What does it take to run a successful AM Business?

Roundtable and Survey Report

Additive manufacturing faces hurdles that need to be overcome to realise its potential, and while there are dozens of conferences that focus on technical elements, very few - if any - conversations focus on the business, economic, and cultural considerations required to unleash the full potential of AM.

Convened by Siemens Energy in collaboration with IQPC, organisers of the Additive Manufacturing for Aerospace & Space conference, this discussion and subsequent survey of senior executives drawn from across the AM ecosystem focused on issues beyond the technical.
I have had the opportunity to participate in various conferences and panel discussions over the years to share my views on how the industry at large can accelerate the adoption of additive manufacturing towards a trusted and fully industrialized process. Technology development typically dominates these discussions, especially with the rapid technical advancements in machine, materials and software that we have witnessed over the last decade.

We have adopted the tag line of “Together we lead the Additive Manufacturing Revolution” in our Siemens Energy AM family, and like the rest of the AM industry a major focus has been technology development. However, while the maturation of technology is fundamental in the journey towards industrial level adoption of AM, I believe we must also consciously address the lesser mentioned soft factors like organization culture if we truly want to lead this revolution.

I have previously presented this model, which attempts to capture this holistic approach that I believe is needed to effectively implement AM at an enterprise level. At Siemens Energy we have elected to set up AM as a standalone venture with end-to-end accountability for both the hard and soft factors that influence our ability to effect sustainable adoption of AM. This discussion was born out of the belief that across the entire AM eco-system, all businesses share this same challenge of how to balance the hard and soft factors that determine the holistic success of an AM implementation strategy. If we have a shared goal to accelerate the adoption of AM across industries, then it is equally important to collaborate and share best practices on how we run our businesses as much as the technology that supports this.
To kick-start the discussion, we hosted a Roundtable and the invited participants represented a cross-section of the AM industry ecosystem; Printer OEMs, users, service and software providers and included metal, polymer and hybrid industry leaders.

Under discussion were three key questions:
1. How can the economic considerations of running an AM business be balanced, and what challenges have been experienced in its adoption?
2. What are the main operational constraints that have had to be overcome and what challenges still remain?
3. How significant is the role of organisational culture?

The discussion was driven not only by the perspective of big OEMs, but also by software and the digitalisation needed for mass adoption. It covered a range of critical areas that both industry and users need to be aware of, matters that also required further exploration.

Following the discussion, a survey was sent out to the wider AM community in order to ascertain whether their individual objectives bore any resemblance to one another; in addition, it also examined whether the difficulties and ‘pain points’ of the various AM users were comparable. The chart opposite is a summary of the comments captured in the survey about the key challenges that the participants see to the wide scale adoption of AM, and how these challenges relate to the model that Markus presents above. This write-up aims to capture some of the key takeaway points and contribute to the debate.

Challenge solutions and future steps to be taken across the AM ecosystem

The survey participants were asked to provide their thoughts on what solutions there might be to existing challenges and what steps can best be taken to enable AM’s wider adoption.

Technology
- Update experts and designers
- Bridge the gap between academia and industry
- Allow the end user to evaluate performance themselves
- Demonstrate and showcase AM advantages
- Develop national collaborations

Qualification
- Implement AM in low/medium-risk applications
- Establish world-class standardization
- Discover necessities of part consistency
- Develop qualified processes and systems for industrial sectors

Culture
- Convincing contacts of the benefits of AM
- Sharing knowledge, and supporting SME’s in adopting AM technologies
- Improved inter-company coordination, with a focus on the customer
- Launch awareness programs
- Convince engineers to adopt AM with re-engineering opportunities

Business models
- Being aware of competitors’ movements and actions
- Strategic planning with partners
- Start simple before branching out
- Focus and concentrate on what the company already does
Key Topic 1: How can the community promote the wider use of Additive Manufacturing?
What challenges have you experienced in its adoption, and how can those sceptical of the technology be convinced?
How can the economic considerations of running an AM business be best balanced?

The discussion began with reflections on a presentation delivered by Markus Seibold from Siemens Energy at the 2020 Additive Manufacturing for Aerospace & Space conference on the importance of culture. The participants agreed on the need for this industry-wide collaborative discussion to identify areas for cooperation across the AM ecosystem. In order to drive the rapid adoption of AM technology - an industry acknowledged to be rapidly evolving - it makes sense to exchange best practices at the executive level.

Throughout the conversation, most of the participants referenced Markus’ model, with some talking about the technologists (left) and the bankers (right), and how to bring these key stakeholders on the AM adoption journey.

While most of the conversation was firmly fixated on the right-hand side, a few opening remarks touched on the technology and the importance of using data to mitigate risk and evangelizing about the technology to key stakeholders but using hard data to do this. The potential of AM technology to create truly differentiating products with improved performance rather than simply to replace or optimise conventionally manufactured parts was seen as important in demonstrating the strategic nature of the technology, the viability of the business model, and bring executive support.

“We think it’s important to present a wide range of capabilities and provide data and information that will lead people to make the right choices leading to better results. There’s a great opportunity to be very innovative from a business model standpoint.”

It was also noted that the model can be interpreted in other ways; one participant mentioned that in their own case, success was a result of securing the support of their banker. This endorsement was seemingly earned by the banker in question recognising how Additive Manufacturing could assist in their own operations. This idea was later connected to the importance of raising awareness of the capabilities of AM.

“It’s on us all to focus on the educational aspect and relate that back to the challenges we face”

Management challenges associated with technology and maturing markets were identified, such as the positions of younger people within a company who truly understand the technology compared to some of the more senior decision-makers who remain more unfamiliar with AM and the opportunities it offers.

“When you come into a new technology, there’s a lot to overcome. The key issue is that the performance of the parts we create is stable, reliable, and repeatable. It’s how we can prove that — we’re not going to have the trust or confidence without it.”

Elon Musk’s advice to business founders of “Have a High Pain Threshold” was quoted. In order for AM to mature to deliver its full promise, it will require intentionality, commitment and endurance. One of the key points was that stakeholders often do not have the necessary ‘pain tolerance’ for this new technology, and that expectations should be carefully managed – indeed, in the accompanying survey, ‘economic constraints’ was the majority (37.50%) answer to the question “What would you consider to be the biggest constraint in your business today towards the goal of accelerated AM adoption?”.
Its hardly a surprise to see that the results from the survey show that the economic and technological concerns are still the most prevalent barrier to the wider adoption of AM. More interestingly though, it is also the case that operational and cultural constraints are coming more to the foreground as soft factor considerations – and both people and businesses are beginning to recognise the need to address these also.

It was stated that there will be a lot of ‘pain’ that needs to be endured to succeed, which later led to the question of how this pain can be reduced to allow more companies to succeed. A concerning issue was raised in that much of AM’s current levels of success and failure is being dictated by the pain thresholds of stakeholders.

“We have also experienced that Additive needs to be a strategic choice by the company. It needs to be an incorporated business strategy”

Additive also needs to be a strategic choice by companies who can see the effect on their business model and can understand both how to use the technology and where it can make a meaningful difference.

Indeed, in answering the question of where Additive Manufacturing positions in their own business today, 42.86% of respondents to the distributed survey considered it to be a strategic technology rather than a wing of R&D or Product Development. In addition, companies that have a better track record at digitalisation have been found to be better at the adoption of AM; this points to the fact that this all starts with a cultural shift.

So while it was uplifting to see that viewing Additive Manufacturing as a “strategic technology” was the majority answer; there clearly remains a large gap to bridge with over 50% still not seeing AM as strategic. If we believe that successful adoption requires AM to be a business level strategy then far more work still needs to be done to convince our organisations of this.

Smaller companies in the AM ecosystem have managed to keep up with digital transformation in an agile way that has helped both their reporting and their ability to compete. An environment of small teams and continually evolving practices leads to a dynamic atmosphere seen as an important non-financial benefit for attracting top talent.

It was agreed that the culture of some of these companies – moving from startups to larger businesses, or publicly limited companies – will change. Risk levels will adjust, and in some cases become more corporate and risk averse. In order to enact this change, it was suggested that trade studies become a widely adopted practice; these trade studies would provide data, and through gathering data a culture can grow. This was connected to an idea raised later in the discussion regarding AM’s comparatively recent appearance as a viable option: unlike other methods, it simply does not have decades of data behind it that can show its effectiveness. This again, highlights the need for standards and industry consortium where all companies can benefit from non-competitive data.

How do you see AM positioned in your business today?
In responding to the question ‘How would you best characterize the focus of the AM growth mindset in your business?’, it was encouraging to see that the majority of respondents believe that the growth of the industry is based on some level of industry collaboration. The change from inward focused growth through protectionism towards industry growth through collaboration is hopefully the start of a significant change in the culture of the ecosystem.

In the current era of consolidations, mergers and acquisitions, and IPOs, the cultural dynamics that are required within an AM organization need to be protected. Merging an AM team into an established manufacturing business may lead to a risk averse approach to the new technology which lacks the track record that risk averse engineers are used to, coupled with the data they typically require.

It was also mentioned that AM is at a point of development that it needs to continually push boundaries by failing and learning. Through agile failure the most can be learnt, and while consequences need to be mitigated, this process cannot take place within a risk averse environment.

“What matters in failure is that we learn a lot and can then take things to the next level. This is all about the technology, and what gaps we have in further developing it, as well as how we ensure quality through qualification and certification”
**Key Topic 2:**

What are the main operational constraints within your own business, as well as those in your associated AM eco-system today that you have had to overcome? What are the biggest operational challenges that you still face in your business/associated ecosystem that is preventing further accelerated adoption of AM, and what possible solutions are there?

Companies making use of Additive Manufacturing need to master all aspects of the process from designing, cleaning and testing, through to assembly. It was highlighted that less than 5% of the production time is spent in the 3D printer itself. An AM part that might take just a few days to print may take 40 days from start to finish to manufacture.

“The Additive Manufacturing ecosystem needs to function more like a software company, and act as the master for all information. From the business side, you have to show it economically makes sense as well as being qualitatively better. The business always needs to know that the part will be produced at better quality for a reduced cost, and that the end product is superior.”

Furthermore, the customer needs to understand the need of their parts. Any misunderstanding or miscalculation by the customer can lead to the part failing, and it is always the AM process that is subsequently blamed. Sometimes a customer may under-spec, which leads to failure, or sometimes over-spec, which can undermine the business case. It is increasingly important to have a well-educated client base in order to preserve the trust in the technology; when parts break, confidence is lost.

The survey asked “How do you solve operational constraints in your business today?”, and only 20% of respondents believe that the answers lie within. This seems to reinforce the need to look beyond the boundaries of our own business to address our current constraints. Collaboration and increased digitisation is going to be key to progress, especially as individual firms are not able to master everything on their own.

The AM Ecosystem needs to function more like a software company than a manufacturing company. Lower costs can be achieved through digital technologies, cloud computing and the right adoption and use of software, which still results in the delivery of higher quality parts.

“Proper digital workflow is a critical barrier to widespread AM adoption...but regarding culture, AM culture requires collaboration at every level. In order for AM to mature to deliver its full promise it will require intentionality, commitment, and endurance”
Key Topic 2 continued

Automation, too, is seen as being key in driving down costs, after which it will be more realistic to persuade any business-oriented sceptics that AM can make products that are qualitatively better and economically viable. An important element of this is recognising how much of the process can be fully automated. However, change management is neither simple nor easy, since those on the factory floor or working with bankers will have to have all of their processes changed; due to the fact that they have become very accustomed to their current operations, enacting change is difficult.

Answers to the question of ‘How committed is your business to overcoming the challenges necessary to reach and push beyond the economic tipping point for successful AM adoption?’ showed that most companies are making strides towards incorporating AM on a wide scale in spite of the identified economic constraints. However, there are clearly some respondents that feel their companies may not have the aforementioned “pain tolerance” of their peers, resulting in less overall commitment.

Proper digital workflow is also considered to be a critical barrier to adoption, especially in the automotive industry where the fewer ‘hands on parts’, the better. Software is seen as being key to this, along with greater levels of automation.

“One can only go so far by myself, but with some of the partnerships we have, we’re able to integrate across various work streams on the value chain to deliver an integrated solution”

One of the greatest identified challenges was the fact that some AM producers are obligated to be the master of every technology and every process; they must understand AM technology from the perspectives of the entire value chain, in terms of what does and does not work. They are required to inspect the technology and ensure that they have satisfied the demands of the customer. In effect they must act as a software engineer, a metallurgist, a post process specialist, etc.
What does it take to run a successful AM Business?

Key Topic 3:
How significant is the role of your own organisational culture (organisation, people, processes etc.) and the associated ecosystem culture (collaboration, technology sharing, connectivity) in how you run your business today?

Confidence and trust are both extremely important, and with trust comes simplicity. The panel stated that they mostly knew far more about additive manufactured parts than about cast parts, but subtractive manufacturing is aware of its boundaries and limits; AM, meanwhile, is comparatively new.

Although external trust levels and outside confidence in Additive Manufacturing were identified as remaining challenges, in answering the survey question of ‘What is the level of trust and confidence that AM holds internally in your business today?’, the respondents indicated that at least within their own organisations, AM is largely viewed positively. However, the eventual benchmark for AM’s success must be similar to those of machining and casting, with their high levels of industry trust. It will likely be the soft factors that ultimately help AM establish itself as a comparable solution with more conventional manufacturing methods.

What is the level of trust and confidence that AM holds internally in your business today?

- High: 61.9%
- Medium: 26.2%
- Low: 11.9%

Standardisation will also greatly help AM learn its own boundaries, and through the use of parts adhering to standard comes trust in the technology, which then opens up more complex applications. In other words, standardisation plays a significant role in establishing trust, which in turn will lead to wider adoption.

“It boils down to two things: confidence and trust. Confidence in being able to understand that you’re going to do what you said you were going to do, and trust in that you understand what you’ve got to do to make it effectively. That trust then expands onto your customers and your regulators.”
Question 3 continued

In order to gain new customers essential for long-term success, large costs need to be sustained to establish a track record. This type of financial decision cannot be made by a spreadsheet - it can only be made by people who can look at an individual case and decide if it is worth building a new business relationship, and worth investing money in a relationship that they believe will become profitable over time. Enabling this type of decision making is why culture is key.

Given the initial hype around AM, there is also a need for expectation management of the applications that AM will be put to. Companies with experience of integrating new manufacturing techniques, such as those who adopted carbon fibre in its own early days, are familiar with the 10-year induction that this can take, but others will need guidance. Again, for such a significant investment that comes with a long journey of adoption, support from the company and recognizing AM as a strategic initiative is important.

“We’ve created teams of people that have the ability to continually evolve. We have to let them infect the rest of the organisation and show the value of AM to the broader team, our bankers, and other stakeholders to increase their pain threshold”

A recurring theme throughout the discussion was the need to raise awareness of AM and its benefits – including some benefits that are not directly financial in nature. Showing successes with Additive Manufacturing and then encouraging its adoption in other sectors of an organisation is a demonstrably effective method of spreading AM use.

Emphasizing the importance of collaboration and cooperation in the Additive Manufacturing ecosystem was the majority answer to the question ‘What best describes your industry partnerships?’. This seems to indicate that there is a move towards an ecosystem culture based on two-way value-added collaborations.

Raising awareness would also lead to countering any misinformation or inaccurate preconceptions that might be encountered. For instance, one participant related how they had heard the expectation that 33% of an aircraft can and will be constructed via AM parts. Managing expectations and embarking on educational efforts over AM’s real possibilities will also have an impact on its broader adoption, as well as further build trust and confidence in its application.
The discussion identified the fact that AM is still a tough business to succeed in and there are challenges that clearly remain before Additive Manufacturing is adopted on a broader scale. Businesses will need a high pain threshold to work through some of these remaining hurdles, but the conversation was fruitful in that a number of ways forward were identified.

Of these, collaboration was identified as a key component needed to make further progress, which further suggests the need for a consortium. The discussion agreed that it will be necessary for the AM community to work together collectively at all levels of the value chain and every part of the ecosystem, pooling skillsets and resources, in order to achieve the best possible outcomes – it was identified that companies themselves cannot function at their most effective when they are operating alone. Importantly the ecosystem collaboration needs to increasingly function in the digital manner to fully realise Additive Manufacturing’s potential as a lean and cost-effective solution.

This does not just refer to collaborating on a production level, but also in cooperating to convince the “bankers” that Additive Manufacturing is a worthwhile investment due to the strategic value to the business as opposed to just another technology stream.

Building trust in Additive Manufacturing was also shown to be important, a viewpoint which was supported by the prior experiences of a number of panellists. However, trust in the technology is inherently linked to AM’s ability to mitigate perceived risks in its use. One proposed way of doing this is standardisation, which is starting to be introduced in Additive Manufacturing.

With both risk mitigation and trust building in mind, the discussion also highlighted the need to raise further awareness of AM. Given AM’s comparatively new nature, reports of both misinformation regarding the risks of using it and overestimations of its capabilities emerged during the panel. Exactly what AM is capable of – and what it is not best suited for – and what can realistically be done with it, as well as managing expectations, will all be of the utmost importance in ensuring the technology’s broader adoption.

The technology development in the industry will remain critical to building the trust in AM, but the discussion has identified a number of softer factors based in our culture, our collaboration models, our organisation designs etc that clearly will play an increasingly important role in convincing the wider community of the sustainability of AM beyond what is technically achievable.
Podcast
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COMING SOON

Europe’s Premier Additive Manufacturing for Aerospace and Space Conference will return to Hamburg in 2022, 22-24 February

We look forward to welcoming you back to our in person event