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CIC Agile Case Study: European Embedded Technology Provider

A grassroots practitioner driven journey of Agile adoption

Case study at a glance

This case study investigates the adoption of Agile processes within a European embedded technology industry provider, delivering technical solutions for sports, health, defence, motorsports and the automotive sector. The report looks to chart the journey towards Agile and its progress across the wider organisation, driven through grassroots adoption.



Bola Rotibi, Research Director, Creative Intellect Consulting
Clive Howard, Principal Analyst, Creative Intellect Consulting
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Executive Summary

The grassroots adoption of Agile within a European embedded technology provider, delivering high tech solutions and hardware and electronic appliances for prototyping, real time data collection and monitoring, reinforced a disciplined delivery, allowing for greater accuracy in the software delivery processes. This has led to greater awareness of Agile within the wider organisation, especially within non-software delivery teams, keen to obtain similar improvements in their delivery processes. The agile journey for the company has been less than five years, but it has been driven by enthusiasm at the practitioner level, rather than through top down management motivation. That enthusiasm, along with demonstrable operational improvements, will provide good foundations for driving Agile into the wider organisation. However, there is already in place a strong culture and process support for the traditional waterfall methodology and a firm organisational set up for project management. Therefore, enthusiasm at the practitioner level needs the strong backing of a determined and committed leadership team, if the progression of Agile is to be sustained.

In charting the organisation's Agile journey, this case study looks to ascertain the impact of Agile on both the wider delivery lifecycle and the business operational processes. Doing so offers an opportunity for better understanding of the role that Agile processes and practices can play in supporting other common workflow initiatives, such as Lean, which looks at reducing waste in the workflow. More importantly, it can serve to provide a path to adoption, as well as a means for identifying strategies for executing Agile beyond grassroots practitioner support.

A strategy for continual improvement and smarter delivery, especially at the operational level is important. It alone, however, is an insufficient driver for wider organisational transformation, without alignment to relevant commercial returns and key business performance indicators. Agile adoption, beyond grassroots support from one area of the business, requires tangible business returns in order to drive higher management engagement to back adoption across the wider organisation.

Agile profile at a glance

Agile Achievement	Practitioner driven Agile engagement within a European embedded technology provider achieving improved product delivery accuracy and quality.
Agile Experience	Four year journey starting in the software divisions.
Agile Footprint	Agile and Lean processes predominantly adopted within the software and instrumentation teams, but with growing interest, support and adoption in the non-software delivery teams.
Agile Drivers	Better discipline and accuracy within the delivery processes and improved customer interactions and visibility, to ensure delivery of required features in a timely fashion.
Agile Gaps	Lack of unified Agile processes and toolset across different teams making it difficult and complex for teams to interact at the wider organisational and operational level. Weak engagement of business management limits commitment and motivation.
Agile Insights	<ul style="list-style-type: none">• Planning has an important role to play in Agile delivery and should not be discounted.• More unified toolsets and Agile processes will help Agile teams to collaborate better.• Agile delivered improved discipline, accuracy and better results against key business performance indicators.• Teams must learn to say no if they want to preserve the benefits of Agile delivery.

Key findings from this case study

- Technologies that provide mock interfaces, mimicking service calls and simulated functionality, allow teams with different workflow dynamics and execution speeds – as in the case of software and hardware disciplined teams - to maintain Agile velocity.
- Lack of unified Agile processes and toolsets makes collaboration across different teams within an organisation challenging.
- Investing time in planning and providing relevant and appropriate documentation still has a crucial role in Agile delivery, since products and projects can require a long term vision.
- User personas and stories allow the needs and goals of the client to be consistently understood and addressed by all involved in the product or project delivery process.
- It is important for teams to be able to say no, in order to maintain a sustainable level of quality delivery and velocity, but also to prevent a fall in team morale. This is one of the key duties a scrum master performs, making them (or someone carrying out an equivalent team facilitator function) a vital role in an Agile team.
- Collaboration, communication and continuous improvement of processes through regular reviews are important team motivators, that help to ensure maximum value is derived for the customer.
- Contracts have to be adapted to reflect the Agile process. It requires greater client involvement so that they have the visibility to be more accountable and responsible for change requests and the completion of contractually agreed feature sets.
- Roles within traditional team structures supporting traditional methodologies, such as Waterfall, can cause friction and conflict with Agile delivery processes.
- Without commitment and support from both ends of the organisation (i.e. from top down management and bottom up grassroots practitioner support), Agile and Waterfall methodologies cannot be so easily swapped in and out.
- Without strong support from the business itself, there will be limits to the Agile progression.

Business and operational gains

- Increased communication and collaboration between team members leading to improved morale, quality and greater velocity of work completed.
- Closer working relationship with the customer, which allowed problems to be found and so fixed sooner. What the customer wants is achieved faster, so projects run more to time.
- Better quality products, as continuous testing and collection of quality metrics both enforces and measurably demonstrates higher quality levels.
- Improved operational discipline, with greater appreciation of and desire to replicate the practices from non-Agile teams.

Case Study in Detail: Practitioner driven Agile engagement within a European Embedded Technology provider

Industry sector

An embedded technology systems provider, focused on delivering high tech services and industrial applications, such as embedded software development, rapid prototyping of hardware and software systems and automotive, control and real time monitoring and data collection systems. The industry sectors which the company serves span healthcare, energy, aerospace, transport, motorsports, defence and automotive.

Company overview

Founded in 1963, the organisation is now a group of five high technology companies totalling over 5000 employees. Based in the UK, they are privately owned and have revenues in excess of £2bn. The different companies develop products and services as diverse as racing cars to food. This report focuses primarily on one of the group's core businesses – systems technology.

The systems technology business has over 200 people, which has grown from 50 only two years ago. The company builds products covering electrics, electronics, sensors and software solutions. Their clients come from a range of industries, including sports, health and wellness, defence, motorsports and automotive.

Agile maturity – a journey that begins at the “grassroots”



The systems technology company operates three business areas: systems, equipment, and modelling and simulation. Within these are separate teams, responsible for different aspects of consulting, software, design and hardware. As with many systems companies, this organisation has a history of using Waterfall methodology for designing, building and delivering products. Its processes, structure and culture have therefore been heavily influenced by this approach.

Four years ago certain teams began a journey to adopting Agile practices. In that time some of those teams – namely those responsible for the software delivery processes, for which the Agile manifesto was clearly looking to improve – have travelled further and faster than others on this journey. The movement towards Agile was driven by a few individuals from within the delivery teams. The software teams have been applying a combination of Scrum and Extreme Programming (XP) for most of this time. During this time, the methodology has evolved (and continues to evolve) to suit the needs of the organisation, which has a mix of software, electrical/electronic and hardware engineering disciplines. The cross cutting workflow dependencies and constraints of the different

disciplines need to be supported within an Agile context. Even though the Agile methodologies used by the organisation have undergone a level of adaptation, they still remain true to the core principles of Agile, as outlined in the manifesto.

Process heritage



The Waterfall methodology, as with many systems organisations, was the overwhelming methodology. Despite the progress of Agile within the company, the Waterfall approach continues to be a firm fixture, particularly for the non-software discipline workflows and teams.

Agile execution



While the software teams have advanced their Agile transformation considerably, the teams responsible for hardware tend to be those that lag behind. Similar to many other hardware organisations they have found it challenging to adopt Agile. Unlike software, it is not so easy to go back and change features of hardware. This inherent challenge means that hardware teams, however committed to an Agile approach, will always run slower than the software teams.

Process and tooling alignment between software and hardware

The biggest ongoing challenge is the lack of a unified Agile process and toolset across different teams within the different areas of the business. Typically, the teams responsible for hardware, such as electronics, use Kanban, which suits lean manufacturing processes better than Scrum. Kanban is a just-time-delivery planning and process improvement system, inspired by the Toyota Production System and Lean manufacturing. It is an approach that focuses on displaying and limiting work in progress. Specifically, it allows teams to collaborate to incrementally progress the flow of work to a next stage status (i.e. planned, in progress, done) as and when it is required, so that team members are not overloaded with too many work activities. Kanban allows measurements to be taken at each stage and fosters a culture for continuous improvement.

There are also some teams which operate an Agile approach in between Scrum and Kanban, often referred to as “Scrumban”. This is essentially Scrum with a Kanban board. Many projects require teams to work with one another and the lack of a unified process makes this complicated.

To help address the differences in execution speeds between software and hardware teams, which occur as a result of the differences in process dynamics when delivering physical systems, both the software and hardware teams use mock-up techniques to continue development, while each is out of synch with the other’s delivery sprint. Software can simulate the calls that hardware would make to the application. Conversely, the software team can create mock-up services for the hardware team to test against, until the real services are complete.

Tooling priorities: raising the requirements for tool interoperability

With not all teams being at the same stage in the Agile transformation process, working together can be difficult. Another area out of alignment is tooling, where different teams use different tools; not just for development; but also for managing their processes. Some of this is ideologically driven from within the team. For example, electronics is firmly entrenched within the Microsoft toolset of Team Foundation Server and Visual Studio. Meanwhile, software embraces open source tools and technologies, such as Linux, Java and MongoDB. A more unified toolset would help the teams to collaborate better, but this is something that would have to be enforced (if at all possible). Others faced with this challenge have turned to supporting an interoperability strategy, allowing disparate tools to exchange relevant information and align processes.

Agile planning through personas and user stories

One aspect of the systems business’ Agile implantation, which the software team highlights, is that they invest time in planning and documentation. These are often activities that many Agile practitioners do not consider part of Agile. However, the team believes that they are still crucial to any project; which makes good sense, because projects still require a long term vision. The planning is different to the traditional Waterfall approach.

Instead of large documents, the Agile teams work with the customer to create user personas and stories. These personas represent users of the application and include key requirements of that user; the team goes as far as to give each persona a name and a photograph. All teams involved in the project would have access to these and refer back to them to make sure that the product is meeting the needs of the intended users.

Similar to the user personas, the user stories are cards, of which each card outlines a different requirement of the application. The cards use simple bullet points and are again used by all of the teams involved. For example, development teams would use them to create the necessary functionality. Testing teams would use them to make sure that functionality meets the intended requirement.

Agile team qualifications – recognising the value of the scrum master and learning to say “no”

The journey to Agile required some lessons to be learned and the process has evolved over time. One key mistake made in the beginning was that the teams took on too much work. The old way of thinking had teams agreeing to new requirements and then trying to deliver on them. This mindset carried over initially, with the result that many of the benefits of Agile broke down. Team members also worked on different projects, so collaboration and communication was greatly reduced. By agreeing to deliver too much, the Agile concept of sustainable working pace also broke down.

Teams were working longer hours and as individuals rather than a coherent group. As a result, morale and quality was reduced. This was addressed by the inclusion of a scrum master, which resulted in teams pushing back on requests coming from the business. While this got the Agile methodology back on track it continues to aggravate project managers and other roles within the business as they have to wait longer for their requirements to be addressed.

Team practice gains: collaboration and communication through to continuous improvement

A further Agile behaviour that has proved popular and constructive among the teams is increased collaboration and communication. Agile team members are far more engaged with one another and this is fuelled by practices such as the daily stand-up and pair programming (where two programmers sit side by side and code together). This has also had the effect of motivating the teams. Another key motivator has proven to be Continuous Improvement, whereby processes are constantly reviewed with the aim of improving both them and the value derived from them by the customer.

Managing the Agile evolution – from contracts to culture

A major concern for the organisation when using Agile, is the contract that is agreed with each customer. Traditionally, the contracts team would create a document that outlined what product was to be built, the timeframe for delivery and how much it would cost. This required estimates of time and cost which if wrong, or if the project requirements changed, would result in delays. The contract often specified that any delay would be paid for by the organisation. As customers frequently changed requirements during the project, resulting in the project overrunning, the organisation ended up losing money.

Agile had the problem that sprints do not inherently guarantee an outcome. What this means is that a sprint could complete a number of work items within a given feature set, but not all of them. Therefore, at the end of the sprint the full feature set was not completed. Should the customer then change requirements (as they so often did) the next sprint would go back and change some of those items, but again this was not enough to complete the full feature set. Two sprints have now passed and there is no usable feature. The concern was that this could continue to the point where at the end of the estimated project cycle there was very little actually delivered of the required feature set, as outlined at the start.

The contracts team adapted the contracts to reflect the Agile process. This meant the customer would work closely with the team and so have much greater visibility into the process and its progress. By being close to the product's development, they are in a position to identify potential issues sooner; requirement changes can therefore happen quicker and work completed faster. With Waterfall, there was nothing for the customer to see until very near the end, at which point changes required far more significant

reworking. Through Agile, the teams often get the customer requirements right faster and so projects can stay on schedule, or even come in ahead. The customer can also stop the project at any time. Ultimately, the flexibility and closeness to the teams allows the customer to see the impact of a change on the deliverables, thereby giving them a level of ownership and responsibility for their change requests. Such visibility and involvement enabled tighter control of the feature list, as well as greater focus for ensuring completion. Changes being visible to the customers was seen as a benefit to them and so the new contracts were acceptable.

Agile impact



Discipline upheld and reinforced to organisational acclaim

Agile requires teams to be disciplined and this is something that was a concern for those initially promoting it. The discipline comes from adhering to the process: design and size exercises; stand-ups; show and tells; testing throughout development; sticking to the agreed backlog items within a sprint and so on. This proved to not be a problem and in fact other non-Agile teams have voiced admiration for this and would like to be more disciplined themselves.

For those in the Agile teams, the new working practices are popular and they have become firm advocates for Agile within the broader organisation. As the push for Agile is coming from within the delivery teams this is important.

Demonstrable operational and commercial returns

Agile has shown results. The accuracy of project timing estimates has been much better than before. More importantly, projects do not overrun and so the business loses less money. The traditional way of working had simply come to expect that projects would overrun. In recent metrics exercises, the Agile team was able to both provide more detailed metrics and also performed better against those defined by the business.

The business identified Key Performance Indicators (KPIs) to measure the quality of the teams. Areas measured included accuracy of project estimates and meeting deadlines. Agile teams performed better against these KPIs than their non-Agile counterparts. At the same time the Agile teams were able to provide data around the development process, such as testing, total number of defects, code coverage and burndown rates. Some of these demonstrated improved quality within the product itself. With customers also more

closely involved with the teams and getting what they want faster than before, they are also happier and more satisfied with the output.

Insight gained



Agile execution challenged through traditional process and cultural conflicts and team hierarchy

Internally, the challenge has been the cultural conflict between the traditional Waterfall methodology and Agile. Traditionally, project managers were an important part of the process and Prince 2 is widely used. The typical team structures operated a hierarchy of project managers, line managers, developers, engineers and so on. Agile demands a much flatter structure and does not recognise roles such as line manager and project manager. From the very beginning this created friction between the Agile teams and roles within the organisation, who viewed it as threatening or disruptive to them.

Examples of where Agile ran into the organisation's culture and traditional team and project setup:

- *Project managers demand Gantt Charts to be brought to meetings, in order to ascertain the project's progress. The typical Gantt chart requires a view of when project features will be delivered over a long period. Agile's focus is on the next sprint and so specifying that a certain feature is going to be delivered in a period three months away is contrary to the approach. For the Agile teams to provide such long term plans is a constant challenge and point of contention between the teams and the project managers.*
- *Traditionally, teams have always tried to be accommodating to the business and customers. This frequently manifests itself in teams taking on too much work and then working considerable overtime. Agile, and in particular Lean strategies, such as Kanban planning systems, operate at a sustainable pace, which means teams are not overworked and keep to a constant number of hours per week. To achieve this, the Agile teams have to push*

Going forward



The organisation's Agile journey over the last 4 years shows what can be achieved by strong advocacy from within the development teams. However, it also highlights that without strong support from the business itself there are limits.

There is uncertainty in the ability to either sustain or grow the adoption of Agile through the wider organisation. Exercises such as the fortnightly "show and tell" and constant presentations to the group have not overcome the in-built prejudices and misconceptions. For the existing Agile teams there is the challenge of continued movement towards the level of maturation attained by those in software. Bigger than that though is the ongoing fight for Agile's survival within the organisation and the group.

back more and so say "no" more often to new requests. As a result they appear more inflexible and less accommodating than other teams and work less overtime. This is viewed negatively by parts of the business and some other teams.

Despite these internal challenges and cultural conflicts, Agile continues within the organisation, because it has shown to deliver operational and commercial benefit.

Without commitment and support from all angles, Agile and Waterfall methodologies cannot be easily interchanged

The proven delivery and operational benefits keeps Agile running within the organisation. However, these positive outcomes have not resulted in a rapid conversion of the organisation to Agile. The overwhelming majority of people and processes, and most significantly the culture, is against Agile. In fact, Waterfall is still the overwhelmingly dominant approach. Across the wider group Waterfall remains the default approach. Waterfall and Agile are not just processes that can easily be interchanged. They define the hierarchy of people, their roles and the structure of the development teams. Coexistence is proving extremely difficult and, despite the results which have shown Agile to be better in numerous measurable ways, its hold within the organisation continues to be tenuous.

Crucially, the success of Agile has not overcome the cultural devotion to the old ways of working. Unfortunately, some of the principles, such as sustainable working, create friction with other parts of the business more used to getting their own way. Project management, which is set-up for a Waterfall environment, is another constant area of friction.

The proponents of Agile within the organisation have worked hard to try and overcome this issue: they have given presentations on Agile and conducted "show and tells" every two weeks. But, while teams have evolved their Agile processes to improve output, they have not adapted to get more of the business on-board. As a result, there remains a constant danger of Agile being forced back out of the company.