BUSINESS SWEDEN

INSIGHT SERIES 2019–2020

MATERIALS OF THE FUTURE

TRUTH 7: THE RISE OF NEW PIONEERS

Materials engineers are always on the lookout for the next big thing. But customers are increasingly playing an instrumental role in shaping the innovation paths and materials that transform everyday life. In collaboration with Swerea, Sweden's world-class research group, and trend analyst firm Kairos Future, Business Sweden presents a special report in nine parts about the race for stronger, lighter, more sustainable, absorbable – and fully connected materials.

INTRODUCTION:
TRENDS AND TRUTHS IN THE MATERIALS RACE

TRUTH 1:
DRIVEN BY CUSTOMERS FROM HEAVEN AND HELL
Demanding customers who want more and pay less are a strong incentive for rapidly developing, new and better materials. This will lead to a future with higher degrees of collaboration with customers in order to understand their needs, ideally before they are aware of them themselves.

TRUTH 2:
ENVIRONMENTALLY FRIENDLY – SUBJECT TO RESERVATIONS?
The materials of the future are obviously designed in environmentally friendly ways with lightweight, energy saving and low-carbon emissions at top of mind, but how simple will it be to recycle them? Complex, tailor-made materials place high demands on future recycling facilities.

TRUTH 3:
IN THE SHADE OF THE FOREST
The forest is a natural source of raw materials for much of what is made using oil today. Nations rich on forests have great potential for developing new, advanced materials industries based on raw materials.

TRUTH 4:
TOWARD A HYPER-DESIGNED FUTURE
There is no reason to believe that the trend towards more intensively designed and customised products will slow down, quite the opposite. In future, materials may even be designed all the way down to atomic level in order to meet increasingly high demands.

TRUTH 5:
THE AGE OF CONNECTIVITY
Sensors can already be found on many products today, but in the future they will be embedded in materials to a far greater extent as woven fibres, smart coatings, conductive nanotubes or in other forms. The materials will be able to report fractures, overheating and other issues via the Internet of Things.

TRUTH 6:
BORN AT THE CROSSROADS
It is increasingly difficult for a single party to develop sophisticated and advanced materials. The materials of the future are therefore rarely born from a single company but in the interaction between several different parties, each with their own expertise, requirements and areas of strength.

TRUTH 7:
THE RISE OF NEW PIONEERS
New players from the IT and space industry, among others, are beginning to drive material developments to a larger extent. They can often afford to manage major collaborations or, if necessary, develop what they need themselves. Pioneers from other areas are entering the materials industry, both as partners and as competitors.

MATERIALS OUTLOOK 2020:
WHERE ARE WE HEADING?

IN THIS INSIGHT

Join us as we explore the seven truths about the materials race in depth. Go to www.business-sweden.com/insights/reports/trends-and-truths-in-the-materials-race/

MATERIALS OF THE FUTURE, TRUTH 7

THE RISE OF NEW PIONEERS

Who needs materials? The answer is, of course, ”any company that manufactures something”, whether it is curtains, mopeds or stickers. But we already know how to manufacture curtains, mopeds and stickers. There are long-standing industries that have an attuned eye for which materials are best suited to different applications and how to use them. The consequence is that innovation slows down. Nothing is as detrimental to progress as the ingenuity of already knowing what to do, as there is no incentive for inventing anything new.

MAKE WAY FOR THE NERDS

Enter the IT companies. They know nothing about which materials are good, they have no tradition, no accepted successful methods. They enter material manufacturing as complete novices – but they know how to motivate people to be creative. They know how to encourage creative power, how to organise people, how to brainstorm, how to cooperate and how to compete. They are accustomed to an industry that is fierce and based on always finding the latest, best, coolest, hottest, trendiest.

They experiment, they try something new. Consequently, many future materials will likely be shaped – or at least get a chance to show what they can do – by the new pioneers, not established materials manufacturers. These pioneers have no fixed approaches, which means they have every ability to be flexible. They do not have much by way of restricted expenses in the form of factories and supply chains but they have a lot of money and plenty of opportunities to break new ground. They are also good at hiring both experienced professionals and graduates. If they need to develop a material in-house, that can be arranged: if they need to find a provider that is fast and adaptable, this is also entirely possible in most cases.

Who will be the biggest pioneers when it comes to developing future materials? We included this question in our survey and the answers from experts were surprising. One third believe that completely new players such as IT companies and others will play a decisive in shaping the materials of the future. Among those involved in materials development, the percentage is even higher – four out of ten

3RD

Sweden’s ranking in the World Economic Forum’s list of the world’s most IT-literate countries. Only Finland and Singapore are more digitised.

“The crosspollination of engineering, fashion and gamification which, I believe is fully possible, means that orders could be placed directly with production units in the future. The only thing time-consuming aspect is opening these doors.

Anna Kollberg, CEO, Catori

believe that new players will drive the development of the materials, which was by far the most common answer. Out of all of the survey groups, only one believed that the established materials developers will drive innovation single-handedly. Perhaps they are more sceptical of the pioneers, or perhaps it is wishful thinking among people who do not dare or do not want to see the approaching threat.

When asked which stakeholders would be most influential, the replies varied. The most common answers pointed to universities such as Chalmers and KTH Royal Institute of Technology as well as research institutions such as Swerea.

When studying materials in more detail, there are two distinct patterns that are hard to recognise at first glance: the pioneers of the future will either be small, new companies with start-up like cultures or large, powerful companies with well-developed R&D departments. Companies that are good at research but have not previously worked on materials will combine both of these characteristics, as they need to create and think in new ways, while already being established researchers in a broader sense.

THE APP DEVELOPER – FRIEND OR FOE?

Given the pace of change when it comes to customer requirements, it is no wonder that new players have the advantage over established material developers. Materials need to be greener, smarter and more specialised than ever before and this requires new forms of collaboration.

Google's Project Loon provides internet access in rural areas by using balloons. The material for the balloons has been developed by the IT giant in collaboration with Raven Aerostar and is inspired by the bags found in cereal boxes. The balloons have a service life of up to six months, much longer than ordinary weather balloons.

Game distribution company Valve went into production after designing their own gaming hand controllers – and a few years later decided to release the CAD files and allow anyone to 3D print them.

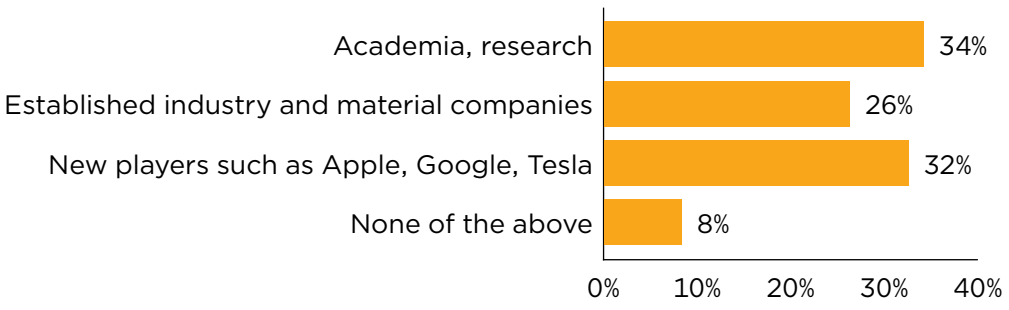
Tesla's plans to expand mean that they will require lithium-ion batteries on a scale corresponding to the entire current global production. In 2019, founder Elon Musk confirmed that Tesla may branch out and invest in mining assets as a way of controlling the supply chain for raw materials, with details yet to emerge.

SolTech Sigma has developed roof panels made from glass that also function as solar panels. Their business model is based on renting out the panels and charging for the electricity – the products are not for sale. A good example of new ways of thinking in traditional industries.

32%

of respondents to our survey stated that new players such as Apple, Google and Tesla will be the most important pioneers when it comes to developing materials of the future.

WHICH PLAYERS DO YOU THINK WILL BE THE BIGGEST PIONEERS WHEN IT COMES TO DEVELOPING THE MATERIALS OF THE FUTURE?



However, in no way does this imply the imminent death of traditional companies which still have capital and assets in the form of factories, laboratories and human expertise. They also turn over a lot more money. In comparison, small, IT-focused start-ups are growing extremely rapidly in the Nordic countries, but they have a lot of ground to cover before they can catch up with established industry – even if their rate of investment is up to ten times as high. Perhaps tomorrow's high-quality, cheap and diverse materials will be found in the interaction between old and new – as engineers and programmers, environmental scientists and industrialists, welders and scientists come together.

New players may pose a competitive threat but they also create opportunity for new, dynamic partnerships that give an injection of creative energy to materials development. The new pioneers have the ability to spot talent in time and will probably determine at an early stage whether they become a useful and reliable friend or a foe.

MINECRAFT MEETS MINING CRAFTS

Sweden's start-up culture is well known domestically and in certain niches also recognised worldwide. Swedes have been extremely good at innovation, especially within IT and communication and the country has a strong industrial base with long-standing traditions. Perhaps it is in the meeting between these two cultures that new materials will arise, with the aerospace, automotive and fashion industries as customers and contributing stakeholders.

All industries depend on innovation, and on the materials side the potential benefits are vast. What advantages can be achieved by combining IT expertise, creativity and robust know-how of traditional materials manufacturing? International companies and experts may well be interested in Sweden's advanced materials expertise – these are opportunities that should not be overlooked.

32 GWh

is the estimated amount of stored energy for lithium-ion batteries that Northvolt's factory will produce in a year when completed in 2021.

"Expectations on required expertise and know-how have changed. While we mainly relied on metallurgists before, today there are a lot of materials experts, physicists and chemists involved. We have broadened our expertise in a dramatic way.

Hans Söderhjelm, Vice President Marketing & Product Development, Höganäs

YEAR 2030: NEW AND OLD, SIDE BY SIDE

It is difficult to single out any single player as a 'material developer' today. That said, it is clear that materials manufacturing is focused more on specific usage scenarios. Products and industrial processes are becoming increasingly digitised, which means that materials are likely to be shaped by two kinds of players.

There are developers with traditional knowledge in steel, linen and other materials. We then have increasingly engaged customers who take an active role in materials development in order to meet precise specifications. They are talented, driven and discerning and know exactly what they need. This means that companies that fail to engage key customers in the right way will face difficult times. The same goes for innovation – standing on the sidelines is simply not an option. It is all about staying on your feet when materials are competing against each other with as much vigour as apps did 15 or 20 years ago.

STRATEGIC RECOMMENDATIONS

Be aware of the new players and the opportunities they represent, even if they fall outside the traditional customer base. Customers may require a new, specialist material in a short period of time. Find ways of learning from young IT companies and start-ups and consider adoption their way of thinking in your business. The start-up mentality, where people dare to try new things on a small scale and experiment with unusual ideas, is also fully applicable to the materials industry. Be aware that competition is toughening and that the impatience of new entrants will probably spread throughout your industry.

2022
Production of specialist materials for 3D printing becomes a multi-billion dollar industry

2024
An ordinary passenger car contains more composites than steel

2027
It becomes common for hospital beds to consist of materials that directly measure the patient's temperature

2034
The weight of an ordinary passenger car equivalent to the Volvo V70 has fallen by 50%

2043
50% of Swedish homes can recover solar energy from their windows

2051
More than half of all garments sold in Sweden are self-cleaning

2058
Industrial landfill has decreased, globally, by 20% compared to today

2076
The world produces more solar cell electricity than any other form of energy

2095
In principle, all materials will be designed and controlled at the atomic level

A PROBABLE FUTURE

The illustration shows a conceivable timeline of possible future developments, based on the best guesses from our respondents. It is of course impossible to say exactly which year these events will occur in – if they take place at all. But perhaps the timeline will provide an indication of what lies ahead.

SWEDEN – A NATION RICH IN FORESTS AND MINERAL RESOURCES

Sweden is Europe's leading mining nation and a global forest industry giant. These natural resources formed the bedrock for Sweden's industrialisation. And they remain important today. But times are changing. Digitalisation is eroding demand for newsprint and new technology is driving innovative applications for traditional metals and high-tech metals. Sweden hosts mineral deposits like graphite, lithium, rare earth metals.

The shift towards sustainable development and renewable materials is transforming the forest industry to a stronger orientation towards higher value products. Innovative companies are using Swedish wood to develop new bio-based materials such as barrier films, chemicals, carbon fibre, textile fibers and other applications with industry-changing potential.

ABOUT THE AUTHORS

Swerea (now RISE Research institutes of Sweden): In 2018 two thirds* of Swerea was acquired by RISE Research Institutes of Sweden (RISE), continuing its scientific work as a part of a total force of 2,700 researchers and experts with extensive industrial knowledge and experience of how to accelerate research results into innovation for practical use. RISE is a unique mobilisation of resources with the aim to increase the pace of innovation in our society. It is owned by the Swedish State and work in collaboration with and on behalf of the private and public sectors and academia, with the ability to take on a variety of roles in the innovation system.

** 1 third of Swerea created the new metal research institute Swerim.*

Kairos Future: Kairos Future is an international consulting and analysis firm that helps companies take leaps towards the future. Through trend and scenario analysis and support in innovation and strategy, we help customers with the big picture and the direction for the future. Kairos Future was formed in 1993, our head office is situated in Stockholm and we have partners worldwide.

Business Sweden: Business Sweden helps Swedish companies grow global sales and international companies invest and expand in Sweden. We ensure that international companies can rely on our knowledge, experience and extensive network to identify new business opportunities and achieve an accelerated return on investment. Business Sweden is present in 50 of the world's most promising markets and owned by the Swedish Government and the industry, a partnership that provides access to contacts and networks at all levels.

We help Swedish companies grow global sales and international companies invest and expand in Sweden.

BUSINESS SWEDEN Box 240, SE-101 24 Stockholm, Sweden
World Trade Center, Klarabergsviadukten 70
T +46 8 588 660 00 invest@business-sweden.se www.business-sweden.com

BUSINESS SWEDEN
THE SWEDISH TRADE & INVEST COUNCIL