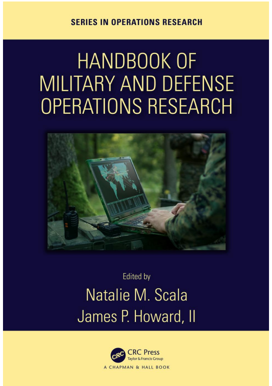

Handbook of Military and Defense Operations Research

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Why Won’t They Use Our Model?

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Chapter 12

Why Won't They Use Our Model?

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12.1 Introduction

What if someone were to furnish you with a Ferrari and pay for all the fuel, tires, insurance, and maintenance? How would you drive the car? Surprisingly this is what happens in the United States (US) military. The services (Army, Navy, Air Forces, and Marine Corps) provide forces to regional commanders and finance the fuel, maintenance, personnel, and supplies required to operate these forces. For example, in the US Navy, commanders decide the policy for sequencing replenishment missions to combat ships. Then, a group of 38 personnel manually produces a sequence of supply missions for the next 1–3 weeks. Anomalies such as the inadvertent creation of multiple supply missions to the same combat ship or the inadvertent omission of a combat ship from the schedule are identified through discussions among the schedulers, supply ships, and combat ships. Any schedule shortcomings are made up for in execution by increasing the speed of the supply ships and increasing fuel usage.

Usually, this tactic works but increases mission cost significantly. One cannot, however, fault regional commanders for basing scheduling decisions on mission completion rates and neglecting fuel costs. The mathematical difficulty of the computations required by the inclusion of the cost of fuel, indeed of almost any additional variable or objective, is too high for a manual system.

The US Navy attempted to address this situation with the development of the Replenishment at Sea Planning (RASP) tool (Brown et al., 2017). RASP is an analytic optimization model of the scheduling process, capable of producing thousands of feasible solutions in minutes and of treating costs as an objective to be minimized. The regional commander would have the ability to make significant savings in resupply operations and the door would be open for other innovations, such as the creation of global links among the Navy regions. Three years of extensive work by a multidisciplinary team yielded a computation engine that we expected to be quickly adopted. Unfortunately, rather than a quick and painless adoption, we had to ask ourselves, "Why won't they use our model?"

12.2 What Went Wrong?

Many authors have addressed the difficulties that arise in the implementation of new technologies such as the decision support systems, optimization models, and scheduling tools that are the basis of much operations research. While some of the major issues, such as linking to legacy systems and design of the user interface are primarily technological in nature, in many cases, it is in dealing with the human component that an implementation team finds the greatest challenges.

Analytics literature offers many descriptions of the pitfalls encountered in implementation and some prescriptions for avoiding them. In an OR/MS Today article (Cokins, 2012) referring to analytics, Cokins asks, "So what continues to obstruct the adoption rate of analytics?" He answers that the major causes are "social, behavioral and cultural issues, including people's resistance to change, fear of knowing the truth (or of someone else knowing it), reluctance to share data or information and a 'we don't do that here' mindset." Note that all of these issues are related to organizational and individual concerns rather than technical matters.

In another case, Leclerc and Thiboutot (2003) report their use of a model-based software suite for the routing and scheduling of a truck fleet in contrast to the policy of many organizations which still use manual or simple legacy systems. Leclerc and Thiboutot are, respectively, director of logistics and Information Technology (IT) manager at a leading furniture company in Eastern Canada. They observe that

> *There is strong resistance to change. Adoption rates should accelerate as resistance to change is overcome by the evidence of results driven by accurate modeling environments, clear demonstration of the scalability and deployability of newer software architectures, and proven return on investment and efficiency gains demonstrated by initial implementations.*

Why then are so many vehicle fleets still using primitive legacy systems?

It is not only analytics that is affected by the rejection of technological innovations. In their 2006 paper, Lapointe and Rivard (2006) report on attempts to implement a medical information system in three hospitals. They report that many physicians "are reluctant to use IT tools." In all three cases, there were strong negative reactions, and only one of the implementations was successful. Why was the success rate of these implementations so low? In this chapter, the authors analyze the issues raised in each case and are able to relate them not only to the attitudes adopted by the putative users of the systems but also to the decisions and actions of the management and the system implementation team. They argue that change agents, such as IT innovators and analytics professionals, can affect outcomes and implementation success rates.

Most analytics practitioners have implementation anecdotes to tell and cases to describe. Where things did not go as hoped, many of them are asking, "What went wrong?" In the case of RASP, reflection and analysis suggested several answers to this question:

- Most of the schedulers using the scheduling model did not, in general, have analytics or IT experience
- Only on-the-job (OJT) training in the use of the model was planned
- Senior officers responsible for ship scheduling were wary of IT-based scheduling, which they perhaps saw as limiting their control over the process and the results
- IT issues, in particular, the connection to legacy systems that contained much of the data required by the model, forced the double entry of much of the data, which was a significant increase in workload

12.3 Conceptual Models of the Reaction to Technological Change

A conceptual model of reaction to information technology implementation may be thought of as a lens through which an implementation may be viewed. It appears that no single model covers all situations and to obtain as complete a picture as possible of the situation, the analyst in search of relevant insights should consider each available model in turn. Lapointe and Rivard (2005) identify four such conceptual models and develop a fifth themselves.

Markus (1983) points out that there may be existing patterns in the organization that interact negatively with an implementation that is under way and these mismatches may create resistance. In particular, she refers to the interactions that a technology implementation may have with existing power structures within the organization. For example, a new IT system might give better access to data (e.g., monthly sales or production figures) that were previously restricted to a few, and this may be seen by the former gatekeepers as diminishing of their power and influence.

Joshi (1991) views the appearance of a negative reaction to change as arising from a user's perception of equity in the balance between inputs that the change requires versus the outcomes that it produces. The user may be measuring inputs in several ways, such as data entry effort, stress level, the difficulty of learning the system, and manual and cognitive effort required to perform the multiple process tasks. Different users may have different measures. Similarly, outcomes include the service level to customers, the change in power level of the user, job satisfaction, salary change, and promotion possibilities. The list of possible metrics for measuring equity is complex and asymmetric. If a user perceives that an increase in inputs, such as the level of effort required to learn the new system, is not balanced by the outcome of better service offered to the customer, a negative reaction to the change may arise. The identification of equity issues requires careful observation and discussion with users.

Marakas and Hornik (1996) identify a user reaction that has its source in fear and stress stemming from the intrusion of new technology into a previously stable environment. They refer to the inflexibility of some individuals faced with changes in the ways of work that leads them to use covert means to procrastinate, slow their performance, or otherwise delay and obstruct the implementation.

Martinko, Henry, and Zmud (1996) suggest that individuals perceive a new technology according to both internal (e.g., the users' perception of their ability to master the new technology) and external influences (e.g., experience with other similar technologies). These perceptions then lead the user to develop expectations as to the outcome and efficacy of the technology. Of course, unfavorable expectations can engender a negative reaction.

Lapointe and Rivard (2005) take a longitudinal perspective and propose a multilevel model that seeks to explain resistance behaviors at the individual and workgroup levels. When a system is introduced, users will assess it starting with their individual initial conditions (e.g., knowledge, experience, power) and of the characteristics of the proposed system. If the users' expected consequences of implementation of the system are unfavorable, this triggers a negative reaction. This analysis takes a longitudinal perspective of the implementation, tracking it through its different phases, and covers the reactions both of individuals and of work groups.

Ford, Ford, and D'Amelio 2008) recommend prudence in the analysis of implementations because change agents may not always deliver unbiased accounts of users' actions. Some cases of failure due to "resistance" should rather be attributed to the actions or omissions of the implementation team.

12.4 Are There Resistance-Prone Changes?

The principle of *continuous improvement* is at the heart of Toyota's highly successful strategy for the management of industrial production (Shingo, 1989). Supervisors and factory workers often meet, every day in some cases, to discuss ways of improving quality and production flow. Examples of continuous improvements that occur on the shop floor include the enhancement of tools and adjustments to inter-workstation conveyors. In the area of operations management and control, installing a faster computer to speed up solver computations is an example of continuous improvement. Toyota managers feel that they obtain better productivity and quality through the constant application of continuous improvement rather than from occasional radical changes. A great advantage of continuous improvement is that it is less likely to engender negative reactions ("resistance") to the proposed changes, particularly since workers are involved from the very beginning of the development.

It is not always possible to avoid radical change, however. Consider two cases from the past:

- The replacement of manually controlled machine tools by multi-axis computer-controlled machining centers
- The introduction of personal computers into a workplace wedded to mainframe computing and the IBM Selectric typewriter

For these two examples, one sees that the change required was great: the new devices that actually perform the work are completely different, new computer-based systems are required, workers must be extensively retrained, and the range of work that can be performed is both broadened and deepened. When these changes occurred in business and industry, they were radical, and there were many occurrences of negative reactions. In some environments, the change was chaotic, but in others, the transition was adroitly managed.

Is it possible to identify which analytics projects are likely to engender negative reactions, foot-dragging, and resistance before implementation commences? The System-Task-Planner framework may be used in the analysis of an analytics solution implementation to determine if it is likely to cause potential users to display negative reactions.

12.5 The System-Task-Person (STP) Framework

In our lexicon, a "framework" is a structured way of visualizing, recording, and analyzing observations of the people and events involved in technology implementation. It is an analysis tool.

The STP framework shows the links among three elements of a technological implementation: the system, the task, and the person who is the user of the technology.

The *system* is a purposeful arrangement of instruments and tools that aid the worker in the production of goods or services. The instruments and tools in question may include workstations, networks, models and solvers, information systems, and other software. One may still find a manual "system" composed of paper worksheets and forms, blackboards, flip charts, and a manual of procedures.

Campion and Medsker (1992) propose a definition of the task which, while general, is a good fit for factory work. They define the task as a set of actions to be performed by a worker in order to transform various inputs into an appropriate output by means of instruments, tools, and methods. Meister (2003) offers a complementary definition well-suited to knowledge work. He sees the task as an arrangement of behaviors of the worker (perceptions, cognitions, motions, actions) linked and ordered in time and organized so as to attain a goal.

The "person" is the individual responsible for the execution of a set of operational or planning tasks using the system provided. The "person" might be part of a work group performing essentially identical tasks (for example, work in a call center), or one of a series of tasks that are carried out in a fixed sequence (as in a formal business process).

The STP-Triangle (Price & Rousseau, 1994) in Figure 12.1, is a framework and a tool for the analysis of a model's implementation that illustrates the interconnection of these three elements. The triangle represents human involvement in producing work output.

Figure 12.1 displays text balloons that identify the roles of various actors involved in establishing and maintaining the execution of the Task. The three nodes of the framework involve the following roles:

- The **Task** is established and maintained by a task designer who may be an analytics professional, a business process designer, an experienced operator, or a manager. It is executed by a person referred to as a "user."
- The **System** is managed by an IT team that deals with the evolution of the hardware and software and with system security and with ensuring the compatibility of the various software modules. The System includes hardware (workstations, computers, networks, storage devices) and software (information system, databases, software tools, analytics models) designed to assist the user, in the execution of the task
- The **Person** (user) who executes the task is supported by a human resource manager who is responsible, among other duties, for hiring, training, performance evaluation, and workplace safety

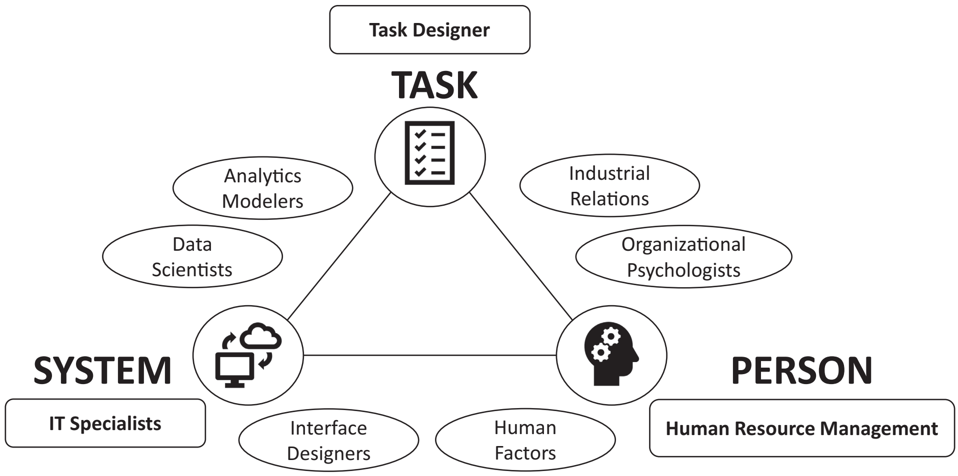

FIGURE 12.1: The System-Task-Person (STP) framework.

The three links of the framework may also be associated with specific roles:

- The **System-Task** link is where analytics professionals are usually found implementing models. The modelers work at formulating a representation of all or part of the task while the solvers devise algorithms (or choose them from among existing algorithms) for obtaining appropriate solutions that will assist the users in the execution of the task. The modelers will work nearer to the Task end of the link, while the solvers will need to work closely with the IT specialist
- The **System-Person** link requires the skills of the interface designer and the human factors specialist. The interface designer will ensure that display screens are clear and logical and are easily navigated. The human factors specialist will contribute knowledge of the cognitive efficiency of various interface choices
- The **Person-Task** link may involve industrial relations issues. For example, a proposed modification to the task may change job descriptions that are embedded in a collective agreement or require retraining of the users. Organizational psychology may contribute to the evaluation of personnel or to identifying potential health issues

Note that while nine roles have been identified, fewer actors may be required. For example, one analyst may redesign part of the task, model the revised task, design the model solvers, write the code to implement the model, and integrate it into the existing IT installation in a total of four roles. The human resources manager may cover issues with industrial relations, psychology, and human factors, and so this one actor will take on three roles. It is important for the analyst to note that for a model to be successfully implemented, each of the nine roles must be covered. In a given application, some roles may be "walk-on" bit parts – for example, there may be little or no industrial relations impact or health and safety issues. However, all roles must be covered.

The model implementation team may be "rich" in expertise. Some roles may be covered by a "resident" incumbent. For example, there may be an IT systems manager, a human resource manager, or a human factors person who has both the expertise and the organizational authority over a role. If there is no such resident incumbent or if that person is unavailable to the implementation team, there is a need for the analysts to develop minimal expertise in the field in question. There is no doubt that most analysts are more comfortable working along the System-Task link. The talents required to work effectively on the other two links are the "soft skills" mentioned so often in talks and publications.

To reduce project risk and to facilitate implementation, the analyst would do well to identify which actor will play each of the roles and to specify what script – the desired actions – the actors must follow for the project to be a success.

The manager who "owns" the STP triangle framework of Figure 12.1 is a tenth actor. This manager is the owner of the task, controls access to many elements of the triangle, approves the project, and judges progress and results. The analyst should be aware of what script this senior actor will follow and what constraints this script may add or remove on the implementation.

The situations outlined in Figure 12.1 are examples of how the nodes and arcs of the STP framework may be populated in a given project and not normative ideals. In practice one is likely to find a wide variation in the training and experience of the individuals playing a given role. For example, the Person role may be in the hands of a board-certified industrial psychologist in a firm with a depth of such professionals. Such a professional could conceivably be the overall team leader. This might occur in a firm developing software for public use, such as a touch-screen for an automobile dashboard which must transmit data to the driver without being an intrusive distraction. In other circumstances, the Person role could be managed by an experienced and respected engineer with a deep knowledge of the firm's Human Resource policies.

12.6 Supply Ship Scheduling in the US Navy

Let us return to the US Navy's ship scheduling model, RASP, that by 2017 had been implemented in two US Navy sites overseas. This experience in implementing the model enriched the framework and contributed to fashioning its present form.

Even now, in some locations, supply ship scheduling is being done manually. Schedulers seek a "good" feasible solution such that all operational ships receive timely resupply, supplies delivered are adequate in quantity, and that costs, particularly supply ship fuel costs, are controlled. A legacy information system records data concerning each operational vessel: its present position, time and place of the last resupply, and the current levels of onboard commodities and ordnance. It may also show a target time and location for the next resupply at sea. For the present time period (a specific number of days) manual scheduling assigns a specific supply ship to the task of resupplying one or more operational vessels at known times and locations. In the manual scheduling process, the schedulers must ensure that each supply ship can complete its assignments in the time required and supply the required material to the operational vessels.

As one would expect, some schedulers produce better supply ship assignments than others. Coordination among the schedulers ensures that the overall solution is feasible, but for several reasons, the manual solution may be far from what could be considered as optimal. For example:

- Manual scheduling is time-consuming and the schedulers may not have the time to improve the first feasible solution found

- Coordination among schedulers may be imperfect and details overlooked may render the proposed solution infeasible
- Human schedulers will often favor “greedy” heuristics in scheduling (e.g., first do the job with the shortest processing time, go to the closest city in the Traveling Sales Person) and non-intuitive, but high-quality solutions may never be found
- In order to render a trial schedule feasible, it may be necessary that supply ships travel at high speed, requiring more fuel, and driving up the cost of the supply operations
- The turnover rate for naval personnel assigned to the scheduling task is a problem because they are given only on-the-job training and are in post for relatively short periods (three years or less) which causes a loss of expertise

Naval Postgraduate School developed an operational planning solution that generates optimal replenishment schedules for the resupply ships. The primary focus of the tool is to minimize supply ship fuel consumption while servicing combatant customer ships with adequate supplies. The secondary focus shifts to the planning staff itself, seeking to reduce task force staff workload through the automation of data capture and standardized report generation.

Let us now look at a few of the elements that a prior analysis with the STP framework could have revealed.

On the Task node: At the Task node, the STP triangle owner is the supply ship scheduling organization Commanding Officer (CO). The CO owns the task and negotiates a rendezvous with the commanding officers of the customer ships to ensure timely resupply and will be held responsible for any failures. While the manual scheduling system has its faults, it functions nonetheless. The CO understands the system and is able to “tweak” it in unusual situations or when faced with unforeseen events. The CO may be nervous about accepting the work of what may seem to be a “black box.” What can the CO do should the current model solution be unsatisfactory? The CO of the first implementation site actually had some of these concerns and informally revealed them to the analyst at a social occasion. Further compounding issues are that each supply ship command is independent of one another and have completely different business processes due to geographic differences. Each CO has a different opinion on how the scheduling model fits into their scheduling and planning processes.

System node: The legacy system was installed on a secure computer network, due to the ships’ schedules being classified, and was managed by an IT specialist on site. Initially, the installation of the new model on the secure system was not authorized. This created an increase in overall workload because data from the legacy system had to be manually copied to the computer on which the model was installed. A heuristic of the model was developed to allow full implementation into a Microsoft Excel spreadsheet.

Person node: Schedulers are assigned to this task in the same manner as for any other shore assignment. They receive only on-the-job (OJT) training, and there is no specific computer literacy requirement. Not all schedulers fully commit to using the model because, in the short term, it involves an increase in workload as well a commitment to climbing the learning curve. The short-term assignment (one to three years) of the schedulers does not encourage investment in learning the new process. The new scheduler may or may not get adequate training on the model or have the background to immediately absorb the training.

Person-Task axis: An increase in workload was caused by the need for manual re-entry of a large volume of data. A junior reserve officer with an appropriate background was identified and trained for several days in the use of the model. He was assigned, as part of the implementation team, to carry out the day-to-day OJT of the schedulers, to shoulder the temporary increase in the overall workload, and to identify desirable modifications to the model and its computer implementation.

System-Person axis: Early in the implementation, it became evident that interface design was an important issue. Schedulers were keen to have screens and printed reports that exactly reproduced those of the legacy systems. Numerous requests for reprogramming the user interface were dealt with as expeditiously as possible. Many formatting issues such as font sizes and box colors were addressed to satisfy customer requirements in this area.

System-Task axis: Implementation of the new model modified the Task to some degree. Rather than producing one feasible solution, the schedulers would be able to explore some high-quality solutions and to modify them to some degree. The model also allows for exploration of "What-if" scenarios. Ten-page scheduling messages were automatically formatted and produced and that reduced production time and reduced errors from manually typing the schedule into a Microsoft Word document.

12.7 The State Space Framework

A Google search for the term "resistance to change" will yield approximately 75 million "hits." Resistance to change is real and observable, but merely saying that an implementation failure was caused by resistance to change leaves many questions unanswered.

Because *resistance* is so frequently blamed for failures, a project implementation team is sometimes asked to include dealing with negative reactions to change in the project plan. From the professional literature, many implementation teams have chosen to use the work of Kübler-Ross (Kübler-Ross, 1969) on death and dying as a model of "resistance to change." Kübler-Ross proposed a model of the emotional stages that will be experienced by a person who is told that death is approaching. The five stages are denial, anger, bargaining, depression, and acceptance. In adaptations of this model to represent resistance to change, more stages are sometimes added, and the terms changed to better fit a technology implementation project, but the principle is the same. Direct adaptations of the Kübler-Ross model assume that resisters display denial when the project is announced and then go through a progression of emotional states that end with acceptance.

Adopters of this interpretation of the Kübler-Ross model seek to move users through the intermediate stages and to overcome resistance through an appropriate communications plan. If the users continue to "resist," communications are repeated or augmented. This may actually help, and it is indeed important to have the best communications plan possible and to ensure that participants are not led to unhelpful positions through a lack of information. However, while there is value in the adaptation of the Kübler-Ross death and dying model to technology implementation, the two situations have characteristics that are quite different.

If careful medical diagnosis determines that a disease is fatal and untreatable, it may lead the person affected to *acceptance*. A technology implementation project simply does not have this weight of inevitability. Users know that the implementation is not preordained and that they are not obliged to accept it passively. The technology implementation situation is closer to the model depicted in the state space framework in Figure 12.2.

When a technology implementation project is announced, the participants will have different emotional reactions. Some will see the new technology as desirable progress while others may be more cautious.

It is useful to see the state space framework as a Markov chain in which a user may move from any state to any other state with some non-zero probability. For simplicity's sake, Figure 12.2 illustrates what are the most common states and transitions. Each of the states in this model will be familiar to practitioners who work in the area of technological innovation and organizational change, although others may carve up the state space in different ways.

One finds reference to such state space frameworks in Lapointe and Rivard (2005) and elsewhere. Lapointe and Rivard use a finer definition of the states of resistance, referring specifically to states of apathy, passive resistance, active resistance, aggressive resistance, and implicitly to those called trial acceptance and satisfying.

Some users will, for their own reasons, move directly from *Awareness* to *Trial Acceptance*. They may conclude that their knowledge and previous experience will allow them to use the new technology and benefit from it without great difficulty. Alternatively, they may feel that the new technology will bring advantages such that

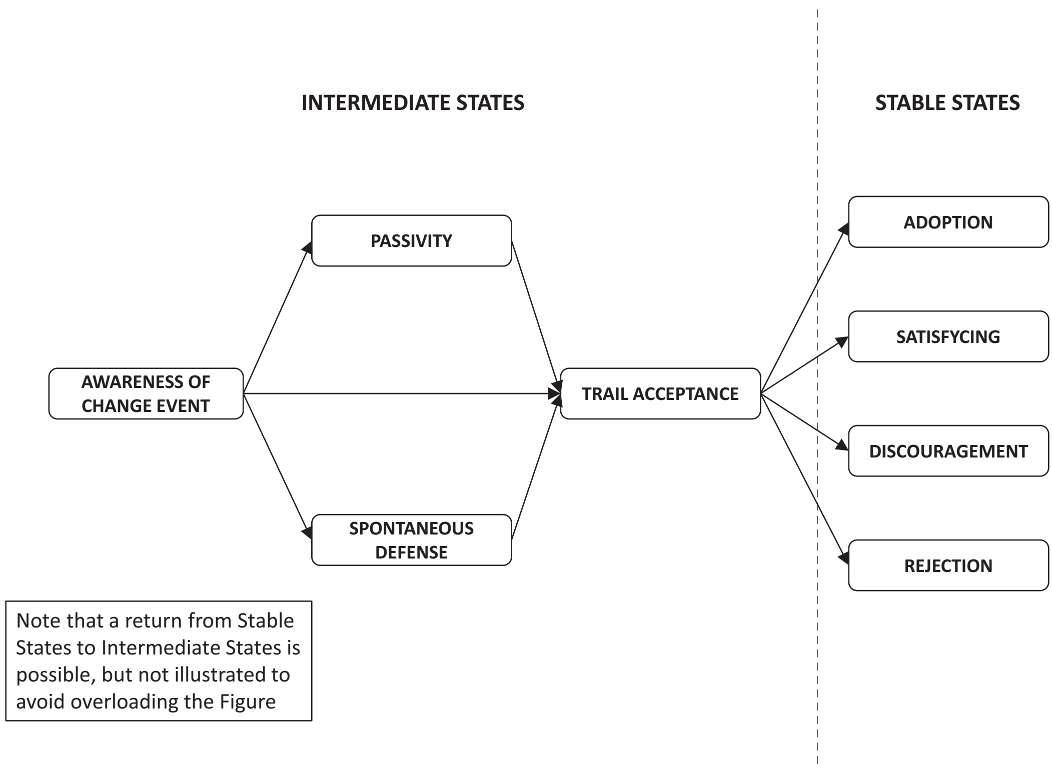

FIGURE 12.2: The state space framework.

even if a sustained adaptation effort is required, the benefits will outweigh the costs. They will refrain from the immediate and permanent adoption of the technology, so as to see if the supposed advantages materialize and if the barriers to adoption are as expected.

Others will exhibit *Passivity*. They feel that the new technology will not affect them. It may be that their work, as they see it, will not be touched by the new technology. Others expect to be transferred or to retire before the technology is implemented or are distracted in their work by issues in their private lives. These participants may move to *Trial Acceptance*, but perhaps not all of them will. Some, as a result of further thought, discussions with others, or due to new information received, might move to the intermediate state, *Spontaneous Defense*, and refuse to accept the new technology.

Spontaneous Defense is a state of aggressive and vocal objection to the technological implementation. Signs of this behavior may appear immediately following the announcement of the project. There are a number of possible causes for the adoption of this behavior. Experienced users who are adept and efficient with whatever legacy system is in place may feel downgraded by a new technology which will allow any new user to perform at their level. They see the new technology as part of a "de-skilling" process that devalues the work they perform. Others feel that the new technology is too difficult to master and that they will be left behind, or that mastering the new technology will require a considerable effort for which they will not be compensated.

There are also instances where vigorous objections to the proposed implementation are based on objective reality. The new technology may not, in fact, fit the job, and some users may fear that they will be obliged to invent a work-around and attempt to use both new and legacy technologies in parallel.

Possible transitions among the intermediate states that are not illustrated include passages from *Passivity* directly to *Discouragement* or *Rejection*. Where a user moves from *Trial Acceptance* to *Defense,* a good first impression may be shattered as a deeper understanding of the technology is gained through experience with its use as in Case Two of the Lapointe and Rivard (2005) report.

The four final states are:

- *Adoption* – A state describing users who have mastered the new technology and use it to the best of their ability
- *Satisfying* – A state describing users who have a basic knowledge of the new technology but who use it without enthusiasm and without actively seeking to improve their performance. They "get by"
- *Discouragement* – A state describing users who have been unable to master the new technology and who, at least for the moment, do not feel that they will be able to do so
- *Rejection* – Some users will definitively reject the technology and will seek to have it withdrawn, sometimes through the governance structures of the organization (committees, grievances, technical analyses) and sometimes outside of them (attempts to influence decision-makers). Others may use the technology but will vocally find fault or object to it at every opportunity and blame it for delays and errors

The state space framework of reactions to the implementation of new technology offers a richer representation of the sequence of emotions that a user may experience than the adaptations of the Kübler-Ross model, which was developed for a very different set of circumstances. It will be useful as a lens through which the reactions of users may be observed and interpreted. Rather than rely only on a common communications approach to helping users through the implementation of new technology, it encourages the analysis of users' behaviors and allows each individual to be situated within the state space framework. An individualized approach may then be crafted to address the concerns of the users and to better identify those unable or unwilling to embrace the change.

12.7.1 Motivating Users to Move to Acceptance and Adoption

There are actions that the implementation team can adopt to encourage users to adapt to the changes required by the proposed implementation. Stone, Deci, and Ryan (2009) offer a guide to actions that favor the reinforcement of a sense of competence, relatedness, and autonomy among users. They include the following list of actions in their recommendations:

- *Invite active user participation* in the implementation of change by asking users open questions
- *Avoid direct confrontation with users* who express emotional reactions to the implementation, for example, by formulating questions that invite clarification of their position
- *Offer choices if possible* (e.g., software systems, packages or platforms, team composition, implementation schedule) and clarify the roles and responsibilities expected of users
- *Provide positive praise* of specific contributions to the project but avoid routine formulaic praise which will be seen as insincere
- *Minimize coercive controls*, such as the use of compensation and benefits as a motivational strategy, as this may actually be counter-productive
- *Go beyond formal training* to develop talent and promote the learning of new skills and the sharing of knowledge. User groups, internet-based communities of practice, or professional and scientific societies may be useful forums

12.8 Anticipating Negative Reactions to the Implementation of a New Model

12.8.1 Use the STP Framework to Understand the Change

Radical technological change projects can present greater difficulties than more routine implementations, no matter how well they are designed and how great their benefits. If implementation of the analytics model and associated IT system also requires changes to the task process or to the user's job, this must be taken into account at the earliest opportunity. While the project plan may have no activity or resources for this analysis, if it is set aside, project risk will increase. The decision-makers may hesitate to engage in a revision of the task process or the users' ways of work if the analytics model is seen as "simply" an update to whatever legacy system is in place, but if the change is radical, these steps will indeed be required. From the analytics point of view, the change is most often centered on the system models and algorithms but may involve modifications to the task, in the tradition of industrial engineering. Will the changes to one of these elements be great enough to require changes in the other two?

Using the STP framework as a guide, one may ask if a proposed system implementation affects the power relationships (Markus, 1983), the perceived equity balance (Joshi, 1991), or the stress and fear level (Marakas & Hornik, 1996) of the users or if their previous experience with technology (Martinko, Henry & Zmud, 1996) may lead them to a negative reaction to the change. Answering these questions will require careful observation and interpretation of the ways users interact with the new technology, the task as currently defined, and the attitudes and intentions of decision-makers who are involved.

12.8.2 Use the State Space Framework to Observe Stakeholders

Most analysts have little or no formal training in the so-called soft-skills for dealing with human behavior. However, the implementation of a new technology cries out for such skills. The analyst can use the State Space framework to note current thinking of various users, follow the evolution of their points of view, and detect at the earliest opportunity signs of negative reactions. Typical mitigating actions are improved communication with stakeholders, changes to the project timetable and, if necessary, to project content and even to the group of users. This activity will remain ongoing throughout the implementation period and will require careful observation of stakeholders' verbal statements, work habits, and non-verbal communication. It also demands that the analyst develop the self-awareness and humility required to ensure that claims of user "resistance" are not used to mask the effects of shortcomings of the new system.

12.9 Summary

The STP triangle reminds us to ensure that the model and associated IT system are tuned to the needs and skills of the users and that both address the task in an efficient and effective manner. The state space framework provides a useful tool for following the progress of users' points of view concerning the implementation, while the conceptual models cited (Markus, 1983; Joshi, 1991; Marakas & Hornik, 1996; Martinko, Henry & Zmud, 1996; Lapointe & Rivard, 2005) suggest pertinent axes for observations.

In the analysis of implementation, the analyst should remember Ford, Ford, and D'Amelio (2008) who suggest that if there is "resistance," it may be a reasonable reaction to a flawed system or even a way for change agents to explain away their own management failings. Change agents should be careful and open in their interpretations of users' actions and be willing to negotiate accommodations. The following points summarize the point of view of Ford, Ford, and D'Amelio:

- In a radical change, old ways of work and agreements will be cast aside, perhaps creating *violations of trust* or perceptions of such violations. A radical change should, therefore, be managed as a dialog that is not driven by a rigid timetable
- Change agents must develop *compelling arguments* in favor of proposed changes (legitimization) to avoid the early development of strong counterarguments that are harder to rebut once enunciated

- Change agents should call for a *concrete first step*, such as attendance at a training course, system demonstration, or site visit. If there is no call to action, users may conclude that there will be no change
- If change agents describe only favorable outcomes, they will provoke a strong reaction should a hidden difficulty actually arise. The analyst can use the state space framework

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