

CADs : Constraints, Assumptions (Risks, Requirements) & Dependencies

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Most business analysts have parts of their requirements documents dedicated to Constraints, Assumptions, and Dependencies (CADs). When risks are identified they are usually handed over to someone else to manage - mostly a project manager. In theory, Constraints, Assumptions, and Dependencies (CADs) play an important role in controlling organizational changes. In practice they are often reduced to a tool for shifting blame when things go wrong. "We got signed off on this," does not increase organizational success, doesn't make the process perfect.

We can adopt a practical way to address this: *restructure all constraints, assumptions, and dependencies as risks or requirements*. This has several advantages.

- **Realistic:** This approach accounts for uncertainty in a way that organizational changes rarely include guarantees.
- **Simple:** This approach consolidates five apparently distinct concepts into two concepts, and takes advantage of the processes most organizations have in place for controlling risks and requirements.
- **Easy:** This approach is simpler; this paper describes some practical rules that can be followed by anyone - even a novice with no understanding of the deeper implications.

Integrating a set of concepts into a simple heuristic seems like a tall order. The logic is clear, but it relies on having a common understanding of the concepts under discussion. Defining the characteristics of risk is the starting point.

1. Understanding 'Risks' More

Risk: a description of an event, with a probability of causing a decrease in value, to a stakeholder

The dictionary describes risk as "a situation involving exposure to danger." Breaking this down and filling in some implications:

- "a situation": An event or set of events, and the context in which they occur.
 - "exposure": Someone or something is exposed, so a person is involved. The person involved in the event is commonly called a "stakeholder."
 - "danger": The possibility - not certainty - that a stakeholder will be harmed.
- Simplifying and generalizing these ideas, results in a working definition of risk: "The possibility that an event might decrease value for a stakeholder."

One of the most important stakeholder groups for business analysts is the organization itself.

1.1 Responding to Risks

Stakeholders respond to risk through plans or actions that

- reduce the probability of the risk,
- reduce the impact of the risk, or
- prepare the stakeholder for the consequences.

In some cases, you are the stakeholder responsible for responding to a risk.

Business analysis plans are usually responses to the risks of broken communication, broken coordination, or broken collaboration. For example, consider the Business Analysis Planning and Monitoring knowledge area in the *Business Analysis Body of Knowledge® (BABOK® Guide)* version 2. This knowledge area defines what a practitioner of business analysis needs to understand and the tasks a practitioner must be able to perform to create effective plans. But why plan at all?

Task	Examples of why planning failure, and of failures to plan
1 Plan Business Analysis Approach	Poor coordination of overall BA activities with other stakeholders.
2 Conduct Stakeholder Analysis	Poor understanding of stakeholders well enough to communicate with those stakeholders.
3 Plan Business Analysis Activities	Poor coordination of specific BA activities with other stakeholders.
4 Plan Business Analysis Communication	Poor communication with stakeholders. Missed opportunities for collaboration with stakeholders.
5 Plan Requirements Management Process	Poor collaboration and coordination with decision makers.
6 Manage Business Analysis Performance	Inability to coordinate reactions to problems, opportunities, and constraints in the business analysis process.

In general, risk responses often develop plans and actions in five categories:

- **Prevention:** Eliminate the possibility or the impact of the event entirely. "Do not skydive" prevents "death by parachute failure."
- **Reduction:** Reduce the probability and/or impact of the event if it occurs. "Have backup parachute" reduces the risk of "death by parachute failure." "Use checklist" reduces the probability of "death by pilot error."
- **Transference:** Shift the lost value of an event to a third party.
- **Contingency:** Set aside resources to absorb value lost in an event; a 'rainy day fund' or 'bench strength'.
- **Acceptance:** Stakeholders may not make specific plans to address a risk. This is a reasonable approach when other responses are not feasible. If this is done through ignorance it is called "short-sighted". If this is done with *malice*, it is called "*misconduct*" or "*malfeasance*".

1.2 Risk Attributes

Attributes	Description
<i>Event</i>	A thing that happens, especially one of importance.
<i>Impact</i>	The expected non-zero decrease in value resulting from a possible event.
<i>Probability</i>	The chance that an event with an impact will occur in a given timeframe. The probability of a risk is always greater than zero (it could occur) and less than 100% (it is not guaranteed to occur).

<i>Timeframe</i>	The probability and impact of an event depend on the timeframe for the risk. For many risks, the probability increases to certainty as the timeframe increases. For example, one mediocre customer service interaction is unfortunate, but not damaging; three bad interactions might cost you the customer.
<i>Stakeholder</i>	The person or group who would experience the loss of value.
<i>Response</i>	A plan or actions to reduce the probability or impact of a risk.

A common, simplified way of expressing this is:

(Risk = Impact x Probability) or ($R = I \times P$)

Timeframes and **stakeholders** are usually implied, rather than stated, as you can see in the formula above. This may be acceptable, particularly if the context of the event has clear boundaries. Even so, it is important to consider who is affected and in what timeframes. Two stakeholders might see the same risk in quite different terms, while understanding the short- and long- term implications of risks will help to avoid wasteful over-preparation (analysis paralysis) and shortsighted decisions (penny-smart, pound-foolish). In this paper timeframes are formally identified, and the Organization is the stakeholder unless explicitly stated otherwise.

Notes on Risk Language

"**Positive Risk**" and "**Negative Risk**" are terms used with no general agreement on what the phrases mean. In most cases both are used to describe the possibility of causing an increase in value to a stakeholder.

Bottom Line

As long as 'risk' is used to refer to possible reduction in value, it is a potent tool for preparing for undesirable change. Avoid shortsighted decisions by considering who is affected, and the long-term and short-term implications of the risk; state the timeframe for this risk.

2. Understanding Assumptions

Assumption: a description of an event with severe impact but very low probability

Assumptions are commonly described as "things that are accepted as true or certain, without proof, or still not been approved." They usually refer to events that can be controlled by the people making the organizational change, so they generally refer to events that could affect the change itself. (Dependencies are more commonly used to describe conditions that must be true for the solution to operate after the change is complete. See the next section, "*Understanding Dependencies*" for more.)

In practice, assumptions are not statements of presumed truth that go unquestioned: they are used to identify events that would jeopardize the change the assumption is wrong. In other words, assumptions are poorly stated risks.

2.1. Assumption Attributes

Attribute	In Theory	In Practice
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Event	The assumption is incorrect.	
Impact	Significant to Severe (or why would you note it?)	
Probability	0% (true by definition)	Greater than 0%.
Timeframe	Eternal.	This Change.
Stakeholder	Organization	
Response	None (do not plan for things that will not happen).	Transfer the blame.

Assumptions are seductive because they embed a passive behaviour: the only rational response to a true assumption is to take no action. The way they are stated obscures the risk, and makes it easy to avoid planning any response. Worse, assumptions are usually within the control of the team making the change, so they should be relatively easy to control. Assumptions invite stakeholders to assume the risk instead of preparing a response because it is wasteful to expend effort preparing for something that is not going to happen.

This means that in practice, making assumptions is an unrealistic, high-risk behaviour. Yet the practice remains, so there must be some benefit associated with generating and recording assumptions.

Assumptions do not help deliver a solution with lower organizational risk, but they do provide a small degree of personal protection for the people making a change; they are a form of escape clause. When the event concealed in an assumption occurs - the "0% chance" turns out to be "greater than 0% chance" - the assumption is written proof that the change agents identified the event. You can tell the the person funding a project, "You signed off on this assumption."

Unfortunately, this does not unspend the time and money wasted in a failed change, and it does not do much for your reputation as a business analyst.

2.2. Addressing Assumptions

Assumptions about the Change

Most assumptions describe events that affect the process of making an organizational change. Reform these as risks, and manage them using normal organizational risk management processes. For example, add these risks to a project risk log, to ensure the project manager and sponsor know about them.

If your organization does not have standard risk management processes, create a risk log for the person sponsoring the change. Be very careful to avoid informally assuming responsibility for the risks in the log. The person who approves the requirements and the budget for the change *must* take direct responsibility for these risks, or formally delegate that responsibility. If this person does not take responsibility, they cannot make informed decisions about the change and the organization.

If you find yourself with formal responsibility for managing these risks, do not panic. There are extensive resources online to guide you in basic risk management practices, and you will be in a much better position to deal with problems. Assumptions are low-probability, high-impact risks, so it is often reasonable to assume the risk or to set aside some contingency to deal with the impacts if the event occurs.

Assumptions about the Solution

Some assumptions may describe events that affect the solution as it is being changed from the current to future state. These may be better restructured into transition requirements than risks. In these cases, the response is restructured into a requirement statement. The impact and probability become part of the measures of the requirement. An example of this transformation is found below, in *Understanding "Dependencies"*.

2.3. Bottom Line

Assumptions are risks made risky; if you're going to manage risks, have this authority formally delegated to you. Otherwise, assumptions provide a way to transfer blame while obscuring opportunities for real risk responses.

3.0 Understanding Dependencies

Dependency: a description of an event that would halt a change or invalidate a solution

Dependencies are conditions that are necessary for a desired event to occur. If the dependency is not fulfilled, the impact is catastrophic: everything that needs it will fail. Unlike assumptions, dependencies do not imply any particular certainty that they will be fulfilled. Dependencies often describe events that are outside the control of the people making a change.

3.1. Dependency Attributes

Attribute	In Theory	In Practice
<i>Event</i>	The dependency is not fulfilled.	
<i>Impact</i>	Show Stopper.	
<i>Probability</i>	Unstated. Varies.	Greater than 0% to Inevitable.
<i>Timeframe</i>	Unstated. Varies.	This Change.
<i>Stakeholder</i>	Organization	
<i>Response</i>	Control the dependency if possible. Assume the risk if control is not possible.	Transfer the blame.

Many dependencies are subject to inevitable, occasional failure: power outages and earthquakes are a examples. These events may be predictable in the sense of '6 hours of power failure per year' - but the actual seconds and minutes when the power will be off cannot be known in advance.

3.2. Dealing with Dependencies

Dependencies are useful for defining critical paths for the change or the solution. Unfortunately, they are usually stated with no consideration for probability or timeframes. Dependencies related to making the change are usually simple to restate as risks. Other dependencies can be more complicated to deal with, but can usually be stated as some form of non-functional requirement.

Dependencies, Plans, and Risks

When planning a change, dependencies are used to define the sequence of events, if not the actual dates for those events. For example, a product line cannot go into mass production if it has not been approved,

so approvals are a dependency. Dependencies are necessary, so a missed dependency will halt a change.

In many cases, a dependency has very low probability of failure in the timeframes under consideration. For example, an organization with a mature Agile development practice is very likely to have requirements approvals happen in a timely manner. In this situation, the dependency hardly recognized as such, and is simply incorporated into the plans. In a less mature organization, the approver might frequently be 'too busy' to review or sign off requirements. In this case there is a high probability that the change might be delayed for weeks or months for lack of a signature. The sequence that is noted in the plans is still valid, but the timeliness of approvals should be noted as a risk, and managed appropriately.

Dependencies and Requirements

When defining a solution, dependencies define key relationships between solution components, or between the solution and the context. Consider these using the example of an online store, with solution components including a shopping cart and a catalogue. The shopping cart depends on the catalogue, since there is nothing to put in the cart until the catalogue has items in it. If the Marketing Group is responsible for the catalogue and the e-Commerce group is in charge of the shopping cart, the e-Commerce group would see the catalogue as a dependency. Considering the entire store, and the things it must have to operate, exposes other dependencies, such as a functioning internet connection and working online payment system. In this scenario, these are both external dependencies for the entire solution. They are outside the direct control of the people responsible for the solution.

If the e-Commerce Group starts an IT project to upgrade the shopping cart functionality, they might identify many dependencies. Many are better stated as requirements than as risks. For example, consider the dependency on having at least one item in the catalogue, stated as a risk:

1. The Catalogue must have products for customers to select.
 - a. Event: Catalogue has no products for customers to select.
 - b. Impact: Showstopper
 - c. Probability: Very Low
 - d. Stakeholder: Organization
 - e. Timeframe: Duration of the Online Store
 - f. Response: A typical response to this risk would be for the e-Commerce project to contact the Marketing Group as project stakeholders, and let them know that the dependency exists.
- But what happens if the e-Commerce business analyst restructures this event as a requirement? It might look something like this:

1. Requirement: Online Store displays Products from the Catalogue.
 - a. Description: A customer browsing the Online Store is presented with Products from the Catalogue.
 - b. Priority (Impact): Critical
 - c. Probability: n/a
 - d. Stakeholder: Marketing Group, Customer
 - e. Timeframe: Duration of the Online Store
 - f. Type: Interface Requirements
 - g. Measure: All queries to the Catalogue return ≥ 1 product
 - h. Error Conditions:
 - i. Catalogue returns no products: *See System Recovery Requirements.*
 - ii. Catalogue not available: *See Business Continuity Plans*

By formulating the dependency as a requirement (or set of requirements) the project team and the organization can develop effective processes and tools for handling failure.

Next, consider a more complex dependency, converted to a risk. In this case, structuring it as a risk is quite misleading:

- a. Payment Gateway can complete transaction requests from the Online Store
- a. Event: Payment Gateway cannot complete transaction requests from Online Store
- b. Impact: Showstopper
- c. Probability: Very Low (all systems have 99.99% uptime, or better)
- d. Stakeholder: Organization
- e. Timeframe: Duration of Online Store
- f. Response: As stated, this risk appears to be quite unlikely. Some contingency in the project should be sufficient, along with a reasonable Service Level Agreement from the folks maintaining the various systems.

Restating this as a set of requirements, we see a very different story:

2. Requirement: Customer can complete payment for product.

- a. Description: All systems between the Customer and the Payment Gateway are functional. This requirement does not consider payment problems originating with the Customer, such as insufficient funds or a loss of personal internet access.
- b. Priority (Impact): Critical
- c. Probability: n/a
- d. Timeframe: Duration of the Online Store
- e. Type: Reliability Requirements
- f. Measure(s): Outage time $\geq 1\text{h}:15\text{m}$ per year (see below)
- i. Online Store Uptime: 99.999% = 4m15s Outage/year
- ii. Catalogue Uptime: 99.999% = 4m15s Outage/year
- iii. Payment Gateway Uptime: 99.999% = 4m15s Outage/year
- iv. Inventory Uptime: 99.999% = 4m15s Outage/year
- v. Internet Uptime: 99.990% = 52m36s Outage/year
- g. Error Conditions: ...

This requirement, though incomplete, is likely to provoke a very different response from the organization. The risk version of the dependency could be stated in a much more robust manner, with additional statistical analysis, but many organizations do not have the capacity to address risks at that level of complexity. Practically, the same robust response can be achieved by using the processes already in place for managing requirements.

Certainty and Requirements

Requirements usually presume a timeframe that lasts as long as the solution, rather than the duration of the change. This means that dependencies end up stated with the assumption of certain failure and the necessity of a systemic response. Responses are built into the solution and the organization, instead of relying on management decisions.

3.3. Bottom Line

Depending on the nature of the dependency, restructure it as a risk or requirement. If it is helpful to call out the dependency for the attention of decision makers, do so - but try to maintain a link to the risks and requirements that were driven by the dependency.

4. Understanding Constraints

Constraint: a description of an event with severe impact and very high probability

A constraint is something limits options. Limits set boundaries on value, but they do not inherently increase or decrease value. For example, a solid, stable foundation limits your options when renovating a house - while making it possible to build a solid, stable structure; a federal regulation might make it illegal for your organization to share customer information across divisions, making it hard to provide good customer service experiences - and protecting consumer privacy. In these senses, "constraint" encompasses the second part of the definition of a requirement in the *BABOK® Guide v2*:

A condition or capability that must be met or possessed by a solution or solution component to satisfy a contract, standard, specification, or other formally imposed documents.

Constraints are said to 'encompass' requirements because they are broader than requirements in several respects:

- Constraints may not be represented, or even be known. For example, casinos took advantage of loss aversion long before the concept was invented.
- Constraints may not be formally imposed. For example, no person imposed seasons or lifespans; at most, people have named them.
- Constraints may refer to experiences and characteristics of a stakeholder, in addition to conditions or capabilities. For example, the religion of a stakeholder group often constrains the solutions that are valuable to that group.

In many requirements documents, constraints are noted alongside assumptions and dependencies - often in the front sections. The people who actually build solutions based on requirements have a tendency to "skip past all that useless stuff" to "get to the things I need to work on." (Quotes are anecdotal, drawn from a decade of being a coder, working with coders and engineers, developing business analysis templates and measuring their use, and many conversations at business analysis events across North America.)

4.1. Constraint Attributes

Attribute	In Theory	In Practice
<i>Event</i>	The constraint cannot be satisfied.	
<i>Impact</i>	Severe to Sudden Death.	
<i>Probability</i>	0% (Constraints must be satisfied)	Varies from 0% to <100 nbsp="" td="">
<i>Timeframe</i>	Varies.	Varies.
<i>Stakeholder</i>	Organization	
<i>Response</i>	Prevent, Reduce, or Transfer the risk.	Varies.

The probability of satisfying a constraint varies because it depends heavily on the situation. Unlike risks, some constraints are fundamental aspects of reality or of humans, and as such they will be satisfied. Any change or solution that attempts to violate these constraints will fail to the degree that it does not conform to reality.

It is important to note that many constraints may appear to be fundamental aspects of reality when they are actually social conventions, expectations, economic theories, ingrained perspectives, learned responses, federal regulations, or other negotiable or flexible limits. In each of these cases risk event may be prevented not through a change in behaviour, but by a change in perspective on what the limits really are.

4.2. Considering Constraints

Constraints share many characteristics with assumptions and dependencies. Like assumptions, constraints are known to be true - though constraints are more likely to be based on evidence or experience, rather than belief or desire. Like dependencies, constraints have a wide range of probabilities - though it is never certain that a dependency can be satisfied, and it is sometimes certain that a constraint will be satisfied.

When considering how to allocate a constraint, look for the characteristic that makes the limit inevitable or unchangeable. Is it really impossible or impractical to alter the constraint? If there is wiggle room, carefully consider the implications: there may be a significant opportunity for your organization. For example, you might be able to negotiate with the regulator, to pivot the business, or write off the sunk costs of antiquated hardware.

If the constraint is a solid limit, restate it in much the same way you restate a dependency:

- If the limit affects the change itself make plans to tailor the change, or redefine the constraint as a risk. Compliance to a mandatory template that does not apply to the current change is a common example of an opportunity for tailoring.
- If the limit affects the solution, it should be restated as a requirement with the highest possible priority: at the first sign that the requirement will not be met the entire change effort should be halted and re-evaluated.

This investigation may appear to take you far afield - into politics, behavioural psychology, cultural expectations, or historical trends. As a business analyst, you may be the only person in your organization who ever considers these things at all. This pursuit should not occupy much of your time - the results will often be that it is impossible or impractical to alter the constraint. This pursuit should occupy some of your time - the results will occasionally create a market opportunity, or erase a barrier that holds back your competitors. For example, some universities have realized that their traditional structures were largely based on the high cost and difficulty of delivering specialized information to a large number of students. With ubiquitous access to the internet, this is no longer a real constraint; it is a historical artifact. When these constraints fall, incumbent organizations often struggle to adapt, and many fail.

Organizations like the Khan Academy (<http://www.khanacademy.org/>) or Lynda (<http://lynda.com>) have had significant impacts on traditional schools - to the extent that many top-tier universities are now putting much of their undergraduate programs online for free. Sometimes ignoring them can actually shut down business permanently. Previously in India there used to be porters in the Airport & the same has been extincted now because of trolleys & escalators.

This technique is particularly valuable for business analysts working in strategic or enterprise portfolios, but it has value for all business analysts in every domain.

4.3. Bottom Line

Constraints are limits - but some are limits to you organization's vision, or ability to adapt. Test these limits enough to understand if they are absolute, or an opportunity to differentiate and deliver surprising value. If they are, restate them as requirements. Otherwise restate constraints using the same approach used to restate dependencies.

5.0 Action! A Simple Heuristic

Most organizations have structures in place to handle risks and requirements, but lose track of constraints, assumptions, and dependencies until it is too late. Working within existing organizational processes, reallocate each of these to risks or requirements. If you are responsible for dealing with the risk, you may also formulate a plan to respond to the risk.

5.1 Key Attributes of CADs

Factor	Impact	Probability
Assumption	Significant to Severe	> 0% to < 100%
Dependency	Show Stopper	> 0% to 100%
Constraint	Show Stopper	0% to < 100%

5.2 Allocation Options

CAD Focus	Allocate to	Rationale and notes
Change	Risk	<p>Redefine the CAD as a risk so a response can be defined and managed using organisational processes.</p> <p>Stakeholders affected by the CAD are more likely to understand the impact and make informed decisions.</p> <p>If you have direct control over the response, define a plan for that response along with the risk.</p> <p>Improves quality of ongoing relationships with stakeholders in positions of power.</p>
Solution	Requirement	<p>Redefine the CAD as a requirement so the people building the solution can address it using organisational processes.</p> <p>Stakeholders in the requirement are more likely to understand the impact and make informed decisions.</p> <p>Improves quality of relationships with stakeholders who build and test the solution.</p>

5.3 Organizational Process Assets

Most business analysts are constrained by established standards, processes, templates, and expectations. For example, your organization may demand that you complete a requirements document with constraints, assumptions, and dependencies.

As a business analyst, you should take the attitude that rules exist so you think before you break them (*Thief of Time*, Terry Pratchett). Use your business analysis plans - particularly your Business Analysis Approach - to define how you will tailor or alter your use of these parts of the standard template. When you socialize your Approach with your stakeholders, remind them that these sections will be in the

document, but with the statement that "The contents of this section have been allocated to risks or requirements, as appropriate."

If you meet resistance to this level of tailoring, do what you do best: ask difficult questions in ways that do not get you fired. When a CAD is discovered in an elicitation session, ask for the probability and timeframe, and the impacts and stakeholders. With a little practice, you'll find your stakeholders demanding that the CAD be put someplace useful, like a risk log or requirements.

If you practice business analysis in an enterprise perspective, you will find yourself talking about 'objectives' and 'goals' more than requirements - but the rationales and processes for handling them are the same.

6.0 Conclusion

A significant part of effective business analysis work is finding ways to represent information in a manner that will help stakeholders be most effective. Converting constraints, assumptions, and dependencies into risks or requirements is one way to help ensure that your stakeholders can make immediate use of this information, using techniques that are familiar to them. You can take advantage of this translation overtly, by adjusting your business analysis processes, and updating your business analysis approach - or subtly, by asking questions and rephrasing. In this sense, CADs and CARRDs can be used to shift blame by avoiding the risk entirely, instead of by saying, "You signed off on this."