

# Business Analyses for COTS Solution

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**Abstract**—Whilst working on projects implementing commercial off the shelf, referred to as COTS products, we came across considerable amount of literature detailing the architecture and the development aspects of COTS but relatively less describing ready methods of finding an appropriate COTS product together with the detailing of requirements. Though large frameworks that provide a very structured approach towards finding the right COTS solution exist, however they may turn out to be too extensive to implement in full.

This paper makes an attempt to provide an insight into activities related to the arena of business analyses concerning the implementation of a COTS solution. It tries to address a number of issues and challenges that could be faced while carrying out business analyses considering a COTS implementation. The paper focuses on activities beginning from writing the business case to requirements gathering and finally selecting the right product. The paper tries to provide a useful amalgamation of suitable approaches and activities drawn from various sources in conjunction with useful insights drawn from various approaches that have been used in real-life situations. RUP being almost a standard de-facto in most organisation, the paper uses a lot of terminologies derived from it where required. It details the activities during the inception and elaboration phase of the lifecycle where most of the challenges lie for a business analyst; with the biggest being selection of the appropriate COTS package that can deliver the business requirements and organisations IT needs with minimal tradeoffs.

**Keywords**—Business Analyses, COTS, RUP, Business Modeling, Requirements Gathering

## I. INTRODUCTION

THE use of off the shelf packages to implement technical solutions is becoming increasingly popular in government as well as in commercial sectors such as telecom and financial services. However, there seems to be limited understanding of how to use the Commercial off the shelf products (COTS) in an effective way, how the existing processes need to be tailored in order to accommodate best practices for COTS usage, and what all new processes need to be introduced for the successful use of COTS products.

A COTS product is an off the shelf solution supported and evolved by a vendor who retains the full intellectual property rights to it. The product needs to be configured rather than constructed from scratch in order to implement a particular business solution. Hence COTS based development is more of an act of composition and reconciliation rather than pure construction. It is therefore driven and governed to a large extent by the market place, as to what products market has to offer and often entails a trade-off and compromise to the actual requirements. This introduces a need for the organisations to be flexible with their existing or desired business processes in order to effectively use COTS. This also brings along the aspect of considering the need of a more effective solution selection and procurement process that can provide the best match for the organisation's existing IT architecture, infrastructure and also to the business solution they are trying to implement. With respect to requirements gathering this often introduces a chicken and egg situation, as the requirements cannot be determined hundred percent upfront before choosing a product and how can you choose a product that best matches your requirements if you don't know them hundred percent.

Following are some differences between traditional built from scratch and COTS -

TABLE 1 COTS VS BUILT FROM SCRATCH

COTS	Built from Scratch
Driven by the market place.	Driven by organisation's internal development competencies.
No changes to internals of the product as the vendor owns the intellectual property rights.	Any time any changes can be incorporated.
Business modeling mandatory	Business modeling optional
Requirements can not be completely ascertained independent of the solution.	Requirements determined upfront and solution built to cater them.
Often leads to changes in the existing or desired business processes.	Development from scratch hence mostly suitable to implement the desired business processes as required.
Development is an act of composition.	Development is an act of construction.

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## II. COTS BUSINESS CASE

When developing a COTS business case one must provide the basis for Build versus COTS decision. It's at this point that one would consider whether to opt for a COTS approach at all, how appropriate it would be for the given system, and in some cases it can even go down to the level of deciding whether a particular COTS product or technology would be appropriate for the given system or not. The business case should consider not only the end user needs and program level issues but also the COTS market place. This would include information for instance on the following -

- a. Different vendors in the market place, the organisations that use them.
- b. How these vendors/suppliers differentiate themselves from each other and what typical relationships vendors/suppliers have with their buyers.
- c. What competitive forces drive this market segment and what types of contracts and licenses are common.
- d. What are the industry standards that are operating and governing them together with the identification of any applicable commercial standards.
- e. Identification of organizations that have similar needs or are already using the short-listed vendors.

The business case analyses should contain parameters concerning feasibility study of a solution using a COTS product covering various aspects related to business, engineering and the contract issues associated with the use of COTS product and services. It should include the following:

- ❖ The potential vendors, their maturity in the product and stability.
- ❖ Study should take a system service lifetime view rather than just the initial buy and build aspect.
- ❖ Which technology will win dominance of a particular market niche or how long a vendor will maintain a commitment to a given product.
  - a. Matching of the requirements, which for COTS solution a figure such as 80% would be adequate.
  - b. Matching of High Priority requirements by 100%.
  - c. Other factors such as reducing operational support costs and personnel for the program by a certain %.
  - d. Consider the **risks** whilst determining "feasibility". Often this could be a deciding factor between the different alternatives.

What kinds of risks each entails and the relative impacts of those risks. Risk would also guide the depth of analysis necessary for a particular solution.

- e. Comparisons between the different alternatives may not be straightforward. Different alternatives will have different liabilities and different advantages. It will rarely be the case that there is one clear winning alternative.

**Analyze the financial implications:** COTS-based system may incur costs for things such as reacting to new product releases and marketplace changes, technology refresh, continuous evaluation, marketplace and technology watch, licensing, and (re)integration. It should include details such as:

- a. Total cost of ownership which for COTS should include estimates to cover infrastructure, product evaluations, and the unpredictability and magnitude of product changes, as well as the backup plans that address costs and choices when a COTS product is no longer available or if a vendor leaves a market i.e. taking market place volatility into account.
- b. The projected return on investment (ROI) over the system lifetime. ROI should not just measure the monetary aspects but should also include other potential benefits, such as better system quality and stability, reduced schedules and timescales, more favorable risk profile, increased capability and usage across multiple programs within a domain.
- c. Licensing options if any with each of the COTS product.
- d. The cost of risk mitigation, managing risk being an inherent part of COTS lifecycle.
- e. COTS product end-of-life events to cover scenarios in case product being dropped by its vendor or its vendor going out of business. This is an inherent risk in choosing a COTS solution.
- f. Ramp up and Product lifetime support costs which may or may not be included in licensing options.

One thing to note about a COTS business case is that it is continuously evolving and needs constant updating at different instances during the lifecycle.

### *We have the Business Case now what Next*

Once the initial Business Case is established that has significant justification about why to go for a COTS solution along with information about the market place, the kind of vendors that are operating and the kind of organisations that are using similar solutions the next steps involve delving into the Business Modeling and Requirements Gathering activities.

### III. BUSINESS MODELING

Business modeling is one of the most important activities that is required for evaluating choosing and implementing a COTS solution. Without a good business process model it is almost impossible to identify the correct COTS solution and effectively use it. The business analyst must:-

- Model the current end-user business processes in sufficient detail to determine the implications of implementing end-user business processes implied in possible candidate COTS solutions.
- Model the target end-user business processes in sufficient detail to differentiate the important capabilities required in possible candidate COTS solutions.

2. Identify the delta from the desired to achievable end user business processes through the COTS solution.
3. Prototype the required changes to the end user business process.
4. Communicate with business to carry out an impact assessment of the change.
5. All this needs to be captured in a business process change management plan which details the migration strategy for the affected organisational units due to the changes.

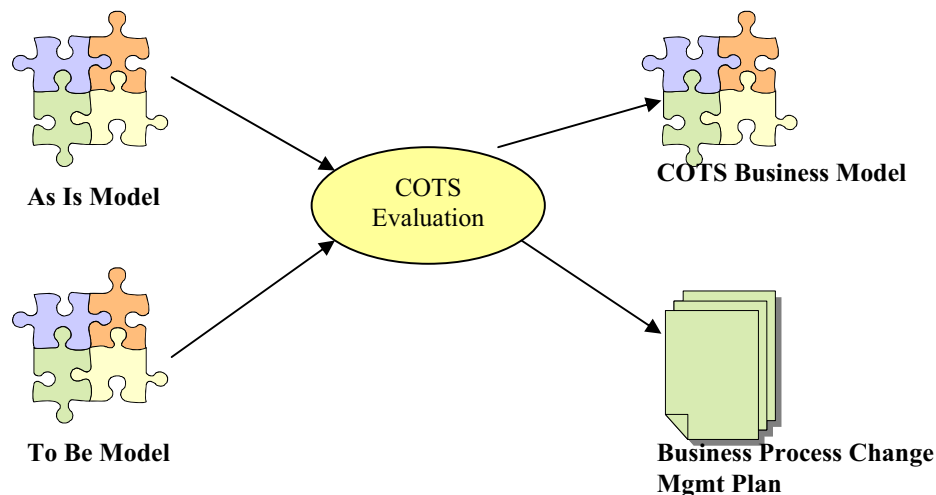


Fig. 1 COTS Business Modeling

- The above 'As Is' and 'To Be' models should be prepared purely considering the business requirements and independent of any consideration given to any of COTS solution in mind. This would be helpful in an effective evaluation of the correct product.

As COTS packages are defined as per a generic view of the end-user business processes implemented by the vendor, changes to the desired or target end user processes is unavoidable. Henceforth business analyst needs to carry out the activities of negotiating and co-ordinating the business process change with the end users. This would involve the following -

1. Evaluate the product or products based on the two models to identify which product can provide the best results with minimal changes to the desired To Be model.

### IV. REQUIREMENTS GATHERING

Parallel to the business modeling, activities of gathering and specifying requirements at a high level need to be carried out. For this, RUP process of organising the requirements is considered and more and more organisations seem to be using RUP. It is important to consider that requirements gathering can not be a linear activity for a COTS solution as suitable consideration needs to be given to the COTS product selected or to be selected. To some extent, the requirements gathered would form input towards selecting the product and in various aspects the vice versa happens, hence a well co-ordinated and thought out approach needs to be taken whilst gathering and specifying the requirements.

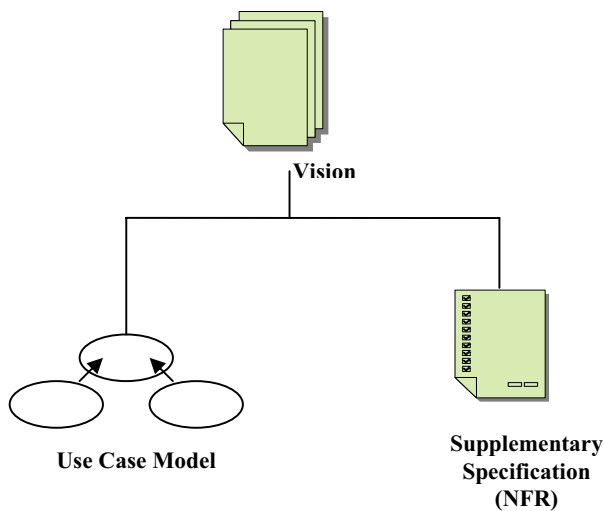


Fig. 2 COTS Requirements

**Vision:** Stating the stakeholder needs and features of the system. The vision document serves the basis of the discussion and agreement between the various primary stakeholders and represents the requirements in a short, abstract, readable and manageable form. The vision is written at a level of detail that is readily reviewable and understandable by the primary stakeholders of the project. It forms a basis for COTS selection along with other further detailed artefacts as discussed below.

#### Use-case modeling:

Once the Vision is agreed and signed off, the business analyst should abstract out of it a draft Use Case Model. Though not complete in all respects, the draft use case model could be of good value in elaborating requirements to an extent where it's beneficial in evaluating and choosing the right COTS solution. This model can subsequently be enhanced and corrected to match the actual implementation through the selected COTS solution.

**Functionally Significant Use Cases:** As in traditional built from scratch approach, architecturally significant Use Cases are of utmost importance, so in a COTS solution Use cases represent the critical functionality or put in other words, drive the solutions functionality, and are of utmost importance. The business analyst needs to identify the Critical and significant uses cases and detail them to an appropriate extent so that they can be used in evaluating the various COTS solutions. As obvious not all COTS options would fulfill the needs completely and there would be scenarios where:-

- COTS solution falls short in meeting the needs of the significant use cases. The impact this would have on the required solution should be determined.
- COTS solution operates differently from the behavior required in the significant use cases. Impact of trying to align the end user process to fit in this solution needs to be determined.

- COTS solution provides additional functionality that is not addressed in the use case model. Determine if these additional features adversely affect the end user business processes or do they provide an opportunity to optimise the end user business process.

**Use-case to NFR mapping:** This related to the non functional needs that a use case must fulfill. Use Cases (Critical Use Cases only here) need to be mapped to the non functional services that are required for their successful operation. These include mapping data persistence, security features, concurrency, transaction management etc to the use case. These Non functional requirements (NFR) are established and captured as part of Supplementary Specifications.

**Supplementary Specification:** The supplementary specification includes quality attributes required by the solution that are not specific to a Use Case. They characterise restrictions or constraints in the form of Non functional requirements and often represent standards and constraints that the organisational follows and hence the new solution should follow and comply to. These need to be determined in order to establish how the COTS solution fulfils these requirements. A solution that can meet all the functional requirements but doesn't fit in to the organisation's existing infrastructure and architectural framework can be outrightly rejected.

Once these requirements are captured and stated they need to form the next criteria for evaluating the shortlisted COTS solutions. As with Use Case evaluation the following scenarios would occur where:-

- The COTS solution operates differently from the behavior required in Use Case mapping and the supplementary specification. Determine and state how much impact this has.
- The COTS solution provides quality attributes that are additional to what is required. Determine if these additional attributes affect the requirements adversely or if they provide an opportunity to further optimise the required solution.

## V. PRODUCT SCREENING

An additional activity in COTS lifecycle that goes hand in hand is screening the shortlisted COTS solutions against a set criteria and rationale. We have seen whilst going through the previous sections as the COTS products needs to be evaluated against all the requirements artefacts from Business Models to the Supplementary specification. This section provides a synopsis of the activity and states its importance.

For a COTS implementation, the business analyst should establish a product screening document that captures a screening criterion according to the business case and organisational needs. It's against this document that the components would be evaluated, accepted or rejected and in

which all the evaluation that is carried out would be detailed. This document forms the justification and recommendation for the finally selected COTS solution.

- State the list of products shortlisted in the Business Case and the rationale behind the selection.

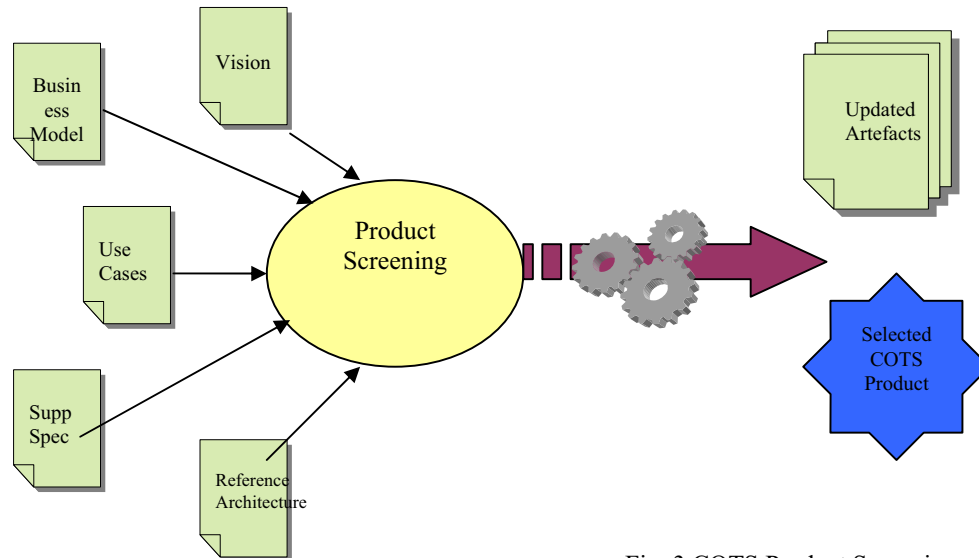


Fig. 3 COTS Product Screening

The Product Screening document should:-

- State the criteria for screening COTS products. This should be derived from initial details as captured in Business Case.
- State a set of critical expectations regarding COTS products such as
  - Interoperability to platforms, databases, etc.
  - How the new product should match to the already-existing components involving infrastructure, build processes, control models, data manipulation models, etc.
  - How the new product should fit in to already-existing components involving the patterns of interaction identified by protocols and other data communication characteristics.
  - What percentage of the requirements the product should initially meet in order to qualify as Good, Satisfactory, Not Satisfactory.
  - What weight age does each type of requirement carry in order to come out with a rationale in situations of conflict where the product meets one type of requirement more than another. E.g.: One product might be satisfying the Use Cases more but doesn't match the Non functional requirements, and another one could be matching the NFRs more than the Use Case.

- Reference the requirements artefacts as they are developed and state how the activities for evaluating the products against them need to be carried out.
- Record the details of product evaluation against each of the requirement artefacts. Record reasons for elimination of any product as you progress with the requirements gathering and evaluation exercise.
- Although not an activity for the business analyst, the short listed solutions need to be evaluated against a reference architecture document. Reference architecture would be a set of criteria that would determine how a solution could fit in within the context of organisational architecture and infrastructure, where and how does it align with the organisations IT strategy, how does it map to the existing infrastructure. Architecture evaluation would lead to similar scenarios which need to be captured and detailed:-
  - The components within the COTS solution do not have required interfaces or behaviors to link effectively into the architecture, with each other, with existing infrastructure, or to the broader organization's architecture. Determine the impact of not meeting these interfaces or behaviors and how it affects the required solution.
  - Certain components within the COTS solution might overlap with existing technologies already in use within the organisation. Determine the ease with which

- such functionality can be bypassed and the existing components which are in use still can be used.
- Components within the COTS solution provide additional interfaces not addressed in the architecture. Determine if these additional interfaces adversely affect the architecture or, in case they offer an opportunity to optimize the architecture.

VI. CONTINUING AHEAD

So now we have an initial set of artefacts and a chosen solution. This finally leads us to a confident situation where we know we have chosen a COTS product that matches the business needs and the IT needs to the best possible limits and where not what impact this product has on the requirements initially captured. By following the approach highlighted in the paper, one can thus eliminate the possibility of rushing into purchasing a COTS solution directly without verifying its true capacity and comparing with what's available in the market hence provides more confident and objective decision in choosing the right product that could meet the needs.

- which would run in context of the COTS solution and how it can implement the Use cases.
- 6. Software Architecture Document for the solution produced by the technical architect. This would contain the details of how the COTS product fits in to the architecture of the organisation, what communication mechanisms it uses, how persistence is managed, what are the security features and how they are achieved etc.
- 7. Also delving further into the elaboration and construction aspects of the solution, for COTS it's more an activity of configuring the COTS product to deliver the requirements rather than pure construction. Writing of interfaces and glue codes would need to be done where required.

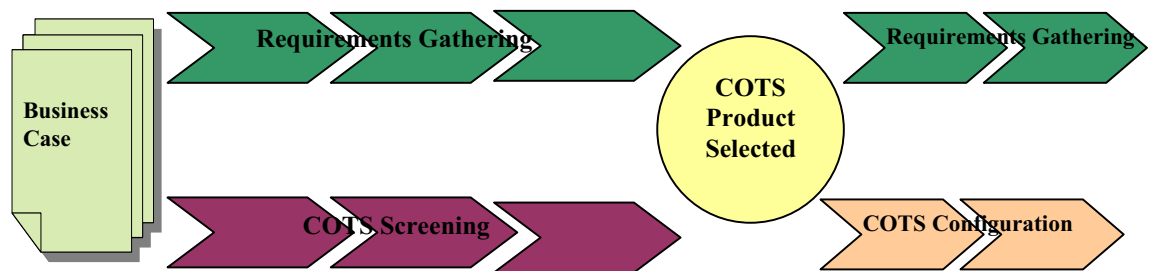


Fig. 4 COTS Business Analyses Process

Next step are to analyse the impacts and update the artefacts so that they truly reflect how the solution would be provided through the COTS product. Once the artefacts are updated further requirements analyses can be progressed keeping in view the chosen product and how it can meet them.

This would lead to:-

1. Updated Vision in case a compromise is made to a stakeholder requirement whilst selecting the product and to which stakeholder's have agreed.
2. Updated To Be Business Model reflecting the agreed change to end user processes as can be achieved through the chosen solution.
3. Updated Use Case model to illustrate how the COTS product would deliver the complete solution.
4. Updated Supplementary Specifications matching the capabilities of the COTS product.
5. Detailing of the Use Cases as per the new Use Case Model. This would involve stakeholder workshops

VII. CONCLUSION

The approach detailed in the above sections provides a basis for performing COTS requirements gathering and evaluation. Below table summarises the artefacts produced whilst carrying out the various Business Analyses Activities for COTS.

TABLE II COTS ARTEFACTS

#	Name	Description
1	Business Case	<ul style="list-style-type: none"> <li>❖ Provides justification for BUILD Vs COTS</li> <li>❖ Provides Parameters for COTS feasibility</li> <li>❖ Provides information on COTS Market Place</li> <li>❖ Details the financial implications</li> </ul>
2	Business Process Models	<ul style="list-style-type: none"> <li>❖ As is Model</li> <li>❖ To Be Model</li> <li>❖ COTS Business Process Model</li> </ul>
3	Business Process	<ul style="list-style-type: none"> <li>❖ Details the changes to the</li> </ul>

	Change Management Plan	desired business process model as enforced by COTS product selection.
4	Vision	❖ Details the stakeholders needs and required features of the system.
5	Supplementary Specification	❖ Details the Non Functional and additional requirements of the system.
6	Use Case Model	❖ Details the Use Cases, which describe the interaction between the system and the users.
7	Product Screening Document	❖ Details the evaluation criteria for the different COTS products and how each of the short listed product performs against it. ❖ Details the justification for selecting the COTS product.

The paper doesn't delve into the aspects of architecture and construction or that of Project management as these are as specialised areas that need due independent consideration as does business analyses for COTS needs. One of the things paper assumes is that RUP or rather the iterative approach adopted by RUP suits best a COTS implementation as it addresses the inherent risks that a COTS implementation carries. By adopting the iterative approach the high risk features of the implementation can be brought forward in initial iterations thereby addressing them rather than being struck by them all at once in the end by following a waterfall or any other approach.

#### ACKNOWLEDGMENT

“Author Puneet Dixit thanks Nick Foster and Keith Hurst of Landregistry of England and Wales for providing the opportunity to come up with a generic approach for analyzing, selecting and implementing COTS based solutions. Also thanks to Rajeeva Tiwari former colleague and consultant at Perot Systems for his support and review of the Paper.”

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