

**Draft report for the Plastindia International University Webinar on
"Cost and Sustainability Comparison of Injection Moulding with 3D Printing"
April 14th, 2022**

As a part of joint program between Plastindia International University, PIU, and UMass Lowell, a webinar series has been organised. The second webinar on "Cost and Sustainability Comparison of Injection Moulding with 3D Printing" was delivered by Prof David Kazmer on April 14th, 2022.



Ms Shreyal Dhume on behalf of Plastindia International University, welcomed all the attendees. She briefly reviewed the webinar presented by Prof Wan Ting Grace Chen on the launch function, March 10th. For the launch function, over 425 registrations were received.

Jacqueline White, Manager of Corporate Training & Education introduced the speaker Prof David Kazmer, Past Chair of Plastics Engineering. He presented the webinar on Cost and Sustainability Comparison of Injection Moulding with 3D Printing.



Prof Kazmer lucidly explained the Injection Moulding & 3D Printing Process. He explained the cost of machines, power, mould, etc for production of plastic products from injection moulding process and compared this with 3D printing process. For injection moulding process, he considered Milacron machine Roboshot a-S130iB (all electric), with hot-runner system and cold-runner system. For 3D printing, he considered Creality CR10S-Prp (stock, Bowden) machine and for Injection Printing, he compared Creality Ender 5 (Volcano + Micro Swiss Direct) system. He dwelled upon environmental, social and

governance factors. As per the 2020 calculations, US Gross Domestic Product & CO₂ Emissions, \$1 = 0.249 KG CO₂.

He considered Tensile bars as a case study. Composition of the polymer system was 95% Neat PLA + 5% masterbatch of green pigments. He also showed the calculations for amount of heat to be supplied and removed. He brought out the point that heat transfer rates are very critical for the successful manufacturing of plastic products. He considered process energy efficiencies vs theoretical 0.0022 kWh/part and concluded that cold runner moulding has 50.7% efficiency, hot runner moulding has 76.4% efficiency, 3D printing, upgraded ender 5 has 1.3% efficiency and injection printing, upgraded ender 5 has 3.3% efficiency. The cost per piece depends upon number of pieces manufactured, since cost of machines and moulds is very high as compared to that for 3D printing. He related the cost to the carbon printing. This is very critical since 3D printing is generally used for prototype production. He then explained the process of 3D moulding which is being developed very rapidly.

Comparison of this kind depends upon number of factors such as type of machine used, cost of power, skills of operator and similar points. This type of comparison can help developments in 3D printing and also other conventional processes. The main aim is to bring down cost and carbon footprint.



What is ESG?
Environmental, Social, and Governance Factors:

ENVIRONMENTAL
Impact on the planet

- Greenhouse gas emissions
- Air and water pollution
- Biodiversity
- Deforestation
- Recycling and waste management
- Natural resource use
- Renewable energy
- Water scarcity
- Energy efficiency
- Sustainability initiatives
- Relationships with regulators

SOCIAL
Relationships with employees, customers and community

- Diversity and inclusion
- Company culture
- Data protection and privacy
- Customer satisfaction
- Relations with local communities
- Human rights
- Labor standards
- Product safety
- Employee training
- Ethical supply chain sourcing

GOVERNANCE
Corporate leadership standards

- Board composition
- Management diversity
- Shareholder rights
- Lobbying
- Executive compensation
- Accounting transparency
- Separation of CEO and Chairman roles
- History of shareholder lawsuits
- Relationships with regulators

<https://sustainfi.com/articles/esg-investing/>

Injection molding provides efficient material and process usage. However, machine and mould capital costs can be problematic. Energy efficiency of 3D printing is very poor. It can be improved by using smaller beds, lowering temperatures, increasing melting capacity, printing faster and process planning for less movement. He acknowledged PIU, NSF Grant #1914651 "GOALI : Adaptive fused filament fabrication" and Stratasys Corporation.

Post the webinar, there was an interesting Q&A session. Mr Jayesh Rambhia, Vice President, PIF, Sponsoring Body, PIU, proposed vote of thanks. He observed the losses caused by Covid-19 to the industry. He brought out the importance of carbon footprint for India and rest of the world. He thanked Prof David Kazmer for a thought provoking webinar. He mentioned that the talk was very interesting and senior members like Shri MP Taparia and Shri Arvind Mehta for their keen interest in the webinar. He expressed his thanks to Polymerupdate for nice arrangements. He also announced that the next webinar will be delivered by Prof Stephen Burke Driscoll, UMass Lowell on May 19, 2022 at 18:00 hrs on the topic 'Competitive Pros and Cons of Transparent Plastics'.



Dignitaries from Plastindia International University & University of Massachusetts, Lowell, USA

Polymerupdate served as the Media Partner for the webinar on the conferencing platform Zoom.