discussed in Section 5.4), (2) how the information and data obtained by the appraisal are analyzed and presented to the community, (3) how the vulnerability of the community and associated risks are perceived and interpreted, and (4) how the recommendations from outsiders are received and understood by the community. In turn, these implications control how projects are designed, planned, executed, monitored, and evaluated in the ADIME-E framework and how predictable the outcome of those projects might be. Finally, they affect the sustainability of projects well beyond the completion phase.

Uncertainty also implies that "as complexity rises, precise statements lose meaning and meaningful statements lose precision," according to the law of incompatibility formulated by the mathematician Lofti A. Zadeh. Simply put, predictable and rational answers to uncertain problems are not possible. The system dynamics tools discussed in Chapter 6 allow for exploring variability and the effect of uncertainty on system behavior by exploring "what if" with mental models. But even mental models of systems have their own limitations and uncertainty and cannot generate definite answers because they depend on the perspective of those who build the models and their decisions in defining the system boundaries. As a result, in any model, things are included by decision makers because they are deemed important whereas other issues are ignored and made unimportant. This method supports the mathematician Box's observation in his book with N. Draper (1987) that "essentially all models are wrong, but some are useful."

In summary, inherent community uncertainty cannot be eliminated because of the inherent complexity and unpredictability of human systems and the other systems with which they interact. Therefore, it must be embraced and accounted for accordingly by using appropriate decision-making tools. One positive aspect of uncertainty is that it forces project managers to make mindful decisions and pay attention while working on projects.

Project Failure

As mentioned several times in this book, a lot of criticism exists in the literature about the delivery modes of small-scale community development projects, and concerns have been raised about their high rates of failure. Aside from failure resulting from poorly executed projects conducted by inexperienced groups or decision makers who have no skills in making those decisions (which is often the case), there are many instances where the projects have failed despite good planning, management, and execution. In many ways, the previous discussion on uncertainty can shed some light on that issue.

In his book, *The Logic of Failure*, Dörner (1997) proposed four reasons for why things fail in complex situations despite good initial planning:

- Slowness in human thinking: we feel obliged to economize and simplify;
- Slow speed in absorbing new material: we don't think about problems we don't have;
- Self-protection: we need to make things easier and have things under control to preserve our expectation of success; and
- A limited understanding of systems: we have a hard time comprehending complexity, we make hypotheses, and we are ignorant of what we don't know.

Dörner concludes that all four reasons, when combined, may lead to unexpected behavior, and he cites several real-life examples illustrating this conclusion. In one example regarding the development of the fictitious country of Tanaland, it is shown that, despite good intentions, failure to keep asking questions in the decision process in a project may lead to its rapid failure because decisions are made using nonupdated information.

Poor decision making is not the only thing that leads to unintended consequences. They may also arise from poor group dynamics. According to Diamond (2005), failure may happen when groups fail to

- Anticipate a problem before the problem actually arrives,
- Perceive a problem that has actually arrived,
- Solve a problem once it has been perceived, and
- Solve a problem after trying to do something about it.

There are plenty of reasons why projects fail in any of the phases shown in Figure 4-2, and the literature on the subject is quite extensive. Nolan (2002) lists various causes of project failure in the framing, management, and assessment stages of a project. At the *framing stage*, a project may fail because various aspects of the project have been overlooked or because wrong or incomplete decisions have been made from the appraisal data. At the *management stage*, project failure may result from bad or inadequate implementation of the project, or parts of it, or from failure to adapt to changes as the project unfolds. Finally, at the *assessment stage* (monitoring and evaluation), a project may fail because results are overlooked or lessons from the past have not been transferred into future project activities.

Clarkson (2013) lists the top 10 reasons why projects fail in general as the following:

1. Poor sponsorship,
2. Unclear requirements,
3. Unrealistic timescales or budgets,
4. Poor risk management,
5. Poor process and documentation,
6. Poor estimating,

7. Poor communication and stakeholder engagement,
8. Poor business cases,
9. Inadequate and incorrectly skilled resources, and
10. Scope creep.

In practice, and especially in small-scale community development projects, it is hard to avoid failure. In fact, we can say with a high level of certainty that failure is a possible option. Among the aforementioned reasons, it has been the experience of the author that scope creep is more a rule than an exception because it is indeed not uncommon that an intervention fails because the situation has become something other than the one planned for a project. A common scenario is for a project to spin off into subprojects that require additional planning, management, and resources. For instance, it is not uncommon for a "drinking water supply only" water project to branch out into sanitation, hygiene, health, food, and energy subprojects. Project spin-off may quickly become a major challenge for project managers who start out having to deliver high-quality projects with strict constraints. The experience of project managers, combined with monitoring and evaluation of projects as early as possible in project planning and management, is critical to reduce the effect of scope creep and to avoid unexpected surprises.

Finally, there can be positive aspects to project failure. Failure leads to valuable lessons learned, especially from projects that had all the components for success. Unfortunately, detailed documentation of past projects with positive and negative outcomes is rarely found in the development industry (Valadez and Bamberger 1994). It is indeed rare for organizations to report failed projects; and if they do, no effort is placed on trying to link negative outcomes to project design and management. The literature is mostly biased toward reporting good outcomes (often superficially) rather than failed projects. It is time to replace "failure" by "lessons learned" and start learning from past case studies.

4.9 Project Delivery in Complex Systems

One difficulty in using any of the project cycle management frameworks mentioned previously is that there is a need to accommodate the uncertainty, complexity, and unpredictability inherent in developing community projects in all stages of the project cycle. Absent in such projects are the blueprints that guarantee control and predictability, as in projects in the developed world. This context requires changing the role that managers and practitioners play in projects, their responsibilities, and attitudes when encountering challenges. As remarked by Narayan (1993), project managers need to serve as "managers of change rather than as overseers of [project] schedules." Furthermore, "their central task is to design a learning and problem-solving environment characterized by facilitative leadership, goals and a vision that are shared by users, systems

for two-way knowledge generation, resource generation, conflict resolution, and generally accepted rules and regulations."

More often than not, in developing community projects, practitioners are confronted with setting the problems before addressing them, a difficult task indeed when the situation is ill defined at the beginning (Schön 1983). Once the problems have been set, solving them requires integrating adaptive change, variability, and flexibility and introducing contingency plans and options in project planning and execution. As remarked by Narayan, practitioners need to balance what is expected of them in traditional problem solving by being able to maneuver in an unpredictable learning and changing environment. The strategy used depends greatly on the nature of the projects, the community, and who the project decision makers and stakeholders are. In recovery and development projects, for instance, where time lines are less stringent and more time can be used for reflective practice (and practical reflection), uncertainty can be managed (or at least reduced) using an adaptive approach that allows for a certain amount of flexibility.

Because uncertainty in development projects arises from the complexity of communities and human systems, the tools used in planning such projects must reflect those unique features. Practitioners must also recognize that participatory community development takes time, is culture and context dependent, and cannot be imposed over a rigid time frame nor using a top-down approach only. Therefore, using traditional management tools developed in the Western world that expect nothing less than predictability is unlikely to be of any use in the context of projects in developing communities. In Chapter 6, we discuss how system dynamics tools are better suited to address the multidisciplinary, cross-disciplinary, multistakeholder, and uncertain nature of development projects.

Project management in uncertain conditions is not new. In fact, it is more a rule than an exception in engineering practice, even in the developed world, where uncertainty can be better handled through a combination of objective and subjective decision-making tools (Elms and Brown 2012). In his book *Projects that Work*, Nolan (1998) divides project planning methods into two groups of methods: *interactive* methods and *directive* methods (Table 4-3). Interactive methods are used when "the elements of the project evolve as time goes on, and as new learning occurs." Schön (1983) calls this approach *reflective practice,* which is more in line with the intervention of *self-reflective practitioners* than experts (Caldwell 2002).

Interactive and reflective methods account better for uncertainty, are more flexible and adaptive, and require preplanned adaptability and more subjective decision making. They are better suited for a learning environment. These methods are an integral part of what Patton (2011) calls *developmental evaluation,* which is an approach recommended to evaluate progress and make

Table 4-3. Aspects of Directive versus Interactive Project Planning

Directive Planning	Project Features	Interactive Planning
The impetus for the project comes from above.	Origin of the project	The impetus for the project comes from below.
Interventions are temporary.	Nature of the intervention	Involvement is long term.
The environment is stable and familiar.	The environment	The environment is unstable or unfamiliar.
Projects center on things rather than people.	Focus of the project	Projects emphasize growth in human capacity rather than material things alone.
Detailed knowledge of techniques, outcomes, and contingencies is assumed to exist at the start of the project.	Role of existing knowledge	Incomplete knowledge is assumed; learning about what to do becomes a major project goal.
Little learning or new knowledge is assumed to be necessary to make the project work.	Role of new knowledge	Learning and new knowledge are seen as central to the success of the project.
Overall strategies and objectives are spelled out in advance.	Strategies and objectives	Objectives and strategies emerge gradually from on-site study of the situation.
The research, decision-making, and action functions in the project are separated and done by different groups.	Integration of effort	Research, decision making, and action are combined and done by essentially the same group of people.
All resources, activities, and timetables are spelled out in advance.	Choice of resources, activities, and timetables	Resources, activities, and timetables are determined as the project proceeds on the basis of experience gained in this field.
Project decisions are relatively "pure" and can be made in terms of a few controllable variables, preferably of a quantitative nature.	Decision making	Project decisions are "impure" and are made in terms of shifting often qualitative factors.
Implementation is routine and involves the application of prespecified solutions. Tasks are somewhat routine and repetitive.	Implementation tasks	Implementation is creative and experimental and changes as the project evolves. Tasks are not routine, but may need to be done differently at different times.

Table 4-3. Aspects of Directive Versus Interactive Project Planning (*Continued*)

Directive Planning	Project Features	Interactive Planning
Few modifications of the project plan are possible at later stages.	Modifications of plans	Continual modification of the project plan is necessary to take account of new learning.
Little local initiative or participation is required.	Local input	Local participation is necessary to shape the project.

Source: Nolan (1998), with permission from Riall W. Nolan.

decisions in complex and uncertain settings in social innovation. The approach is about exploring the parameters of an innovation and, as it takes shape, changing the intervention as needed (and if needed), adapting it to changed circumstances, and altering tactics based on emergent conditions.

Interactive methods differ from more traditional *directive planning* methods, which are more rigid and linear, require predetermined accurate information and objective decision making, and rely on the input of experts. Most civil engineering projects (e.g., building a bridge) that deal with manufactured materials rely on directive planning or *blueprint planning*.

In a recent paper, Elms and Brown (2012) discuss the decision-making process necessary to address complex situations. They argue that even though the engineering field prides itself on its rational objective approach to decision making, there are many complex situations in which a subjective (or intuitive) approach is better suited with or without the use of additional rational decision tools. That combination of approaches can be included in all components of decision making, i.e., defining the project aim, deciding on a plan of action and alternative actions, assessing the project constraints, and accounting for the context in which the project is taking place. Elms and Brown remark that using dominantly subjective methods seems to lead to better decisions "for problems at the interface between straightforward technics—the traditional province of engineers—and the environments (natural, social, economic, political and so on) surrounding them," which are the complex problems of interest herein.

In the framework proposed in this book, an interactive planning approach called the design-as-you-go method is recommended. It has been used, for instance, in geotechnical engineering for tunnel project management over the past 40 years. Geological conditions in which tunnels are to be excavated and human systems in a community setting have something in common: they are not completely known at the outset of the project. More information and data about the ground conditions and the community emerge as the project moves along from appraisal through design, implementation, and closing. Thus, in both

instances, there is a need to adjust project decision making accordingly and allow for reflective practice, flexibility, and preplanned adaptability. In some instances, a need exists to introduce simple (but not simplistic) solutions to handle the complexity. The decision process becomes a combination of objective decisions based on solid engineering principles and subjective decisions based on the encountered field conditions. Contingency plans are introduced to account for the complex and uncertain nature of the projects at stake. In tunnel construction, the design-as-you-go approach called the new Austrian tunneling method, or NATM (2013), has three main attributes in terms of project planning and decision making.

- All parties involved in the project (clients, engineers, and contractors) are required to agree beforehand on a joint approach to handling changes in geologic conditions, a preplanned adaptability. Because tunnel design is about designing its support system, all three parties agree on various support methods based on the most likely geologic conditions to be encountered. Upon ground excavation, all parties meet to check the conditions and agree on selecting a type of support system until new ground data become available.
- At all times, the tunnel is instrumented and the ground conditions are monitored. The performance of the tunnel is evaluated continuously. Any unexpected change results automatically in a change in project design.
- Contract documents reflect the multiparty agreement in the decision-making process and have been approved by all parties. The litigious nature of the project is therefore reduced through relationship and trust.

How does the NATM translate into community development projects? Its first attribute relates to participatory planning, where all parties and stakeholders (insiders, outsiders, and government) involved in the development project agree on a range of action plans depending on the community conditions encountered. The second attribute expresses itself in the form of having a project monitoring and evaluation structure in place as soon as possible as a way of assessing the progress of the projects in a participatory manner. The third aspect deals with the contractual practices of development agencies and the need to include alternative dispute resolution agreements in contractual documents to handle issues and disagreements between stakeholders as they arise (Nolan 1998). It also relates to the fact that collaborative projects are easier to handle, and more likely to succeed, than those that are confrontational.

In recovery and development projects, interactive planning approaches such as the design-as-you-go approach are better suited to the situation because more time is allowed to make decisions and adapt to changes in project conditions. In rapid response projects (refugee camps and other crisis situations), directive planning makes more sense because the response time is constrained,

there is less tolerance for uncertainty (in a very uncertain environment), and more rigorous and timely decisions need to be made quickly in relation to saving lives and protecting populations.

In general, practitioners involved in small-scale development projects need to be cognizant of both interactive and directive planning approaches and use the appropriate ones as needs arise. They must recognize that each project is unique and requires a specific approach. Failing to recognize the uniqueness in project planning and execution by using the same tools irrespective of the project context may create more harm than good.

4.10 Chapter Summary

In this chapter, the basic components of the ADIME-E framework for small-scale projects in developing communities were introduced. A more robust description of each component of the framework is provided in the forthcoming chapters. The main attributes of the proposed framework can be summarized as follows:

- Its components are borrowed from existing development frameworks.
- It includes logic used in engineering project management.
- It emphasizes the contextual and participatory nature of development projects.
- It is centered on household livelihood, i.e., the smallest basic human community unit.
- It acknowledges and accounts for the uncertain nature of development projects in all stages of the project cycle.
- It accounts for the integrated and multidisciplinary characteristics of development projects where technical and nontechnical issues are intertwined.
- It recognizes that depending on the project phase and the type of project, adaptive planning methods (with subjective decision making dominant) or directive planning methods (with objective planning methods dominant) need to be used.
- It recognizes that development projects involve human systems and interaction with other systems, and therefore a need exists for using system dynamics tools rather than linear cause–effect tools in project planning and design.

The overarching goal of the proposed framework is to provide the conditions necessary for sustainable community development and social change leading to communities that are more stable, resilient, equitable, secure, healthy, and prosperous. In general, such communities have the capacity (or ability) through resources and knowledge to (1) address their own problems, (2) be self-sustaining, (3) cope with and adapt to various forms of stress and shocks,

(4) satisfy their own basic needs, and (5) demonstrate livelihood security for current and forthcoming generations.

Finally, it must be recognized that the proposed ADIME-E framework is not a magic bullet that transforms a community overnight and guarantees its transformation. Development takes time and hopefully consists of more steps forward than steps backward on the road to community self-reliance.

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