6 Challenges Facing Geosynthetic Manufacturing

Challenge #1: The Labour Crisis

The manufacturing sector's labour crisis is a global problem impacting geosynthetic manufacturers across all verticals.

A recent Deloitte report found 500,000 jobs remain unfilled in U.S. manufacturing alone. It's 36% harder to find talent today than in 2018. The authors of the Deloitte report estimate 2.1 million manufacturing jobs could be left unfilled by 2030. This pattern is emphasised in high-income countries in contrast to regions like China who observed a rapid labour market recovery post COVID19.

The lesson learnt from COVID is obvious, that Geosynthetic manufacturers who can attract, upskill and retain their staff will have a commercial edge to face the challenges and their competition in future.

One way to attract younger workers to manufacturing is through the introduction of modern technologies. A 2021 survey of frontline manufacturing workers in the United States, Germany, France, Spain, and the United Kingdom revealed 45% would leave their current employer if given the opportunity to work in a more modern, digital environment. That rises to 55% among respondents aged 18 to 24.

Challenge #2: The Supply Chain

The gradual lifting of Covid restrictions in 2022 has caused a rise in demand, which has compounded pandemic-related supply chain issues with ocean freight and polymer resins.

Manufacturers must plan differently and over longer time periods than pre-pandemic. Consequently, a new vision has emerged: Instead of the pre-pandemic model of one global factory making everything and shipping it around the world, companies are sourcing products from local, SME-sized manufacturing facilities.

This trend is likely to grow with the result that we'll see fewer large geosynthetic factories and more SME-size manufacturing facilities and suppliers. For global companies, this will ensure a more manageable supply chain. For SMEs, it's an opportunity – provided they have the right automation and digitalization tools to quickly scale up production.

In Australia, Geofabrics Australasia observed a clear de-risking preference for the inclusion of "local" companies into the full Geosynthetic manufacturing supply chain during COVID19. This required a demonstration of supply chain transparency but also created customer flow on demand for things like increased use of local recycled polymer that both de-risks a supply chain and meets "circular economy" needs.

The market appears to see this shift as somewhat permanent and not cyclical with ongoing geopolitical stability creating a sovereign risk migration to local supply chains.

The challenge for a Geosynthetic Manufacturer is can they de-risk the supply chain by engaging and innovating with local suppliers, and will SMEs bring sufficient innovation to threaten the purchasing power of the traditional manufacturing giants long term?

Challenge #3: Rising Energy Costs

The market in 2022 was dominated by the Russian invasion of Ukraine, which was an event that came as a complete surprise to the whole world in February. What for Russia, was expected to be a short conflict has subsequently become a long battle in which the support for Ukraine from the West has resulted in retaliation from the Russians in the form of energy sanctions causing a widespread need for alternative sources at higher cost.

There is also an increasing inflationary cost discrepancy between countries that possess manufacturing capability. European Countries (Spain, France, Germany and Italy) are observing interest rates between 6.2-9.2%, Australia 7.8% and the USA at 6.4%, when compared to inflation in China sitting at 2%.

This creates a rising energy cost point of arbitrage between these manufacturing regions. At a time of general deflation in high impact Asian markets, manufacturers outside of China will continue to absorb increased electricity and

gas prices and the challenge is to mitigate this competitive disadvantage through manufacturing innovation and de-carbonisation.

Geosynthetic manufacturers and suppliers may come under input cost pressure in the US market in 2023 with an anticipated escalation in the upstream crude oil and feedstock polyethylene, elevating production costs proportionally and will affect the final prices of HDPE-based geosynthetics.

Challenge #4: Quality Improvements

Improved quality leads to higher customer satisfaction, reduced waste, and can also lower overall cost.

In recent years, including pre-pandemic, the concept of quality shifted from being treated as a matter of operational compliance to being understood as a strategic business driver.

Industrial automation supports these efforts by ensuring consistent quality and 24/7 availability. However, continuous production of geomembranes without programmed maintainable shutdowns for cleaning barrels and screws can lead to gels and burnt resin inclusion defects. Time must be allocated for running purging compounds through the extruder to clear degraded polymer hang-ups.

If we use Geofabrics Australasia to illustrate these costs during the Covid period of 2020 through to the first quarter of 2022, The investment in maintenance at their 5 manufacturing plants to increase machine reliability has doubled. This will only result in a Return On Investment if shutdowns are mitigated, material efficiency is increased, and quality control is improved to reduce the volume of rejected material.

Challenge #5: Staying Competitive

For geosynthetic manufacturers, lowering costs and increasing productivity are the primary ways to gain a competitive advantage. Automation and digitalization are key, as they enable companies of all sizes to benefit from cost savings and improvements in productivity and throughput.

Traditional automation has a large footprint that isn't a good fit for small manufacturing facilities. Traditional automation also requires extensive safety

guarding and fencing and isn't safe to deploy in the same workspace as humans. Collaborative automation makes robotics accessible to companies of all sizes – even those completely new to automation. One example is the new automated packaging line TenCate installed from Tentoma.

Large players continue to push ahead with their ongoing commitment to research and innovation. GNA recently announced Solmax's new magnetic HDPE geomembrane to enable leak detection.

Atarfil Geomembranes have a team devoted to developing specific HDPE and LLDPE formulations that address specific contaminant risk and can be demonstrated by short term tests rather than a need for long term immersions.

Emerging additive technology means the small addition of certain additives can lead to significant improvements in the performance properties of geomembranes. For example the addition of just 2% polybutylene can improve the NCTL SCR of HDPE by more than 50%.

Embedded sensing such as fibre optic strain sensors or conductive graphene sensors to directly measure mechanical loads as well as to make geotechnical measurements in geosynthetics are another emerging opportunity for competitive offerings. Embedded sensing allows the collection of data such as the temperature, humidity, orientation, pressure, strain, displacement and degradation to assess and mitigate impacts to geosynthetics.

Geofabrics Australasia in the past 18 months, have launched heat bonded lamination capabilities, tripled the capacity in the manufacturing of 100% recycled HDPE Megaflo products, created and expanded their rapid "natural disaster emergency product range" and launched Australia's first containment solution for PFAS and emerging contaminants.

Challenge #6: Sustainability

As global manufacturing moves to more sustainable models, geosynthetic companies are incorporating new sustainable practices into their business.

In the U.S., the Environmental Protection Agency defines sustainable manufacturing as the creation of manufactured products "through economically-

sound processes that minimize negative environmental impacts while conserving energy and natural resources."

The central pillars of global sustainable manufacturing initiatives are waste reduction, adoption of renewable/sustainable feedstocks and improving end-of-life processes for geosynthetics such as recycling.

The new circular economy is giving geosynthetic players the option of virgin-identical polyethylene derived from either recycled pyrolysis oil naphtha or bio-PE from crops.

Rising energy costs are driving companies to look at their energy consumption and renewable energy inputs.

Driving circularity for plastics requires a rapid transformation of the entire value chain. Expanding the uses of post-consumer recycled (PCR) content in geosynthetics: Across the industry there is much R&D on technology for creating "clean" recycled PE streams and finding ways to incorporate them into finished geosynthetic products with performance comparable to virgin resin. The aim is to have "a full PE recycled content without compromising performance, while maintaining an attractive cost-efficiency ratio.".

While the profile of sustainable HDPE has been elevated by the combination of sustainability commitments made by brand owners and the emergence of new technologies for enhanced recyclability, the reality is that the supply chain is mainly equipped and designed around virgin resins. The primary challenge is developing recycled HDPE technology that has a suitable for 'drop-in' replacement in existing manufacturing systems.

Companies like Atarfil Geomembranes, Geofabrics Australasia, Layfield Group, Solmax and others have devoted teams who undertaking both Life Cycle Assessments and Environmental Product Declarations on the Geosynthetics they supply. This is necessary to combat the perception that Geosynthetics are oil industry sourced and do serve both Environmental benefit and a net Carbon benefit.

The challenge for 2023, is can Geosynthetic Manufacturers demonstrate the sustaintability of their Geosynthetic supply chain and demonstrate that a geosynthetic product serves both an environmental and carbon positive benefit.

Reasons to be Optimistic

The Geosynthetic Manufacturing sector and aligned industries involved in civil, commercial and residential infrastructure continue to ride a strong economic wave, due partially to the ongoing pent-up demand from the COVID era of 2020 and the first Quarter of 2022. With rising interest rates and a plateau in inflation now evident in many parts of the World, there is some positive expectation the industry is on the cusp of a change in the economic cycle which will alleviate somewhat, but not solve, the current labour crisis experienced by many manufacturers in select regions.

The emergence of innovative additives such as graphene can lead to a paradigm shift for sustainability. Graphene is a multifunctional additive for sustainability. Solmax is collaborating with a leader in graphene development NanoXplore Inc.

NanoXplore have demonstrated that a small addition of its graphene could allow significant amounts of recycled polyethylene to be used in HDPE products without loss of physical properties.

The experimental findings showed that the addition of graphene resulted in a significant morphology refinement of HDPE geomembranes that facilitated replacing up to 50% of a prime HDPE with recycled HDPE, without compromising the mechanical performance.

Amazingly, HDPE liners a 0.5 weight% graphene loading, resulted in a 15% increase in tensile strength and this was achieved without degrading material toughness.

In addition, improved quality and reduced waste from a collaborative automation deployment boosts competitiveness. And, since collaborative automation is less power hungry than traditional industrial robots, it provides a way to maintain output while reducing energy consumption.

A large developing market for geomembranes is pumped-storage hydroelectricity (PSH) or pumped hydroelectric energy storage (PHES) which is a type of hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of water, pumped from a lower

elevation to a higher elevation. Low-cost surplus off-peak electric power is typically used to run the pumps. During periods of high electrical demand, the stored water is released through turbines to produce electric power.

2023 is likely to be a challenging year for the geosynthetic manufacturing sector. Geosynthetic industry sources expect pressure on margins to continue in the first half of 2023 on weak demand and additional global production capacities of major products. However, demand for geosynthetics proved to be resilient despite challenging economic conditions in 2022 and is set to continue for 2023.

In summary:

The six challenges faced by the geosynthetic manufacturing sector are: a labour crisis, supply chain issues, rising energy costs, quality improvements, staying competitive, and sustainability.

The global manufacturing sector's labour crisis is affecting geosynthetic manufacturers worldwide but is creating higher challenges in areas with high inflation. The rising energy costs in these regions are impacting the industry.

To remain competitive, these manufacturers must lower costs, increase productivity, and incorporate sustainable practices.

The emergence of innovative additives like graphene offers a new paradigm for sustainability.

This article ends on an optimistic note, suggesting that improved quality and reduced waste from collaborative automation and the adoption of sustainable practices could boost competitiveness in the geosynthetics industry.

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