Chapter 2
The Input-Transform-Outcome (ITO) Model of a Project

2.1 Issues with Current Project Management Methodologies

The need for a new project framework emerges from various issues and criticisms related to current project management methodologies (especially those raised by the research community), as outlined in the following discussion:

1. *The neglect of project benefits*. Existing project management methodologies are primarily concerned with output delivery, often neglecting outcome and benefit achievement (Dvir, 2005; Fraser, 2003). As a result, many organisations have become preoccupied with *efficient* output delivery (for example, by completing projects on time) instead of *effective* outcome generation (by seeking to generate desired outcomes). Benefits (defined as the flows of value that arise when desirable outcomes are achieved from a project), are in turn neglected (because they too are related to project effectiveness rather than project efficiency). The methodology proposed here not only highlights the central role of project benefits but also identifies processes that contribute directly to their successful achievement.

2. *Scenario-specific frameworks*. An analysis of the approaches adopted by various professional organisations reveals major differences in processes and terminology across industries and cultures. For example, the information technology sector has developed particular project management methodologies and an associated lexicon. Moreover, formal project management roles, such as "planners" and "estimators", are widely accepted in the construction sector, but not recognised in other industries. Cultural diversity has also triggered the development of unique project management methodologies in various societies. This suggests that current project management methodologies have to be adapted to different project scenarios because they are not generic and lack robustness (see also Dvir, Sader, & Pines, 2006). We propose in this book a rigorous project management framework that can be applied in all project contexts, while remaining flexible enough to accommodate the peculiarities of each project.

3. *Inconsistent and incomplete terminology*. The terms used throughout the project management profession have not been standardised. As well as different words being used to identify the one concept, particular terms are also used to identify unrelated concepts. For example, the "project customers" in the service sector, are usually called "end users" in the information technology sector, while "sponsor" can refer to any of a number of stakeholders such as, funder, owner and champion. There is also considerable confusion with use of "outcome" and "outputs" in various sources (Nogeste & Derek, 2005). All the terms used throughout this text have the meanings offered in the integrated glossary provided as Appendix B (Box 2.1).

As part of the attempt to develop a rigorous (but flexible) theoretical framework, we propose conventions and rules for the consistent labelling of the terms and concepts we use. One of these conventions involves *word structure*, particular rules governing the way that terms are labelled. For example, outputs are labelled with nouns ("a new business process", "a new bridge") while outcomes are usually labelled with participial adjectives ("increased sales", "reduced incidence of domestic violence").

The following sections describe an approach which we claim not only addresses these issues, but a number of others as well.

Box 2.1 Concerns about Project Management Theory

From the Literature

Many scholars criticise current project management methodologies and the lack of a robust theory. For example, Shenhar and Dvir (1996) argue that "most research on the management of projects is relatively young and still suffers from a scanty theoretical basis and a lack of concepts". Meredith (2002) claims that the project management literature is often characterised by non-rigorous research methods and frameworks that are unrelated to previous work. Various reasons for the relative immaturity of project management theory have been proposed. Specific criticisms include claims that the literature has been practitioner-driven (Jugdev, 2004) and reliant on "war stories" (Meredith, 2002), extensive use of normative (rather than positive) approaches, and appeal to lists of factors derived from surveys of project practitioner opinions, rather than empirical research grounded in theory (Packendorff, 1995). Bygstad and Lanestedt (2009) support this claim view by noting that project management methodologies are rarely used "as is" in Germany and Switzerland, but usually modified or adapted before application. Increasingly, there have been calls for improved theory generation through research designs that build on existing literature to develop models for rigorous, evidence-based testing in industry (Meredith, 2002).

2.2 Projects as Processes

All work (both project and operational) can be viewed as a collection of processes. A process is a structure of activities that produce an identifiable output. An output always takes the form of an artefact. Examples come readily to mind: a new insurance policy, the Sydney Opera House, a fishing licence, the prototype of a new chemical pump, a reengineered procurement process or an order (placed on a supplier). Because outputs, also known generically as *deliverables,* are artefacts, they are always labelled with nouns. In some cases, outputs take the form of a change to an existing artefact. Consider a process that will see the personal details of an insurance policy holder updated. That output would be appropriately entitled "Updated policy".

A closer look at the illustrative list of outputs given above suggests that they emerge from processes of two kinds: those that will be done only once and those that will be repeated. Projects are unique processes, while business operations are repeated. Processes of both kinds share many characteristics: they consume resources, involve work that can be systematically described by some sort of script and they produce outputs. Despite this similarity, distinct frameworks of management have evolved for projects and business operations.

Frameworks for managing projects (rather than operational processes) are the focus of this book. It will become clear that, because these frameworks involve significant work and resources of their own, their suitability for the management of "day-to-day" processes is problematic. Instead, "business-as-usual" processes yield to different approaches, collectively described as *operational management*.

Operational processes and projects differ in many respects, one of the most important of which concerns "change". Not only are projects intended to introduce specific, defined, targeted change into the world, but the extent to which this actually happens determines whether a project was successful. By way of contrast, operational processes are, in a sense, intended to maintain the status quo. Because different frameworks of management have evolved in business for the two classes of process, the question arises "under what circumstances is it appropriate to execute a process under an operational management framework, and under what circumstances is a project management framework required?". The following test is proposed. If the work being undertaken already has a reliable, comprehensive script, then we would execute it according to that existing script—in other words, as a business process. Reliable scripts can only be obtained by refining them over many repetitions of the same piece of work. For example, in many jurisdictions, the registration of a new car is described in a detailed script that has been developed progressively by state road authorities over long periods of time. On the other hand, an exercise to re-engineer the registration process (and, accordingly, introduce major changes into the existing script) is a unique exercise and so should be managed as a project.

If a script does not exist, then the piece of work can be executed in only two ways: by writing a (somewhat tentative) set of instructions, which is then followed

during execution or by "making it up as you go along". Writing a script for a novel piece of work is, in fact, the foundation of *project planning*. Because we do not really expect that a new script (especially if it is assembled *ex nihilo*) will be correct in every detail, it is necessary to monitor its execution (to detect any errors) and then correct it whenever it is found wanting. Monitoring and correcting a tentative script for a process is the foundation of *project management*.

Now what about "making it up as you go along"? This implies execution without a script. In general, the more important the work the less attractive this approach, however anecdotal evidence suggests that very small pieces of work (such as taking a phone call) are best handled in this way. Such processes are identified here as ad hoc *tasks*.

From this perspective then, processes can be categorised into three, according to the particular set of "management rules" we use to guide their execution:

1. *Business (or operational) process*. If a piece of work has a reliable script, run it as a business process (using the practices of operational management). Operational management practices are generally applied to repeated, "relatively complex" processes.
2. *Ad hoc task*. If a piece of work has no script and it is "small", execute it as an ad hoc task (by making it up as you go along). Treatment as an ad hoc task is suited to all "relatively simple" processes, regardless of their novelty.
3. *Project*. If a piece of work is "large" and has no script, run it as a project (using the practices of project management). Project management practices are suited to novel processes and become more effective as the complexity of the work increases.

To apply these rules, it is not necessary to define "complex", or "small" because their role is not to classify work, but to simply guide the selection of an appropriate management approach.

Figure 2.1 suggests a mapping from process novelty and complexity to an appropriate choice of management regime. It should be noted that neither axis in this diagram has a defined measure and so it is purely indicative.

Fig. 2.1 Classifying the management of work according to its novelty and complexity
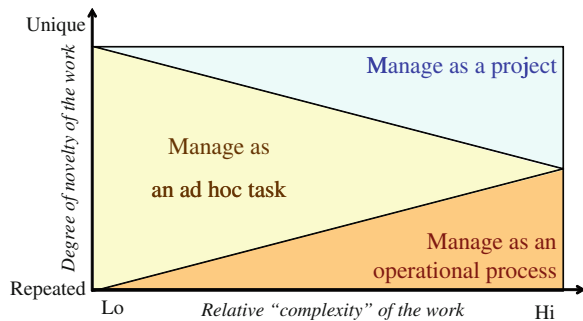
2.3 Modelling the Project as a Process

This section describes the "conventional" Input-Process-Output (IPO) model, (which underpins many project management methodologies), discusses a shortcoming of this approach and presents the foundations for the extended project methodology that follows. In the course of this discussion it becomes necessary to consider a number of entities who have various "interests" in the project, otherwise known as stakeholders. A more comprehensive discussion of stakeholders is provided in Sect. 4.5 in Chap. 4.

2.3.1 The Input-Process-Output Model

We have noted that projects are a subset of processes. As the work of a project is executed, it consumes economic resources, generically identified as *inputs*. For convenience in this discussion, resources are divided into two categories: the labour (of the project team) and the money (outlaid to obtain all purchased-in resources).

When linked in a diagram, inputs, processes and outputs provide us with a simple but extremely potent conceptual view of a project. The relationship among these terms is known as the Input-Process-Output (IPO) model. This model (used extensively in the operations management arena) is shown in Fig. 2.2.

All processes (including ad hoc tasks, business operations and projects) have an underlying IPO model. The IPO model implies a chronology (left-to-right) where, in turn: resources are made available for the work of the project, the work is executed to produce certain outputs and those outputs are then delivered to the outside world. The IPO model itself also figures prominently in project management methodologies themselves, such as the Project Management Institute's Project Management Body of Knowledge (PMBOK) where each of 42 recognised project management processes is described in terms of: the required "inputs" for its effective execution, the expected "outputs" from this process and the "tools and techniques" to guide the process (Box 2.2).

Fig. 2.2 The input-process-output (IPO) model of a project
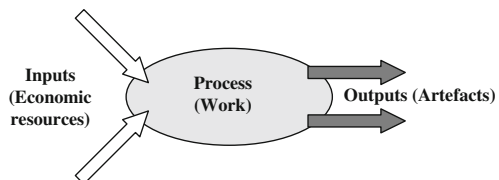
Box 2.2 "Everything is a Project"

A Popular Confusion

It is common to hear the claim that "Everything is a project", with the implication that all of the frameworks and protocols surrounding a project should be applied to all work. Sometimes this is taken even further, with organisations embarking on rather problematic initiatives to "projectise" all their operational processes.

A little thought reveals that, although usually well-intentioned, exercises of this kind do not make a great deal of sense. Take an initiative to outsource an organisation's IT services. This (obviously large) exercise demands, amongst other things, that a business case be tabled so that the work (and expenditure) involved can be approved. (As will be seen in Chap. 4, a business case contains all of the essential information so that a reliable decision can be made about funding the exercise). *Tabling a business case* is therefore an essential element of approval for doing the work of a project. Consider, by way of contrast, the work involved in processing a customer's trolley at the checkout of a supermarket. It would be a cause of some surprise if, on arrival at the checkout, the staff member announced that it would be necessary to have a business case approved before serving you! Clearly, unlike projects, repeated operational processes do not require approval whenever they are executed. (This general proposition is in no way weakened by the fact that, at some time in the past, there may well have been a project to design the current checkout process and that this project had a business case).

And yet, both forms of work are (at least in certain critical respects) similar—they consume resources, demand work and produce outputs. Therefore, both have an IPO model. Presumably, we could extend this list of shared features even further to include many other components such as a framework of risk management. So what can we conclude from this similarity? All we can infer is that regular day-to-day business operations and projects are both examples of *processes*. In other words, *all work is a process*. Clearly although "business-as-usual" is a special case of a process, and a project is a special case of a process—the conclusion (that everything is a project) is false.

Now having said all that, it does indeed make a lot of sense for organisations to formalise the frameworks of management they use for their routine processes, but in doing so they should be more concerned with "operationalising" these processes rather than "projectising" them.

2.3.2 Outputs and Outcomes

Outputs are produced by the work carried out during the execution of a process and are of two kinds:

1. *New artefacts*, where none existed before (such as a bridge over a river).
2. *A change to an existing artefact*, such as a refurbished office building. For ease of identification, we label this particular class of output as an "alterant" (although the term has no particular analytical significance).

Clearly, this is not a dichotomy because, given enough changes, any existing artefact can eventually be treated as new. The word "new" is understood (even if it is not used explicitly) as suggested by examples such as: house, bridge and report. Examples of alterants are: repainted house, repaired bridge and amended report.

Outputs can be viewed as an important *result* to emerge from a project, but an even more important class of result takes the form of the end-effect generated as a consequence of the implementation of those outputs. Such results are called *outcomes*. Although outcomes are not displayed in the IPO model, they represent the very reason for producing outputs, and hence bear further discussion. Outcomes can be grouped in various ways. One important classification indicates whether the outcome is desirable or undesirable. Desirable outcomes can be further categorised as targeted or fortuitous. *Target outcomes* are consciously sought at the outset and represent the rationale for funding the project. *Fortuitous outcomes* are desirable end effects that emerge from a project despite not being targeted.

Target outcomes can be isolated with three simple questions:

1. What is the project's purpose?
2. Why is each of the project's outputs being produced?
3. What end result is the funder (the person approving the allocation of resources to the project) expecting from the exercise?

Consider four illustrative projects: the construction of a new office block, the drawing up of a supply contract with a major customer, the re-engineering of an existing business process and the development of a prototype chemical pump. In each case a rationale for the work involved can be uncovered by asking the questions posed above. An office block may be built to generate a flow of rental revenue. A contract may be drawn up to reduce the risk of supply interruption or price uncertainty. A business process may be reengineered to lower operating costs. A prototype pump may be developed (and evaluated in service) so that a decision can be taken on releasing a new product to the marketplace.

We now draw a subtle, but critical, distinction between the concepts of "tangibility" and "measurability". While an output is always a tangible artefact, an outcome is always a measurable effect. Tangible means, "can be touched", and so

Table 2.1 Outputs versus outcomes

Characteristic	Output	Outcome
Intent	What is to be delivered?	What is the objective?
Form	Artefact	Measurable end effect
Specification	Establish critical features and characteristics	Set seven attributes (characteristics)
Labelling	Noun	Participial adjective
Creation mechanism	Production or delivery	Generation or realisation
Certainty	Production can be guaranteed	Generation cannot be guaranteed
Manageability	Production can be controlled	Generation can only be influenced
Measurement	Through critical features and characteristics measured in quality tests	Through one or more agreed measures with agreed units and dimensions
Tangibility	Outputs are tangible	Outcomes are intangible (but measurable)
Appearance	Impossible without execution of process	In certain cases possible, even if process is not executed
Lead time	Available immediately after process is executed	In general, delayed until after execution of the process

tangibility is a required attribute of an output. Measurable means "can be measured" and is a required attribute of a target outcome. However, because they are end effects (rather than artefacts) outcomes are not tangible. Outcomes can always be expressed as a change in the value of a variable associated with an end-effect, for example: "reduced waiting times", "increased market share" and "compliance with new legislation". Table 2.1 summarises the differences between outputs and outcomes.

For reasons discussed further in Sect. 2.4, outputs have a high degree of certainty (whereby it is reasonable to assume that, if technically feasible, they will, in due course, appear), while outcomes are characterised by uncertainty (because, in particular situations they might not appear). These differences are reflected in the terminology we use where outputs are (variously) *produced*, *delivered* and *implemented*, while outcomes are achieved, generated or *realised*.

In general, different stakeholders view the same outcomes from a project as having different values. "Value" in this sense equates to a level of desirability. If an outcome is judged as having a positive value, it is called a benefit; if it is negative, it is called a disbenefit. (It is possible, of course, that one outcome from a project could be viewed as a benefit by one stakeholder and as a disbenefit by another). As is discussed later, outcomes and benefits are distinct but intimately related, because outcome generation drives benefit generation.
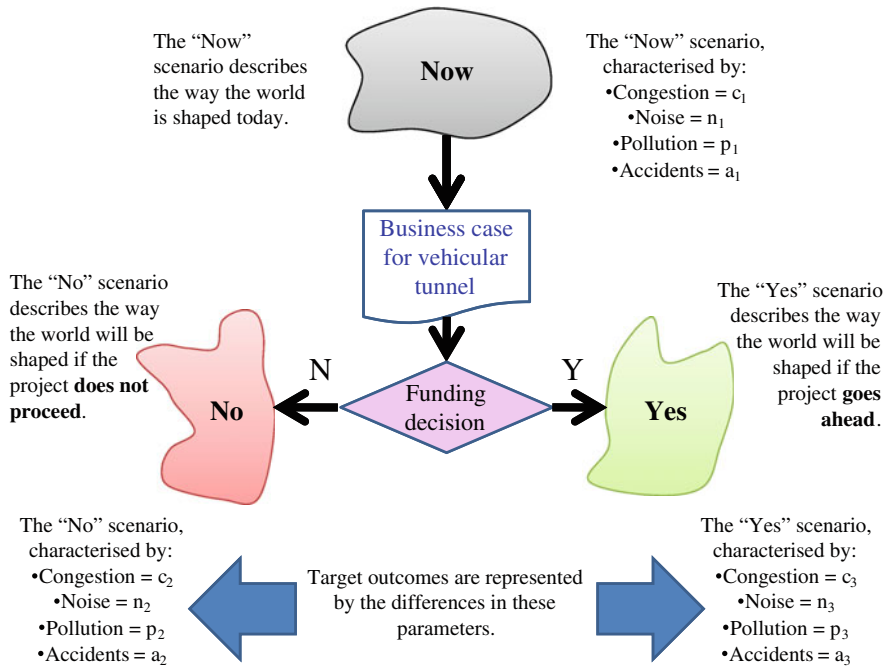
2.3.3 Target Outcomes

To understand why target outcomes can usually be entitled using participial adjectives ("increased …", "decreased …" and so on), a more detailed discussion is required. Consider a project that is being promoted to reduce traffic volumes in a city's Central Business District. As proposed, the project's outputs include a cross-city tunnel, changes in the configuration of existing city streets, a tolling system, a suite of management/maintenance processes and a new business unit to operate the facility. Three scenarios surround this project, each one describing how the world might be shaped (or at least that part of the world relevant to the project):

1. A "*Now*" *scenario*. Describing the current position in which we now find ourselves. This relates to the present state of affairs, characterised by the actual values taken by certain measurable variables-of-interest such as congestion, noise, air pollution and pedestrian accident rates.
2. A "*Yes*" *scenario*. Describing a future position in which we would like to find ourselves if the funder approves the project. This relates to the desired state of affairs, where the same four variables would take on targeted (and presumably different) values in response to the project being approved and completed.
3. A "*No*" *scenario*. Describing the future position in which we would find ourselves if the funder rejects the project. Like the other two, the "No" scenario would also be characterised by peculiar values for each of the four variables. These values could well be different to those found in either of the other two scenarios.

In summary then, there are potentially three different values ("Now", "No" and "Yes") for each of the four environmental measures (congestion, noise, air pollution and pedestrian accident rates). Figure 2.3 illustrates the relationships amongst the three scenarios for the vehicular tunnel project.

Target outcomes are the differences in those variables selected to characterise the "No" and "Yes" scenarios. It is important to note that the target for a desired outcome is found as the difference between "No" and "Yes", it is not found as the difference between "Now" and "Yes".

In light of this definition, outcomes are not time-related effects. In other words, "reduced pollution" does not mean (necessarily) that pollution levels will fall because of the tunnel, it means that they will be less than the levels experienced had the tunnel not been built. Counter-intuitively, it is quite conceivable that the project is outstandingly successful even though pollution levels have actually risen. Despite this, in practice, project participants will often express desired outcomes as the difference between the "Now" and "Yes" scenarios (Thus creating the illusion of a time-based target outcome). When this happens they usually assume that without intervention, the "Now" scenario will remain, eventually unfolding as the "No" scenario. There will be circumstances where that is a reasonable expectation, but there will also be situations where the "Now" scenario is better used as a surrogate for the "Yes" scenario. Consider a car maker who

The "Now" scenario describes the way the world is shaped today.

Now

The "Now" scenario, characterised by:
- Congestion = c_1
- Noise = n_1
- Pollution = p_1
- Accidents = a_1

Business case for vehicular tunnel

The "No" scenario describes the way the world will be shaped if the project **does not proceed**.

N

No

Funding decision

Y

Yes

The "Yes" scenario describes the way the world will be shaped if the project **goes ahead**.

The "No" scenario, characterised by:
- Congestion = c_2
- Noise = n_2
- Pollution = p_2
- Accidents = a_2

Target outcomes are represented by the differences in these parameters.

The "Yes" scenario, characterised by:
- Congestion = c_3
- Noise = n_3
- Pollution = p_3
- Accidents = a_3

Fig. 2.3 The Now/Yes/No scenarios for the vehicular tunnel project

currently enjoys tariff protection in the domestic market, but who is faced with the removal of trade barriers as part of a free trade agreement. The firm's existing market share of 50% is expected to fall to 45% as a result. A marketing initiative is undertaken with the objective of retaining market share. Here, "Now" and "Yes" are the same (in terms of market share), while "No" is 45%. Thus, the target outcome of the venture is, quite properly, expressed as "increased market share" (of 5%) (Box 2.3).

Because target outcomes are associated with *desirable* end effects, it is tempting to express them as an "improvement" in some variable. For example, in the case of the Cross City Tunnel, "decreased congestion" might be described as "improved traffic flow". It is undesirable to use "improved" in the title of a target outcome for two reasons:

1. It is unnecessarily vague: if a measure of a variable has improved, it has changed. If it has changed, it has either increased or decreased. We can conclude therefore that "improved" can always be replaced with "increased" or "decreased".
2. It is used in the title of certain outputs: (defined above as "alterants"). For example, a key output from a project to reduce an organisation's purchasing costs might be "an improved procurement process".

Box 2.3 Scenarios, Outcomes and Operational Processes

Illustration: Hospital Process Re-Engineering

Consider a project to improve the public health service through the reengineering of core hospital-related business processes. Two desirable changes would be "reduced waiting time (for certain benchmark procedures)" and "reduced average costs" (for those same procedures). An undesirable change might be "increased staff turnover". In this example, the "Now" scenario is driven by current practices and procedures that cause the waiting time and cost variables to take on a (presumably) high value. The "Yes" scenario is envisaged as a world with different practices and procedures that cause the waiting time and cost variables to take on a (desired) low value. The "No" scenario could (in this example) represent a world in which current practices and procedures are being overwhelmed by the load of an aging community and so the waiting time and cost variables might be expected to grow even larger. In general, then, the variables that are targeted for change by a project will be the same variables that characterise the way certain operational processes behave. In the language of the business process engineering profession, the variables that define the target outcomes from process improvement initiatives always take the form of changes in specific process metrics.

A critical measurement issue now emerges, whereby if a project is undertaken, the "Yes" scenario will be revealed and the "No" scenario will remain unknown. If the project is not undertaken, the reverse is true. How then are outcomes to be targeted? Setting values for target outcomes has to be done before a decision is taken on the project and so the situation appears even more tenuous because, at that point, neither of the eventual "No" and "Yes" scenarios has been revealed. Outcomes are set by *predicting* values for the variables that characterise the "No" and "Yes" scenarios (and then taking the difference between these predicted values for each target variable). To deal with this issue, it is necessary to use some form of projection in a business case so that the values of the variables used to define target outcomes can be produced for both the "No" and "Yes" scenarios. In most cases the techniques required will be very obvious (such as simple "What-if" analysis), but in others they may involve very sophisticated tools such as simulation analysis and statistical modelling.

A fundamental question in the discipline of project management is "Why do we invest in projects?" If the answer is restricted to an IPO view of the world, it appears to be "To deliver outputs", but that simply begs the question "Yes, but why do we want those outputs?" The "real" answer clearly has to do with the end

effects that those outputs can bring about. We invest in projects to generate desired outcomes because desired outcomes will, in turn, generate a "flow of value" (a benefit) for particular stakeholders (called the project's "beneficiaries"). It should be noted that a funding organisation does not itself have to be a beneficiary to make a rational decision in favour of a project, as would be the case for example, of a local government that funds a streetscape beautification project for the benefit of nearby restaurants and their patrons. Loosely, outputs are the "means" to an "end" (in the form of outcomes and, eventually, benefits). Because it does not recognise outcomes, the IPO model is clearly inadequate for effective project management and so an alternative (based on an extension to the IPO view) is presented in the next section.

## 2.4 The Input-Transform-Outcome Model

In this section, we present the ITO model, which serves as our foundation theory.

2.4.1 Utilising Outputs to Generate Target Outcomes

The above discussion reveals a serious shortcoming in the IPO model (at least as far as a representation of a project goes) in that it makes no mention of outcomes. To address this problem, we modify it by adding two elements (utilisation and outcomes) to the three that are already there (inputs, process and outputs). The resulting five-element structure represents the ITO model of a process, as shown in Fig. 2.4. The ITO model is so-named because it seeks to explain how Inputs on the left are Transformed into Outcomes on the right (Smyrk, 1995).

The left hand half of the ITO model is simply the IPO model, to which has been appended a utilisation mechanism and a *flow* of outcomes. The original "left-to-right" chronology can now be extended. The project's outputs are eventually delivered to someone who then utilises them in a way that subsequently contributes to target outcomes. The entities who utilise a project's outputs in this fashion are called the *project's customers* (not to be confused with the *organisation's* customers, the project's *beneficiaries* or the project's *funder*). While every

Fig. 2.4 The ITO model of a project
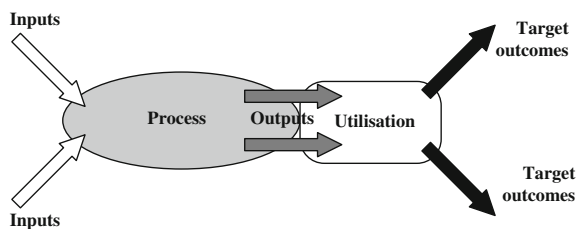
execution of a process has an IPO model, not all executions of all processes have target outcomes. In some cases, there is no meaningful ITO model for individual executions of the process in question. This is a relatively common situation with operational processes. All projects on the other hand, have target outcomes (because they are designed to effect some intended change) and so for most projects, (even those where target outcomes have not been stated explicitly) it is possible to infer an ITO model.

In the left-hand (IPO) part of the ITO model, there is a two-way implication between the process and its outputs. This means that the outputs will exist if, and only if, the process is executed. Because we treat processes as controllable, we are, therefore willing to guarantee outputs. Consider a project to replace an aging narrow steel truss bridge with a wider new concrete girder design. The bridge runs across a river that separates a heavy industrial estate from a harbour that handles both general cargo and containers. A contractor for such an exercise would normally be quite comfortable guaranteeing the replacement because the work involved can be controlled to a high degree.

By way of contrast, in the right-hand part of the figure, the link between utilisation and target outcomes is much weaker. The generation of outcomes is merely correlated with utilisation (and, by implication, with the production of the project's outputs). In other words, it is conceivable that for a particular project, either of two scenarios could unfold: despite the utilisation of outputs, target outcomes are not generated or (more startlingly) target outcomes might well be achieved, even if the project does not proceed.

In the case of the bridge replacement, assume that the target outcome is reduced travel time, with a threshold of 25%. There are many factors that could cause this result not to be achieved (such as an unexpected increase in the number of wide-load trucks that were previously banned from using the steel bridge). There are also many factors that could cause the desired reduction in travel time to occur even if the project is not undertaken (such as the closure of the general cargo terminal). The possibility of both these scenarios confirms that while construction of the bridge can influence the likelihood that target outcomes will be generated, the bridge replacement is neither necessary nor sufficient to achive that result. Together, the list of target outcomes, together with the list of its outputs, defines the project's *scope*.

A further observation about utilisation is appropriate. There is a peculiar (and relatively uncommon) class of projects where the realisation of target outcomes is completely independent of any utilisation of outputs by a customer. An example of such a "non-utilisation" outcome is Ripple Rock (see Box 2.4). We distinguish outcomes that arise without the need for utilisation from those that require utilisation of an output by identifying them as "natural" and "synthetic" respectively. While it is tempting to claim that natural outcomes are generated "automatically", in general, this is not true. It is conceivable that, in certain projects, a desired natural outcome might not be generated to a desired level (indeed, in extreme cases it might not happen at all). All we can say about natural outcomes is that they

occur without anyone utilising the project's outputs and they can be generated below, at, or above the targets set in a business case.

A number of conceptual devices that seek to explain the relationships amongst inputs, outputs and outcomes have been proposed, including the Logic Model (Kellogg Foundation, 2004) and the Outcome Profile[TM] (Walker and Nogeste, 2008). While these models accept that inputs, processes, outputs and outcomes appear in that order, they offer no mechanism to explain what "causes" outcomes to appear. Similarly, PRINCE2 (OGC, 2007), a popular proprietary project management methodology, also highlights the importance of outcomes, but again, appears to ignore both outcome generation and tools to facilitate the

Box 2.4 The Peculiar Case of Projects with Target Outcomes but No Utilisation

Illustration: Ripple Rock

Ripple Rock was a dangerous undersea pinnacle (which rose to within 3 m of the water's surface in the Seymour Narrows near Campbell River, British Columbia in Canada (Wright, Carpenter, Hunt, & Downhill, 1958). Enormous tides sweeping over the reef created extraordinarily chaotic and dangerous sailing conditions that, over the years, are reported to have sunk more than 120 vessels with the loss of 114 lives. After a number of unsuccessful attempts to deal with the problem, in 1958, a project was undertaken to remove the reef. This was achieved by drilling down through nearby Maude Island, horizontally under the bay and then vertically up into Ripple Rock itself. There a network of "coyote" tunnels was filled with over 1,270 tonnes of high explosive. Ripple Rock was then destroyed in, what was at the time, the largest ever non-nuclear peacetime blast.

An example of the many valid outcomes and outputs that could be used to define this project are:

Target outcome: reduced risk exposure (to loss of vessels and lives in the Seymour Narrows).

Output: removed/destroyed reef (in the terminology introduced earlier, an "alterant").

In this case, no one actually utilises the "removed" rock. Any reduced risk exposure that is attributable to the reef will be the result of its destruction. Accordingly, using the terminology introduced into the ITO methodology we note that, although this project has beneficiaries, it has no customers who utilise outputs. Accordingly, "reduced risk exposure (to loss of vessels and lives)" is an example of a "natural" outcome.

Fig. 2.5 suggests a diagrammatic representation of an ITO model where there is no utilization, as is the case with the Ripple Rock project.

**Fig. 2.5** The ITO model of a project with no utilisation
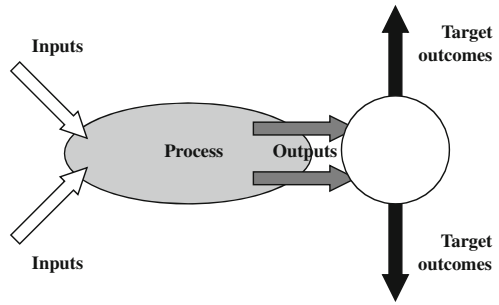
transformation of outputs to outcomes. Moreover, because it terminates with a "closing a project" phase, there is no description of the processes that should be executed during outcome realisation.

2.4.2 The Chronology of the ITO Model

The chronology that underpins the ITO model can be made a little more explicit by showing a horizontal timeline. It does not really qualify as a true "time" axis because the elements in the ITO diagram are not drawn to a time scale. Under this view, the "work" part of the model (represented by the process ellipse) would have defined start and finish dates, notionally obtained by dropping perpendiculars from the left and right hand extremities of the ellipse onto the X-axis, as shown in Fig. 2.6. T_1 represents the date on which the production of the project's outputs begins, while T_2 indicates the date on which the last output is implemented. The difference between these two dates is the duration of the work required to produce, deliver and implement the project's outputs. This corresponds to the conventional concept of project duration (e.g. PMI, 2008). Under the ITO model, however, the duration of the overall project is longer, continuing after utilisation has begun until the flow of outcomes has been secured, as indicated by T_3.

Figure 2.6 shows the most general situation, whereby utilisation takes place over an indefinite period into the distant future. In the example of the Cross City Tunnel (Sect. 2.3), the outcome "Reduced congestion on surface streets" may be

Fig. 2.6 The chronology of the ITO model
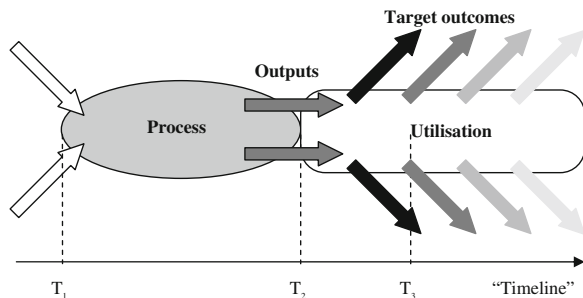
generated every day for as long as the tunnel remains in operation. This would be the case for many projects, but in some instances, utilisation is time limited. Take the case of a five-day exhibition of rare paintings in a provincial city for which the target outcome is "increased awareness of the services provided by a national museum". The bulk of utilisation would take place during the exhibition itself, and thus few, if any additional flows of target outcomes would be expected after the exhibition was closed.

According to the ITO model, a project brings about change when its outputs are utilised by the project's customers. So what form does the utilisation mechanism take? Utilisation represents the total effective operational difference when one processing environment is substituted for another. In the hospital example introduced into Box 2.3, the "Yes" scenario features hospital staff and patients (and possibly others) employing the new outputs. Here utilisation will take the form of certain operational processes being executed (on a day-to-day basis). Some of these processes will be new, some will be modified versions of the old, some may even be the old processes constrained by the new business environment. Because the processes that shape the "Yes" scenario are different from those that shape the "No" scenario, different values will be observed for the waiting time and cost variables. In multiple output, multiple outcome projects (such as the hospital example), many customers will utilise many outputs to generate many outcomes. The linkages here can be displayed with an analytical device called the utilisation map (discussed in Sect. 5.2 in Chap. 5). In such projects, it is possible that certain forms of utilisation by particular customers may actually contribute negatively to target outcomes. For example, the utilisation of (presumably expensive) new medical technology may tend push the cost variable away from its target, and so a trade off may be required between those outcomes that are positively impacted by utilisation of new technology (waiting times) and those that are negatively impacted (operating costs).

2.4.3 Projects and Business Operations

Where does this leave the ITO model of an operational process (as distinct from a project)? The theory behind the ITO model does not require that all processes have their own target outcomes. Two situations can arise. The first is where a process merely contributes to an outcome. In the hospital project introduced in Box 2.3, a task such as "design engagement programme for nursing staff", will contribute to the outcomes of the overall project, but it need not have target outcomes of its own. (Even if it did, we would gain nothing by analysing them). The second is where target outcomes are set for a programme of process executions, but not for individual executions. Take, for example random breath testing by state police. A valid target outcome for this programme would be "reduced incidence of crashes caused by drink driving". Over a year, such an outcome could be measured and compared with some "do nothing" baseline. There would, however, be no point to

setting such a target outcome for each execution of the process, that is for each breath test of each driver who was pulled over for testing.

It is the execution of regular operational processes that determines the values of a host of variables that describe each of the three scenarios used to analyse a project's target outcomes (as discussed above).

The following project case provides illustrations of the ITO terminology. A project is executed by the roads authority to improve the quality of line-marking on national roads. A valid ITO model for this project includes:

1. *Inputs*. Funds and labour, measured in dollars and working hours.
2. *Process*. Mark lines. The productivity of this process can be measured in lane kilometres per dollar outlaid.
3. *Output*. Pavement lines, measured in kilometres of fully marked lane.
4. *Utilisation*. Compliant (or non-compliant) behaviour on the part of road users. This particular form of utilisation takes the form of a change in driver behaviour (probably more accurately called "acknowledgement"), measured in kilometres driven within marked lanes.
5. *Outcomes*. Decreased accident rates, measured in serious crashes per year and increased traffic flow, measured in travel time (between two defined points).

The illustration of this project is shown in Fig. 2.7.

If utilisation is going to occur over an extended time-horizon (and this will be the case for only certain projects), should we separate the project environment from the operational environment? And if so how is that separation to be made? Because of its very nature, the project environment is not suitable for ongoing routine business operations and so it is desirable that, at some point, it is replaced with an operational environment. The timing of this can be decided by applying a *test of conclusion* for the project environment. The project environment ends (and the operational environment begins) when *the flow of target outcomes is secured*. Outcomes are secured when any of three conditions is met:

1. The target flow of outcomes is achieved and there is an acceptable probability that it will continue at this level into the future.
2. The flow of desired outcomes is maximised, and despite falling short of target, there is evidence that it will continue at this level into the future.

Fig. 2.7 An ITO model of a road line-marking project
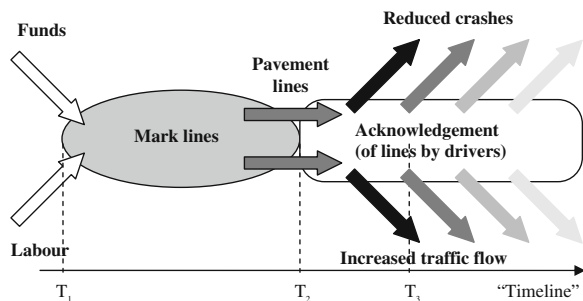
3. The flow of target outcomes is not realised at all and it is expected that it will
   never be realised.

The project environment can also end in the (pathological) situation where
delivery and implementation of outputs does not take place at all (such as when a
project is abandoned part way through). In this case, utilisation does not even start.

The formal transition from the project environment to the operational envi-
ronment is effected with a simple declaration that accountability for target out-
comes now passes to an operational business unit. In summary, a number of early
instances of utilisation belongs to the project environment, until the flow of target
outcomes is secured. From this point on, any remaining flow belongs to the
operational environment.

## 2.4.4 Key Players: Roles, Responsibilities and Accountabilities

It is possible, even at this early point in the exploration of the ITO model to
consider not only some key forms of project stakeholding, but also the nucleus of a
governance model. Such a discussion requires some additional terms and concepts.

The term "key player" used here simply identifies those stakeholders who play
a prominent part in the project. It is not used in a technical sense and requires no
definition. Four key players emerge in the immediate discussion:

1. *The funder* (of whom there can be more than one). Who approves the com-
   mitment of resources to the project.
2. *The project owner*. Who acts as the funder's agent during execution.
3. *The project manager*. Who "runs" the exercise.
4. *Project customers*. Who, by utilising the project's outputs, generate target
   outcomes.

The "parts" that key players might play are usefully categorised into three: a
role, a responsibility and an accountability, as shown in Fig. 2.8. This figure also
confirms that those who play such a part in the project are stakeholders as well (by
virtue of the fact that they are commissioned to fill defined roles and so now have
an interest in the venture).

Fig. 2.8 The relationship
between stakeholding, roles,
responsibilities and
accountabilities
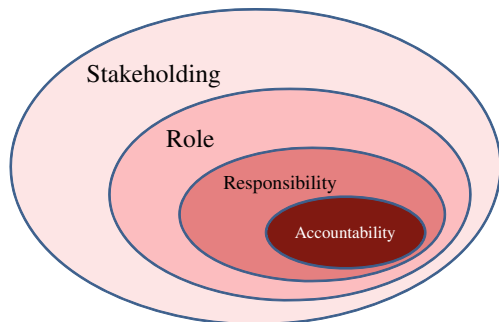
A role for an entity arises when a project-related activity requires the involvement of that entity for its completion. For example, the utilisation of a project's outputs requires the involvement of project customers and so project customers *fill a role* in a project.

A responsibility arises when a role is based on a formal agreement by the relevant entity to participate in certain activities. For example, a project manager is responsible for ensuring that all of the work of a project is appropriately resourced, and so we would expect this arrangement to be reflected in some sort of agreed brief or contract.

An accountability arises when a responsibility is subject to agreed rewards/penalties. An accountability must be accompanied by one or more authorities (powers to take specific actions or make particular decisions). Without authorities, accountabilities collapse into responsibilities. For example, if the project manager is held accountable for delivery of all project outputs (fit-for-purpose, on time and within budget) then he/she must also be granted the authority to deploy the resources made available for the conduct of the exercise. Accountabilities should also be described in a formally agreed instrument of some kind (such as a memorandum of understanding or a contract). It is important to note that, in general, a project customer has no responsibility for (and cannot be held accountable for) utilising the projects outputs.

A funder is an investor in the project who seeks a future flow of desirable outcomes as a return on the funds made available for the exercise. It should be clear that the most important stakeholder in a project is the funder. If he/she does not approve funding (or a continuation of funding), then the project cannot proceed. A funder will only approve a project if the eventual flow of benefits is seen as an adequate return on the funds being invested in the initiative. The term "funder" is defined in the glossary, but for this immediate discussion it should be noted that the funder is the entity who has discretionary authority over the funds required by the project. The funder is not necessarily the "owner" of those funds. While funders may well shoulder accountabilities arising from their *line positions* in their particular organisations, *project* accountabilities stop with funders. Funders are the ultimate stakeholder in the project.

While funders can exist at any level, the approval of an organisation's largest projects tends to fall to the most senior ranks. This frequently gives rise to a practical problem, whereby executives are involved with such a large portfolio that they are unable to play an effective role in the day-to-day leadership of all the projects that they approve. To deal with this problem the role of project owner emerges. A project owner is the person held accountable by the funder for the eventual realisation of a project's business case in general and target outcomes in particular. (It should be noted that the funder can fill the role of project owner if required). Once appointed, the project owner can now commission someone to deliver the project's outputs (fit-for-purpose, within the constraints of an agreed budget and timeframe). Consistent with conventional thinking, the person accountable for delivery of the project's outputs is called the project manager.

A governance model starts to emerge by establishing a client/supplier relationship between the project owner and the project manager.

A project may have more than one funder. This will occur when it is not appropriate for one entity to bear the investment burden alone. The degree of concordance between the objectives of co-funders will shape the project's governance model. At one extreme, all funders may share identical expectations as they relate to objectives and outcomes. Such a project could be approached as if there were only one funder. At the other extreme, funders may have conflicting expectations, incompatible objectives and mutually exclusive target outcomes. Clearly joint funding of such an exercise would make little sense, regardless of how it was governed. Between these two situations are ventures in which the prospective funders find their expectations are compatible, their objectives congruent and their target outcomes distinct but consistent. In such cases, it may well be appropriate to collectively fund a joint project, but allow each funder to appoint a separate project owner. Since an owner is the project manager's client, the project manager now faces the possibility of conflicting advice concerning the direction of the project. To deal with this situation, the governance model provides for a steering committee that is responsible for overseeing the exercise. The steering committee fills the role of client to the project manager. The steering committee must reach a consensus on the instructions and guidance it issues to the project manager.

It is entirely feasible (and quite common) for a particular entity to fill a number of project roles simultaneously. For example, consider a project aimed at reducing binge drinking amongst young women by conducting an alcohol-awareness programme. Because the target community group is presumably better off from a successful project, they qualify as beneficiaries. They are, of course, at the same time the project's customers (in that they utilise the awareness programme to generate the target outcomes) (Box 2.5).

2.5 Illustrating the ITO Methodology: The Project BuyRite Case Study

A case study is used to illustrate various concepts terms, processes and tools that form part of the ITO methodology. "*Project BuyRite*", is based on a real-life exercise conducted by a multinational building products company in the late 1990s. It describes a project aimed at improving the procurement process in a company named *International Concrete Operations Inc.* (ICO).

2.5.1 The Company

International Concrete Operations Inc. (ICO) was a relatively small national concrete operator until it acquired one of its rivals and its two largest suppliers

Box 2.5 ITO-Based Terminology

An Important Distinction: Customers, Beneficiaries and the Client

We have taken a number of steps in our attempt to introduce rigour into the framework introduced here, including:

- Adoption of the ITO model as an organising theory. Much of our discussion emerges as extensions to and deductions from this theory.
- Establishment of a number of principles (which we use to fill a role akin to axioms in other disciplines).
- Assembly of an integrated glossary.

Some elaborating comment is required about the last of these. Selection and adoption of appropriate terms for the elements of our framework involves trade-offs between:

- The need to reflect subtle nuances in the concepts we use.
- Creating new words unnecessarily.
- Acknowledgement of established usage of existing terms.

A particular illustration of the challenges faced here concerns our use of "customer". We use the word in two distinct ways.

- "Project customer" who utilises a project output in such a way that target outcomes are generated. If one were to display project customers in an ITO diagram, they would, of course, appear inside the utilisation rectangle.
- The entity to whom *operational outputs* are delivered (usually involving a commercial transaction of some kind). This use of the word "customer" accords with its commonly accepted meaning. Because the same entity *frequently* fills both roles, some of the existing literature assumes that they are *always* the same. To distinguish these roles we will, where necessary, qualify "customer" with the words "project's …" or "organisation's".

Other distinctions need to be highlighted as well. Two are particularly important because they are surrounded by considerable confusion in the literature.

- The first concerns the role of project owner. As will be discussed in the section on governance, a project manager is commissioned as supplier (of project outputs) by a project owner. Accordingly, the project owner becomes the project manager's "client". The one entity can be both project client and project customer, but in general, that is not the case. We avoid altogether the term "customer" when referring to the project owner.

- The second concerns the project beneficiary, defined here as an entity who enjoys a "flow of value" arising from achievement of target outcomes from the project. Beneficiaries can be project customers, but in general, this is not the case. We do not refer to beneficiaries as "customers".

(a quarrying company and a cement manufacturer). An aggressive programme of international acquisitions over the following 15 years saw the creation of one of the world's dominant players in the concrete, cement and quarrying industries.

International Concrete Operations Inc. (ICO) is organised essentially along country lines, with operations in each country being set up as a business unit.

The firm has always valued entrepreneurship very highly, but has tended to lag its rivals in management capability. Weaknesses in a number of areas have left the company exposed to smaller, faster and more agile rivals. The Board has become increasingly concerned about ICO's vulnerabilities, especially in areas where growth has outstripped the capabilities of its management skill pool.

A significant international benchmarking exercise was undertaken to see how well ICO performed in a number of core processes, particularly procurement. This study not only confirmed what the Board had suspected (that ICO was in the bottom quartile for all processes) but also that:

1. The Company has an unenviable reputation amongst major suppliers of being a very poor payer, with 50% of all invoices still outstanding after 90 days. This has had two effects: (1) reliable suppliers are pricing their offers to ICO at a premium and (2) ICO is unable to take advantage of early-payment rebates.
2. Uncoordinated purchasing policies in different business units over many years has led to the growth of large and costly purchasing functions that have not kept pace with modern procurement thinking. Few opportunities for volume discounts are available to ICO.
3. Procurement processes have "grown like topsy", largely the result of adapting local practice as each new company was acquired. These processes are inconsistent, undocumented, inefficient and slow, forcing most business units to maintain unacceptably large inventories to deal with frequent outages. This situation is a significant contributor to the company's very high working capital.

2.5.2 Project BuyRite

The Board acted immediately on the benchmarking report and asked the CEO in each country to undertake a procurement process improvement project.

Charles Edwards, the Australian CEO, created a new position, National Procurement Manager, and appointed Nancy Palmer to fill the role. Nancy Palmer has secured the services of an experienced business process improvement specialist

Fig. 2.9 Part of the organisational structure of ICO's Australian operation

(Paul Myer) who will serve as project manager. Paul Myer has just successfully completed another similar project, and has brought with him the project administrator from that exercise, Pamela Atkinson, to fill a similar role on "Project BuyRite".

Preliminary discussions involving the CEO, the COO (Owen Oliver), the CFO (Catherine Farnham), the CIO (Ian Ord), Nancy Palmer and Paul Myer have resulted in the assembly of some initial ideas on the shape of the project.

Early stakeholder analysis identified Lindsay Thomas as an important influencer. Lindsay has been with ICO for 35 years (most of that as a Purchasing/Expediting Manager) and is widely respected for his professionalism.

Figure 2.9 presents those parts of the organisational structure for ICO's Australian operation that are relevant for this illustration.

In Project BuyRite, ICO itself (or, more specifically, its community of shareholders) is the beneficiary of a successful project because it is the Company that experiences the beneficial effects of reduced procurement costs. The procurement staff, who are not shown in this particular chart, are the project's customers because it is anticipated that they will work with the new procurement process, and by doing that, reduce the company's operating costs.

2.5.3 The Emerging Shape of Project BuyRite

In order to specify target outcomes, ICO have addressed the following questions about the proposed exercise:

- What are the dominant characteristics of the current procurement scenario?
- What will happen if we do not intervene?
- What objectives do we seek from intervening in some way?
- Why undertake this particular project at this particular time?
- How does the project fit into ICO's business strategy and priorities?
- What beneficial effects can we generate from intervention?
- What opportunities exist to radically change our procurement-related processes?
- How effective are the best of those?
- What are the downsides of intervention?
- How much will intervention cost?
- How risky is such an initiative?
- What strategy should guide the way we tackle this project?

The background to the case study makes it clear that reduced procurement cost is a desired outcome. Furthermore, because a threshold level of reduction will be set, it becomes a target outcome (although there may be others). Now consider a situation at the end of the project in which it is discovered that, not only have procurement costs been reduced, but also that long-standing frictions between procurement and production have evaporated because stock-outs no longer occur. If reduced friction between these two units was not adopted as a target outcome, then this would be classified as a fortuitous outcome. The question of whether or not fortuitous outcomes are recognised when assessing a project is discussed in Sect. 3.4.

Early discussion of Project BuyRite's outcomes suggested the following outputs:

- (Documents describing) a new procurement process
- An enabling software system
- A panel of preferred suppliers
- A new organisational model for the Procurement Department
- A new office for the Procurement Department
- A performance bonus for Senior procurement staff

According to the ITO model, outcomes are generated when a project's customers utilise outputs. In this case for example, both suppliers and Procurement staff will utilise the panel of preferred suppliers to generate reduced procurement costs. As it happens, later work on the project's scope resulted in significant changes to the outcomes that ICO targeted and also to the list of outputs. More is said about this analysis in Chap. 5.

For each output the work involved will, in due course, have to be described in considerable detail. For example, for the outputs of a new procurement process, the team will need to analyse current procurement practice, examine and rank alternative approaches, select a preferred model, configure enabling systems, train procurement staff in the new process and review how well all this was done. When the work of producing all of the agreed outputs is analysed and described, it will then be possible to estimate the resources necessary to undertake that work.

Two classes of resource will be of particular concern to ICO: those that have to be purchased (such as systems and technology) and the labour of ICO staff who will be assigned to the exercise. These will then become the "inputs" in the ITO model.

2.6 Summary

In this chapter, we have examined four critical features of the project environment by considering: the way it evolves in the course of a project, the elements that give it structure, the engagement of key players and their organisation. We are now in a position to discuss in depth project initiation, the first stage on the life of a project.