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AREAS OF INTEREST FOR FURTHER INVESTIGATION IN A CONTINUATION OF THE VIVACE PROJECT

by

Doug Scott (Rolls Royce), David Buxton (UNOTT), Richard Farr (UNOTT)

Abstract:

This document describes business related issues in the aerospace industry, identified as a need for further research and development after the VIVACE project. The issues are grouped into five main areas: Structuring research and technology for business, services, manufacturing and supply chain; Decision support for strategy; Supply chain optimisation; Systems engineering in the extended enterprise; and Legal and Commercial Framework. The conclusion is that business research should form a key part in future externally funded programmes as it forms and could form a key part in systems optimisation. It also achieves the goal of “no surprises after the design phase”.

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	Name	Partner Organisation	Role / Title
Deliverable Leader:	Doug Scott	RR	
Contributors:	David Buxton, Richard Farr Catarina Bovik, Lotta Olofsson Jaqui Crawford, Nigel Smitten	UNOTT VAC RR	
Users:	VAC, RR, UNOTT, Crescendo Team		
Owner(s):	RR, VAC, UNOTT		
Internal Reviewers:	Simon Taylor Anders Nilsson	RR VAC	
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1. EXECUTIVE SUMMARY

VIVACE has provided a great platform from which to explore the possibilities presented by business research. The work completed in VIVACE has triggered thoughts from within the partner companies and universities about what research could continue and on what are the key areas to be explored. This document sets out some of those possibilities.

2. BACKGROUND

Neither partner company has had much, if any, experience of collaborative externally funded research in a business arena. VIVACE has thus proved to be a learning experience not just from the content but also from the process. This has led to debate around what and how business research is conducted and what topics are most suited to this approach. As an industry facing [suggests concentration of market power] challenges we must find better ways to optimise the relationships between the supply chain companies so that the best product is offered to our customers. This can be achieved through excellence in technical solution only when supported by efficient and effective business and service solutions at the concurrently. This report suggests areas for research that support the development of such business solutions along with integrating business requirements into the product design.

3. METHOD

The work started with a formal meeting between Rolls-Royce (RR) and Volvo Aero (VAC) in January 2007; and was followed up by a workshop with the same parties in May. Furthermore, meetings have been held with the University of Nottingham (UNOTT) resulting in further input to this report.

In addition to the formal sessions, some of the issues have been developed through time in discussion between the contributors as well as other personnel from the partners and external companies. Other needs stem from experiences gained from working on major projects within the partner companies where real life experiences have caused the participants to question existing methods and models and strive to seek out better solutions to the challenges facing the industry at the moment.

4. AREAS FOR FUTURE RESEARCH

The subjects are grouped into five areas; Structuring research and technology for business, services, manufacturing and supply chain; Decision support for strategy; Supply chain optimisation; Systems engineering in the extended enterprise; and Legal and Commercial Framework.

4.1. STRUCTURING RESEARCH AND TECHNOLOGY FOR BUSINESS, SERVICE, MANUFACTURING AND SUPPLY CHAIN

It became apparent very early on in VIVACE that while it has been common practice in Aerospace to participate in collaborative externally funded research into products

and product development there were little or no experience in the fields of business and service research, or in most fields outside the hardware product for that matter. This has hampered the research as there were differences in expectation and a lack of understanding on how to handle intellectual property rights within a collaborative project.

Areas where research may benefit

- Develop an R&T process that works for non-product orientated research.
- How should collaborative research be structured to protect the Intellectual Property and Rights of the partners?

4.2. DECISION SUPPORT FOR STRATEGY

Much of any strategy development has to be supported by greater understanding of the variables that make up a particular problem. As time goes on, the aerospace industry is becoming more consolidated through collaborations and acquisitions. The complexity that this brings makes decision-making key to future success.

Companies and their portfolio of products and services have grown and matured to the point where individual projects can no longer be analysed in isolation. Capacity, be it investment, factory or manpower, is limited meaning investment decisions can no longer just be made on the basis of return. This changing arena highlights several areas of interest for future research. We have structured them into three levels: EU/World level, Industry level and Company level.

4.2.1. EU/World Level

Environmental Impacts

- How does the EU compete in aerospace on the world stage whilst managing its environmental impact?
- What areas of research are driven by this?
- How should environmental taxation be developed in a world where our competitors live outside the EU?

People

- Where are the workers coming from? Does the EU develop the right number of skilled people to support its long term desires in aerospace?
- What are the key technologies that the EU should be developing to support the desire to be a leader in world aerospace?

4.2.2. Industry Level

By developing and validating better industry models it will be easier to develop future business strategies. The increasing interactions up and down the supply chain need to be understood. Some of this modelling work has been started in WP 2.1. As the work progressed it became clear that modelling a fixed extended enterprise only permitted a limited number of questions to be answered and

provided limited ability to examine competition within the extended enterprise. Furthering the work on the existing modelling techniques could include:

- Expansion to include more industry players.
- Better market/demand forecasting integration with models
- Ability to play out scenarios and optimize solutions from a competitive, capacity and affordability viewpoint.
- Answer questions such as:
 - How can the value chain for an aircraft programme be developed to incentivise all levels and players in that value chain?
 - How can the industry produce optimized solutions whilst remaining competitive at all levels in the supply chain that retains diversity and is not integrated?

4.2.3. Company Level

The company level modelling needs to address the same type of questions as the industry level but with greater fidelity and across the whole life cycle and portfolio of its products. A company needs to be able to:

- Manage its product portfolio.
- Make investment decisions in a competitive environment.
- Understand the likelihood of success of any investment.
- Be able to understand and react to future changes in the industry by developing robust solutions.
- Understand the implications of its decisions on capacity and risk within its business.
- Manage cross function assumptions in an integrated manner.
- Assess how to develop its business model to maintain a stable future.
- Make money in a sustainable way!

These types of questions are supported by a higher level of integrated understanding than that seen in the industry today. As individual items, each are not too difficult to understand, the key to the future work is to improve the understanding of the interactions and to have the ability to optimize a solution within them. We suggest a continuation of the value chain simulation work as well as an exploration of game theory.

4.2.3.1. SERIOUS GAMING FOR BUSINESS STRATEGY AND SIMULATION

Computer 'games' designed for uses in business are referred to as serious games. A serious game is a computer game used for non-entertainment purposes, in a business context they may be used to address an aspect of policy and or management issue. Through playing the game, management learning can be managed in a controlled environment, enabling better and faster business decisions when faced with a real-world problem.

The software underpinning a 'Serious Game' is frequently a business simulation, such as the Value Chain Model developed with VIVACE work package 2.1.1. The current simulation model is an exploratory research tool, adopting an object-orientated design capturing each 'actor' in the extended enterprise. The model mimics the operational and financial performance of the aero-engine extended enterprise for a number of 'what-ifs', based on the future business scenarios and business models.

The modelling developed within VIVACE could form the basis of an Aero-Strategy 'serious game'. The game, to be played by business managers at each partner company, enhances visibility of the business environment and its response to the decisions made at the multiple tiers of the extended enterprise. 'Gamers' will be able to define complex scenarios and make decisions as the simulation progresses. Some example scenarios are suggested below:

- How business decisions made during the design phase concerning the OE design play out throughout the lifecycle of the programme or within a market.
- How strategic decision made within each company interact to affect the performance of the Virtual Enterprise.
- Play 'be the competitor' to model how strategies may interact and evolve.

4.3. SUPPLY CHAIN OPTIMISATION

The overall supply chain will come under increasing pressure to respond to customer flexibility and lean requirements linked with every faster product and change cycles.

This has to be considered in the background of current delivery and economic pressures, which is some case historically it has struggled to satisfy.

The key area which the initial phase of Vivace is potentially showing a benefit is the supply chain modeling work which even though is in the early stages of development could provide a rapid what if planning tool which will allow data driven decision to be taken and fed back in to the commercial / business planning cycle of enabling supply chain factors to be incorporated in product and business programmers.

The areas for future research should be :-

- Build upon the initial modeling work linking the supply chain tool to a simulation package
- Provide a modeling tool which could support data driven scenarios planning
- Support rapid supply chain simulation to allow upfront business impacts to be assessed prior to programme commitment
- Enable the industry supply chain as a whole to drive supply chain designs and principles which consistently support on time delivery

The modeling tool / module has the power to start and answer one of the fundamental industry capability gaps on supply chain planning and design. By effectively and rapidly accessing and using the data, which is available and turning, it into management information to allow for quantified business decisions.

The results at this stage for the partners cannot be quantified but other industries which have adopted similar practices, have achieved gains in the following areas

- Total supply chain cost operational reduction
- Significant productivity against derived form supply chains which are robust and deliver on time
- Supply chain planning integration in the manufacturing system/ extended enterprise resulting in a holistic planning approach improving customer delivery
- Significant cost reduction by reducing Inventory, space and increasing value add.

4.4. SYSTEMS ENGINEERING IN THE EXTENDED ENTERPRISE

Through recent work on future engine programmes, systems engineering tools have been applied to try to develop a more optimized solution. This has proved very difficult as there are very few examples of the application of systems engineering to a complex system of systems such as those found when developing an aircraft. The authors therefore suggest that there should be some research committed to achieve better understanding into how to optimize the design of a 'system of systems'. This becomes more important as the diverse needs of the consumer, customer, supplier and legislator become harder to balance. It is also essential to explore these issues not only on at the engine level of the offering, but to also move up to the aircraft value chain that leads to the total offering of airframe, engine, subsystems, service package and financial solution. Specific questions to answer include:

- How can the customers and supply chain players' requirements be recognized then broken down into elements that can be flowed down through aircraft level to engine part level, to affect and link to the business model to OE design criteria?
- Is QFD the correct tool to use to capture and break down requirements and flow them through to the design?
- How to connect the business model and value chain modelling tools into the systems engineering criteria? See figure 1 below.

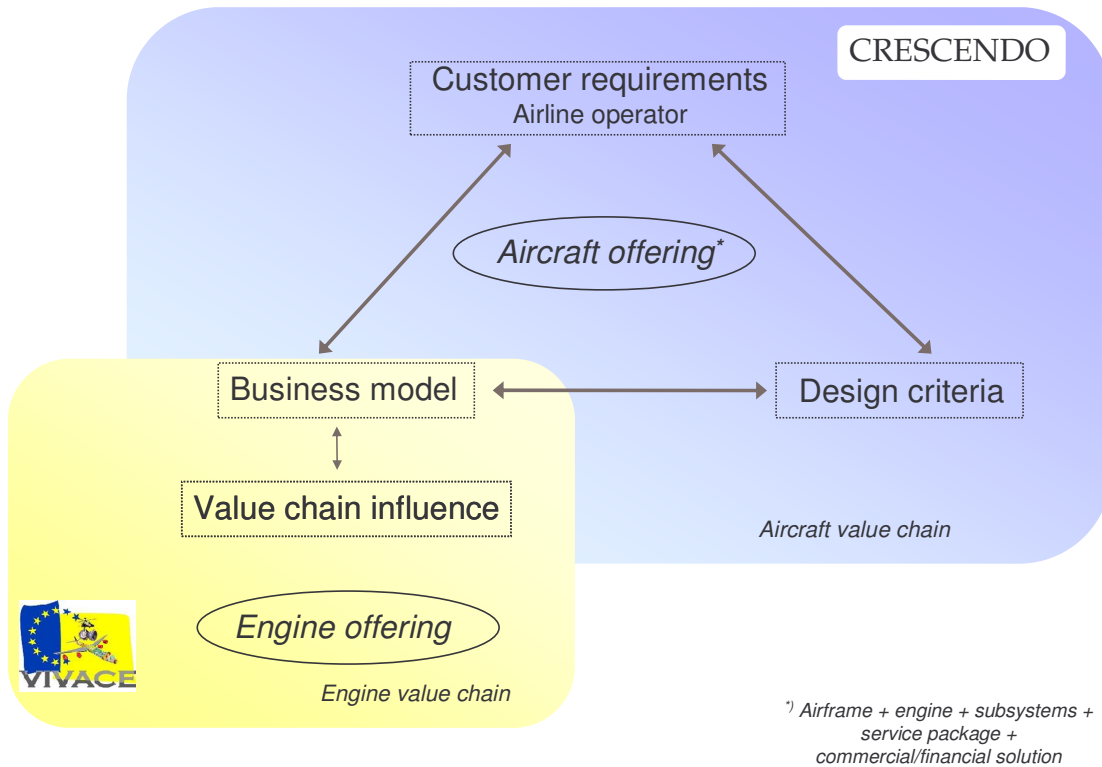


Figure 1. Expanding and moving the business research scope in a continuation of VIVACE.

4.5. LEGAL AND COMMERCIAL FRAMEWORK

The increasingly global commercial landscape and the emergence of lean thinking across an entire business enterprise presents new challenges for the commercial profession. Not least of these, will be the challenge of making stable margins in an increasingly complex contractual environment where traditionally separate entities merge forces to create collaborative delivery, financing and service agreements across the traditional procurement and sales divide. Add to the mix the need to maintain commercial headcount at flat levels even as workload increases, build individual and team capability in key legal and commercial areas, lean working practice where waste and non value added task is eliminated, support task is automated and non core task outsourced. The speed of business transactions and the gap between short term transactional agreements and long term venturing requires a flexible IT systems that can manage the myriad of interconnecting agreements and create a no fuss e-contracting structure using standard forms, proposals and contracts.

There is clearly a wide multi-industry benefit in non competitive collaborative research in lean commercial practices with the objectives to create an integrated commitment management system. A number of critical areas of research that will assist this journey will be:-

- A mechanism to link risk management, value proposition creation, product and sale attribute bundling with contractual packages and a menu driven system based on standard offerings for groups of suppliers and customers
- The commercial value and implications of commercially focused business research, intellectual property and copyright of inventive business processes and concepts that could create a competitive advantage
- Managing multiple interfaces across the buy side and the sell side and managing the interdependency across the boundaries
- Understanding where margin leaks in the product service life cycle and how partnering with capable entities at various points in the lifecycle can create growth and margin potential for all parties in the enterprise
- Lean and cost excellence is prevalent on the buy side and margin management and protection of market value, competitive advantage and efficient sales systems are prevalent on the sell side. We need to track commitments through the chain of handoffs from product and service design through sales and through life service to the consumer/customer.
- How do we increase partner collaboration and implement lean thinking into the sell side of the business and at the same time protect intellectual property, competitive advantage and sustainable margins over the life of products and services.
- How do we use IT to eliminate waste, automate commonly repeated tasks and create risk evaluated deal portfolios where core data is joined up in an integrated commitment management system that enables deal creation instead of slowing the process down.
- How do we attract and retain highly capable commercial and legal professionals and maintain and develop their capability to secure better business performance instead of compliance and control

5. CONCLUSION

Business research should form an important part in future externally funded programmes as it forms a key part in systems optimisation. The pressure from environmental and political factors is becoming key to design optimisation and it is therefore critical that factors other than pure OE performance are included in the systems design parameters.

With continued and increasing focus on “no surprises after development” there is definitely a gap between the product world and the business world. These need to be and are inextricably linked so it makes sense to research an environment where business solutions can be tested, debugged and verified virtually well before entry into service.