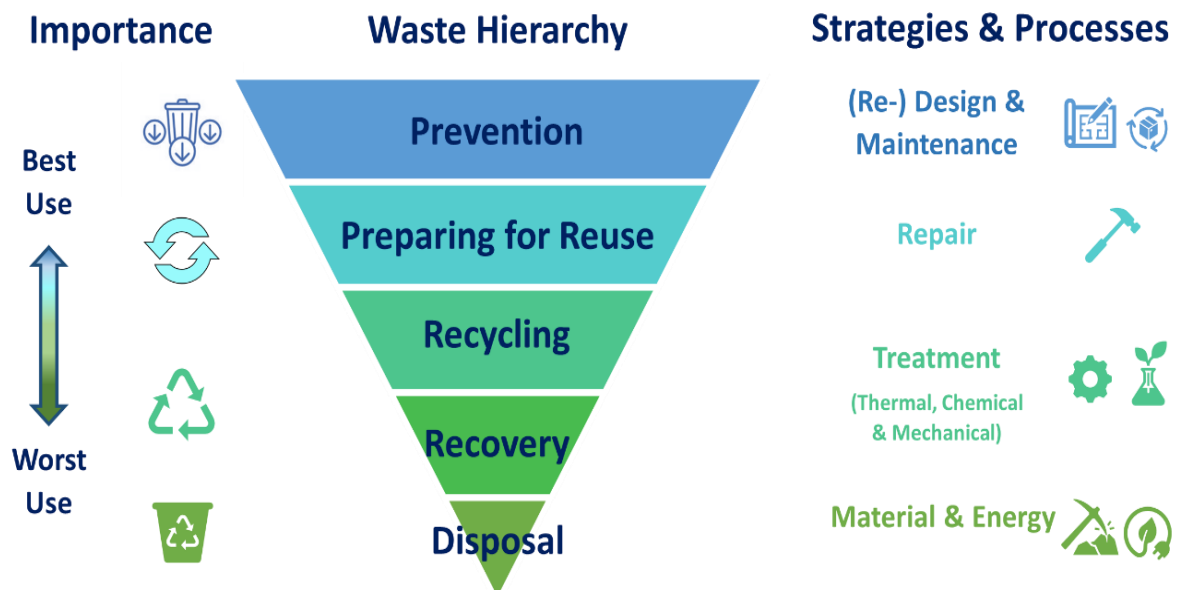
emerged during COVID-19 due to the enormous amounts of bio-medical waste (e.g., plastic gloves, etc.).

In short, CE reforms can't stop at "better recycling" slogans, but they must reshape the full SWM chain while confronting the messy realities that sit outside technical designs, such as rebound effects in energy demand, weak local governance, and poor financial incentives. If these blind spots are ignored, circularity risks will become a green label that shifts burdens rather than reducing them. Overall, a credible transition has to treat public health and environmental protection as non-negotiable outcomes, strengthening planning and regulation while building the infrastructure and capacity needed to manage both everyday waste and crisis surges like COVID-19 medical plastics.

3. The EU institutional coordination for circular economy

The institutional coordination in the EU should align SWM actions and policies with the EGD, by also covering the prerequisites of the CEAP and the 8th EAP. More specifically, the Waste Framework Directive (WFD) presents the waste hierarchy (see Fig. 1) with the ambition to create a toxic-free environment based on just transition through agricultural and industrial policy coordination. For example, an interesting CE solution is the treatment of WtE as a recovery method within hierarchy can leverage organic and agri-residues for biogas.

Fig. 1. A variation of the European waste hierarchy and strategies for sustainable waste management. Source: Halkos & Aslanidis (2024a) and modified by the authors based on EC (2006d, 2008b) and Bax & Company (2018).



In the conceptualization of CE, there are some important schools of thought that offer important explanations on current issues. For example, the performance economy promotes the idea of “service over ownership”, promoting the idea that the consumers only exploit the service of a product, however the owner is not the same as the consumer but the producer. This argument allows for CE schemes such as the extended producer responsibility (EPR). Moreover, the linear economy archetype was based on the cradle-to-grave notion; nevertheless, an interesting school of thought is the cradle-to-cradle (C2C) that is centered on the eco-effectiveness of products in order to mitigate rebound risks, which is better than focusing on eco-efficiency alone.

The institutional coordination of CE in the EU should focus on circular schemes such as the promotion of the pay-as-you-throw (PAYT) mentality that the consumers should pay more in proportion to their waste generation, the EPR as explained previously, and product stewardship based on performance economy. In most of the cases, the above circular schemes focus on two core forms of strategies, on the one hand, the R-strategies (e.g., reduce, reuse, and recycle, etc.) and also the D-strategies (e.g., de-polymerise, de-alloy, etc.) to retain the value of products at atomic-level. Overall, the R- and D-strategies can allow for both material and footprint reduction, based on this perspective, the EU’s sprawling waste-related institutional framework can also provide relevant policies for the security of critical raw materials (CRMs).

4. The International and European Frameworks for Waste Management

Another issue that policymakers should consider in the formulation of future CE action plans is regarding the more adequate integration of global waste-related conventions. The core waste-related conventions are (i) the Basel Convention, (ii) the Rotterdam Convention, and (iii) the Stockholm Convention along with different OECD decisions regarding cross-border movement of waste for recovery or similar issues. Bearing in mind these conventions and OECD decisions on waste, the EU has implemented a robust institutional framework on dealing with the waste crisis.

Initially, the *Basel Convention* was ratified in 1992 and then revised in 2019 and is an international framework to protect people and the environment from harmful transboundary movements of waste (BC, 1992; EEC, 1993). Second, the *Rotterdam Convention* signed in 1998 and then revised in 2005 refers to the restriction (and banning) in trade of certain



hazardous chemicals and pesticides, emphasizing shared responsibility among parties (UN, 2005). Third, the *Stockholm Convention*, which was signed in 2001, targets the reduction and elimination of persistent organic pollutants (POPs), including controlling intentional and unintentional releases and reducing long-term environmental levels (EU, 2019).

Furthermore, the OECD waste shipment controls, which was adopted in 1992 and also revised in 2002 and 2021, the OECD Decision C(92)39 established controls for cross-border movements of wastes destined for recovery. Moreover, it was later aligned more closely with Basel through revisions C(2001)107 in 2002 and also the OECD/LEGAL/0266 in 2021 (OECD, 2009, 2022). Additionally, the EU implemented supporting rules, culminating in Regulation (EU) 2019/1021 on POPs (replacing earlier measures) that incorporate the main proposals of the above conventions (EC, 2019; EU, 2019).

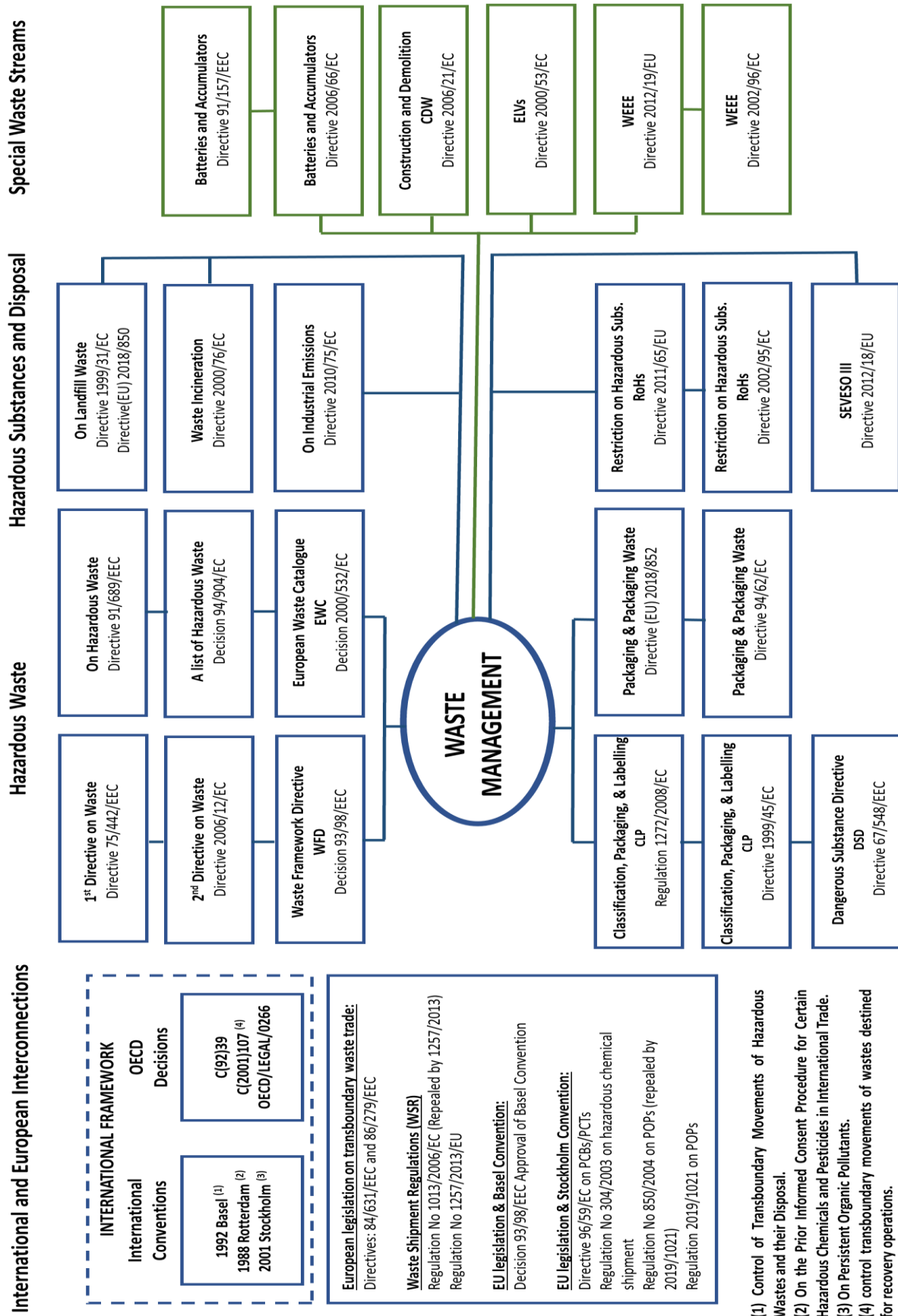
To conclude, the EU policy alignment and legislation should re-consider early EU directives (e.g., 84/631/EEC and 86/279/EEC) in order to build oversight for hazardous waste shipments. For instance, key modern instruments include the Waste Shipment Regulation (WSR) 1013/2006, Regulation 1257/2013, and a 2021 proposal to revise the WSR, linked to the EGD and the new CEAP (EC, 2006c; EEC, 1984, 1986; EU, 2013). In accordance with the previous frameworks, the packaging of waste is addressed under Directive 94/62/EEC (incl. heavy metals), amended by Directive 2018/852 (EC, 1994b; EU, 2018).

5. Dealing with hazardous and special waste streams

Over the past decades, the EU has built a well-structured institutional framework (see Fig. 2) to reduce environmental and health risks from chemicals and waste, spanning everything from hazard classification and labelling to the control of hazardous and “special” waste streams. The reason for investing in this evolution runs from early chemical-safety directives and foundational waste legislation toward a more integrated system centered on the WFD and the waste hierarchy, complemented by targeted rules for high-risk waste (e.g., end-of-life vehicles (ELVs), batteries, and extractive waste, etc.) and broader industrial risk prevention through industrial emissions and major-accident controls.



Fig. 2. International conventions and European directives regarding the waste management framework. Source: Halkos & Aslanidis (2024b).



An initial focus on control of chemicals is based in the EU chemical risk control began with the Dangerous Substances Directive since 1967 and a 1999 labelling directive on classification/labelling/packaging (CLP), later replaced by the CLP Regulation 1272/2008 that focuses on how bio-based plastics fit remains unclear (EC, 1999, 2008a; EEC, 1967). Another EU waste law started with Directive 75/442/EEC adopted in 1975 on polluter-pays-principle and similar basic waste definitions, which was refined by Directive 2006/12/EC, and then consolidated in the WFD 2008/98/EC, which set core SWM definitions (incl. “end-of-waste”) and the five-step waste hierarchy (EC, 2006d, 2008b; EEC, 1975; Halkos et al., 2024b, 2024a, 2025; Halkos & Aslanidis, 2024d; McDonough & Braungart, 2002). Specifically, the waste hierarchy has wide implementation but is burdened by conceptual limits, for example, there is misuse in some Member States, weak prevention incentives and guidance, and also barriers like poor awareness, illegal dumping, weak institutions, and inadequate collection (Halkos & Aslanidis, 2024b; Pires & Martinho, 2019; Van Ewijk & Stegemann, 2016; Zorpas, 2020).

It is imperative for the EU to focus on hazardous waste rules, which are under development and strengthened through Directive 91/689/EEC and the hazardous-waste lists (94/904/EC, 2000/532/EC/EWC with “absolute” vs “mirror” entries), now largely consolidated under the WFD (EC, 1994a, 2000a, 2008b; EEC, 1975, 1991; Slack et al., 2009). Moreover, the EU also regulates key special waste streams: (i) the electrical and electronic equipment waste WEEE (WEEE directives and recasts), (ii) the end-of-life vehicles (ELVs) (EPR, reuse/recycling obligations), (iii) batteries (e.g., mercury limits and collection schemes), and extractive mining waste (e.g., planning, prevention, safe disposal, restoration, and public engagement) (Bourguignon, 2015; EC, 2000b, 2003, 2006b, 2006a; EU, 2011; European Parliament, 2012). Lastly, the resilience against unexpected events covers cross-cutting industrial and environmental safety, which is covered by the Industrial Emissions Directive 2010/75/EU and SEVESO III 2012/18/EU, rooted in the 1976 Seveso accident and aligned with chemical classification frameworks like CLP (EU, 2010, 2012, 2020).

Taken together, these directives and institutional tools are mapping the EU’s circular economy “operating system” that tries to deal with hazardous substances through proper classification and labelling, monitors the circulation of materials especially in special waste streams such as ELVs and WEEE under the notions of EPR and the waste hierarchy. The circularity logic is clear and based on designing out toxicity, prevent waste generation, and treat high-impact streams like WEEE, ELVs, batteries, and extractive wastes as priority loops



rather than disposal problems. Nevertheless, the real test is the final disposal in the environment. Additionally, the EU institutional framework through the industrial emissions and major-accident controls (e.g., SEVESO) takes into account the resilience against unexpected events that would threaten human and natural environments. To summarize, EU tries to close the gap now by turning the waste hierarchy from a ranking into a roadmap that offers strong prevention incentives, properly designs a reliable separate collection scheme across the EU, enforces eco-standards, and promotes public participation that makes “reuse and recovery” a new consumer’s mentality.

6. Conclusions and Policy Implications

The present report indicates that the EU has progressively assembled a relatively well-structured legal and institutional architecture for SWM under the scope of CE implementation. Several aspects of the EU’s institutional framework have been highlighted such as waste-related aspects in international conventions, EU directives, and stream-specific sector regulations. However, the transition from an extensive regulatory “inventory” to a truly integrated and outcome-oriented framework remains robust but, in some cases, incomplete. In particular, the evidence suggests that policy effectiveness is currently constrained by fragmentation and overlapping across policy instruments, uneven implementation across Member States, and limited measurability linking legal provisions to system’s performance indicators. At the same time, SWM has become strategically interdependent with energy security, meaning that the CE agenda is no longer solely an environmental objective but also a resilience and competitiveness imperative for the Agenda 2030 and Agenda 2050.

From a policy perspective, the EU’s guiding principles can be interpreted as operating across complementary governance levels: (i) the polluter pays principle functions primarily at state and sector levels, (ii) the PAYT scheme is most effective at the household level, and (iii) the EPR and product stewardship schemes operate along producer and value-chain levels. Yet the translation of these principles into consistent practice requires stronger operational alignment. For this reason, the present report supports an attempt to interpret international waste-related frameworks and systematic prioritization of the upper tiers of the waste hierarchy as necessary conditions for credible CE transition. WtE should be positioned as recovery within best-available techniques rather than as a substitute for prevention, reuse, and high-quality recycling. Equally, the social dimension of implementation remains decisive, as public



participation and trust-building are indispensable for overcoming non-in-my-backyard (NIMBY) dynamics and for sustaining behavioral shifts compatible with CE goals.

The policy implications, therefore, are threefold. First, the Member States of the EU need to strengthen coherence and reduce complexity by harmonizing responsibilities across the waste hierarchy, particularly in prevention and reuse where mandates are often diffuse; this implies the simplification and alignment of overlapping directives and administrative requirements, while clarifying accountability for upstream interventions that reduce waste generation in the first place. Second, achieving measurable progress by 2030 and 2050 requires scaling enabling conditions for implementation and investment, especially for municipalities and SMEs; this policy implication implies the expansion of targeted CE finance and regulatory support for local enterprises, the enforcement against illegal dumping and weak compliance, and also the upgrade of monitoring systems so that performance can be evaluated against volume-based and CO₂e-based targets across Member States. Third, SWM must be strategically coupled with energy policy in a manner consistent with environmental integrity; this policy option implies the integration of energy-security priorities into SWM planning through secondary-material market development and carefully governed WtE deployment under best-available techniques, while ensuring that emerging materials (including bio-based plastics) and evolving risks (such as POPs and health externalities) are explicitly addressed within the regulatory scope.

Finally, the present report identifies a clear research and evaluation agenda. Moreover, the empirical comparison of “weak” versus “strong” sustainability pathways is still limited by data scarcity and inconsistent reporting, and the causal links between specific regulatory instruments and SWM outcomes remain under-quantified. For these reasons, future work should therefore focus on building comparable datasets and evaluating regulatory effectiveness against harmonized indicators, including recycling quality, landfill diversion, greenhouse gas mitigation, and public-health externalities, while stress-testing policy robustness under technological change and the diffusion of novel materials.



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eee.econ.uth.gr | +30 24210 74664 | eee_lab@uth.gr