

The Technology Transition Model: A Key to Self-Sustaining and Growing Communities of GSS Users

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Abstract

1. Introduction

If Group Support Systems (GSS) are so good, why isn't everybody using them? A vast wealth of lab and field research shows that when the right GSS tool is applied to the right task, team productivity can be significantly enhanced (See Fjermestad & Hiltz, 1998; forthcoming for an exhaustive compendium of GSS lab and field research). Field studies of teams with tasks ranging from strategic planning (Adkins, et al., 1998; Dennis et al., 1997; Quaddus, Atkinson, and Levy, 1992) to IT requirements definition (Davison, 2000;) to military intelligence (Briggs, et al., 1998-99) can routinely achieve cycle time reductions of 75 – 90 % and labor savings of 30 – 50%. Yet an informal survey of GSS vendors suggests that there are fewer than 5,000 active GSS installations worldwide.

Until recently, no clear pattern emerged to explain why one GSS installation would succeed when another would not. The results were unpredictable. Consider the case of the U.S. Navy's Third Fleet aboard the U.S.S. Coronado. The Fleet's J2 Intelligence community adopted GSS for situational awareness and analysis after only four 1-hour training sessions. One reserve officer who checked aboard the ship at midnight and stood an immediate watch found the GSS running on his desktop. With no training or

instruction, he simply began using the system. In an interview the following morning, he reported that the system was so obvious and easy that he needed no help. Three years later, that community continues to use GSS, and its use has spread to intelligence communities on other ships.

Right across the passageway of the same ship, however, despite a desperate need and an intensive three-year intervention, the J5 Plans community never became self-sustaining. This group was charged with a range of operational planning tasks with time horizons ranging from one hour to 5 years. J5 was substantially understaffed, and felt a keen need for the leverage provided by GSS. During the three years, GSS researchers embarked nearly every time the ship went to sea. When the GSS researchers were aboard to facilitate, the J5 staff used the GSS facility many hours a day, 7 days per week. When the researchers were not aboard, the facilities collected dust. Interviews with key personnel revealed that they perceived the GSS as being impossibly difficult to use. Said one, "this technology is so hard to run that I don't see how you could expect normal people to do it."

Why did the intelligence officers become self-sustaining after 4 hours of training, while across the passageway, equally bright, equally motivated planning officers with a painful need

did not become self-sustaining with a three-year intervention?

Consider also a case in Washington, D.C. In D.C. Public Schools, a new pedagogy based on a GSS produced substantial increases in reading, writing, argumentation, and teamwork skills among fifth- and sixth-graders. The students learned to run the technology for themselves and reported it was easy to use. Yet, although the entire faculty of 40 participated in intensive training, only one used the technology on a regular basis. The teachers reported that the technology was so hard to use that they could not conceive of trying to use it in their classes.

then posits a chain of logic to explain why repeatable methodologies may be critical to the long-term success of GSS.

2. Theory

Davis' Technology Acceptance Model TAM (Davis 1986; 1989; 1993) posits that people will develop an intention to use, and therefore will use a new technology if that technology is perceived as useful, and if it is perceived as easy to use (Figure 1). There is robust empirical support for TAM. However TAM was devised to predict software usage a few weeks subsequent to the first hour of exposure. It offered little explanation for why an organization

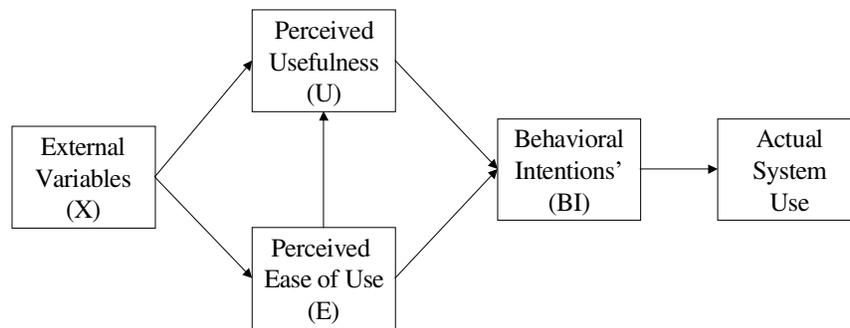


Figure 1. The Technology Acceptance Model (TAM) From Davis, 1986, 1989, 1993

Why did the students find GSS easy to use, while the teachers found it impossible to use? Non-teacher participants in the project had ready speculations: the teachers were too old; they were afraid to look bad in front of the children; they wanted to be the center of attention; they were afraid of losing power, and so on. Over time, none of these speculations held up to scrutiny. The mystery deepened.

This paper describes how the Technology Transition Model provided a key to unlock the mystery of self-sustaining and growing communities of GSS users. It details a chain of logic to explain why GSS is self-extinguishing in some circumstances, and successful in others. It

would eagerly embrace a technology for two years, and then abandon it, and yet we have observed many GSS installations in the field which followed that pattern. TAM offered little explanation for why one group of users would find a GSS obvious and easy, while another group with equal need and equal skill would report the GSS was impossibly difficult. Furthermore, TAM makes reference to an X factor, external variables that influence perceived usefulness and perceived ease-of-use, but the model does not enumerate those factors nor explain their effects.

The Technology Transition Model (TTM) (Briggs, et al., 1998-99) builds on the foundation

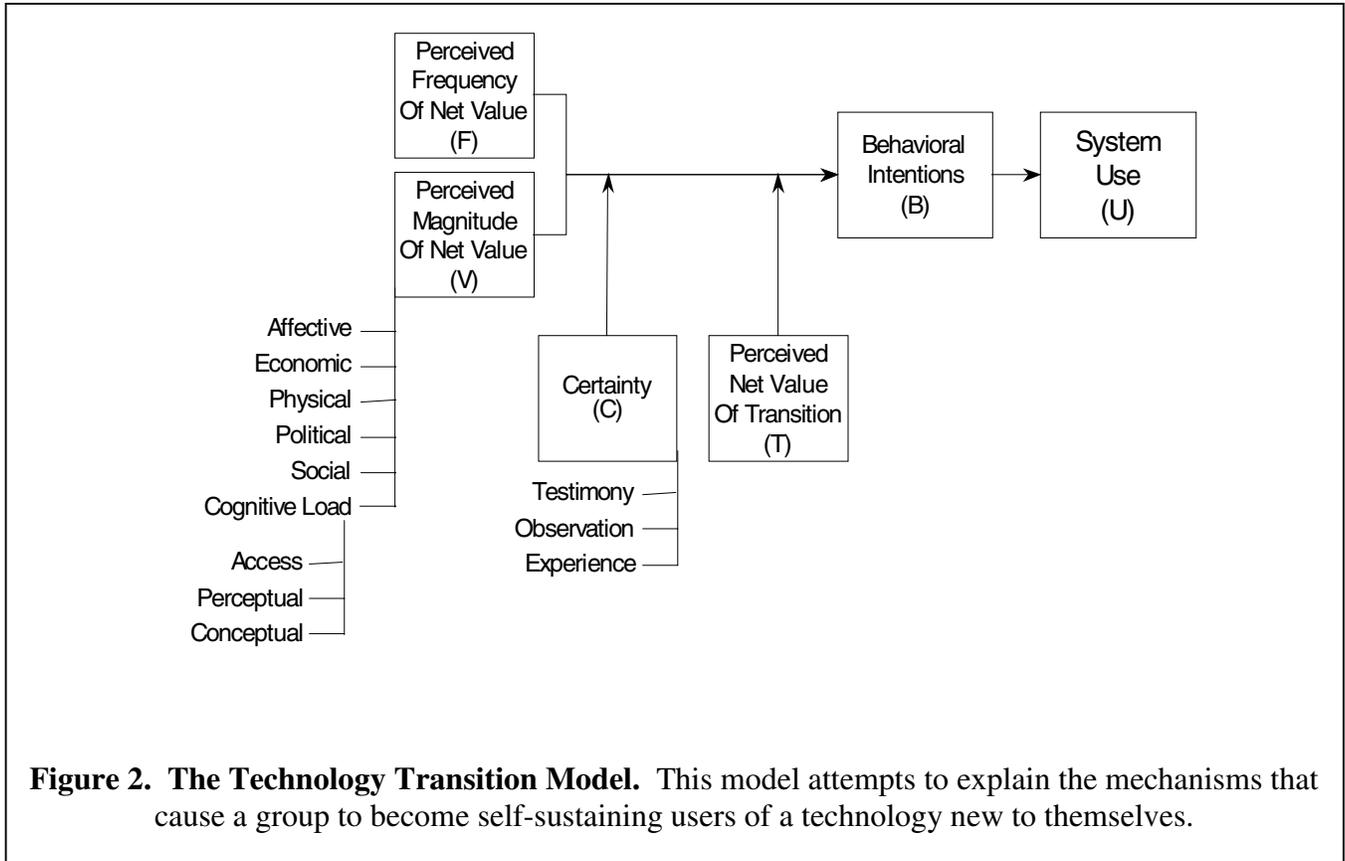


Figure 2. The Technology Transition Model. This model attempts to explain the mechanisms that cause a group to become self-sustaining users of a technology new to themselves.

provided by Technology Acceptance model. TTM evolved from TAM during extensive field investigations of why some GSS communities grew while others extinguished (Briggs, et al., 1998-99). Like TAM, TTM (Figure 2) posits that system-use (U) is a positive function of behavioral-intentions (I). However, unlike TAM, TTM posits that intention-to-use is a multiplicative function of:

1. The perceived magnitude (M) of the net value that might obtain after a switch to the new technology
2. The perceived frequency (F) with which said value might obtain

The direct causal relationship between $M \cdot F$ and B is moderated by two factors.

1. A multiplicative function of the degree-of-certainty (C) about perceptions of magnitude and frequency of value.

- a. Certainty is an asymptotic function of exposure through testimony, observation, and experience. The more exposure one has to a new system, the more certain one feels about ones perceptions of that system.

2. An additive function of the perceived net value of transition (T). There are both costs and benefits to the transition process that are different from the costs and benefits of using the new system once it is in place.

TTM can be summarized as a mathematical approximation as follows

$$B \cong f(I) \cong f(VFC - T)$$

TTM posits that perceived-net-value (V) is an overall sense, derived through the parallel processing of the brain, rather than a rational,

deliberate summation of each individual cost or benefit. Indeed, people may arrive at some V without being able to articulate all the factors that weighed in the assessment. TTM posits that as people consider using a new system, they perceive value (both cost and benefit) along a number of dimensions, among them:

- Affective:** Changes in Positive or negative feelings
- Economic:** Changes in cash, assets, marketability, etc.
- Physical:** Changes in health and comfort
- Political:** Changes in the balance of power
- Social:** Changes in relationships
- Cognitive Load:** Changes in the amount of mental effort expended

Notice that the ease-of-use construct from TAM has been superseded by the cognitive-load construct in TTM. This is because field observations revealed ease-of-use to be a badly confounded construct. Although it was not obvious at first, when people reported that GSS was “easy to use” or “impossibly difficult” they were not always talking about the same things. It was this discovery that unlocked the mystery of why GSS was self-extinguishing in some circumstances and self-sustaining in others.

Cognitive-load is the amount of mental effort a person must expend to use a technology. It has at least three dimensions:

- Perceptual Load:** User friendliness – how much mental effort is required to find and control the features and functions of the software
- Access Load:** Availability – how much effort is required to gain permission and access to use required functionality.
- Conceptual Load:** Understanding – how

much effort is required to understand what the technology is supposed to do for you

The GSS with which we were/ working¹ had an acceptable perceptual-load. People could generally find and use the controls on the software without difficulty. In this sense it was “easy to use.”

The access-load for the system varied from installation to installation. In the case of the intelligence community at Third Fleet, the system was open and running on dedicated laptops 24 hours a day, so access load was negligible. In the planning community the system was installed in a room with a combination lock. People had to find the room-owner and sign up to use it. Once they were in the room, they had to fight with a balky network and a maze of controls for the projectors. Access load was therefore somewhat higher, although it was not intolerable.

The mystery of creating self-sustaining and growing communities of users was unveiled by the concept of conceptual load – understanding what the technology was *supposed* to do. With most software, one must understand what is happening on the screen. With a GSS one can understand what is happening on the screen and still have no idea of how to use the tools. The primary purpose of a GSS is to create, sustain, and change useful patterns of interaction in a group. GSS is not about the screen, it is about what the screen does to the group. Does it cause them to diverge, creating more and more ideas? Does it cause them to converge on just the ideas that are worthy of further attention? Does it

¹ All our research and observations were conducted with GroupSystems software, developed by the University of Arizona and commercialized by GroupSystems.com

cause them to organize complex concepts? Does it cause them to move toward consensus?

GSS can be a rich, flexible, full-featured platform that a facilitator can use to guide a group through any emerging task. However, there is nothing obvious on the screen of a GSS to indicate what will happen in the group – you just have to know. The GSS we used had seven tools, each with about 20-25 configurable features. Each configuration had some subtle yet powerful effect on group dynamics. In all there were more than 10 million possible configurations. It took about a year of apprenticeship to become comfortable with how the various configurations could be used to change the pattern of interactions in the group. During that apprenticeship one learned what to say to a group to explain the technology and the process. Then one could confidently design activities knowing in advance the benefits the group would derive.

3. Why GSS is Self-Extinguishing For Non-Routine Problem Solving

Observations in the field suggested that people with a ship to deploy or a business to run typically did not have a spare year to apprentice themselves as facilitators to learn how to wield a GSS with skill. Further, they typically had no interest in being facilitators. They wanted to be what they were – executives or weather persons or auditors or whatever. Therefore, in order to derive the benefits of GSS for non-routine problem solving, they had to make use of either an external consultant or an internal facilitator. If they depended on an external consultant, they were, by definition, not self-sustaining. If they depended on an internal facilitator, over time issues of perceived economic and political value (V) caused the GSS implementation to be self-extinguishing.

Economic Issues

There were several economic factors that worked against the creation of a self-sustaining community of people that used GSS for special events and non-routine tasks. First, work units tended to be organized around routine, repeatable tasks. It was therefore unlikely that any given work unit would encounter enough non-routine challenges that they could afford their own facilitator. It was therefore common practice to create a GSS center-of-excellence staffed by one or more facilitators to serve the needs of many work units. Because the GSS function cut across organizational boundaries, it was typically approved and funded fairly high up the organizational structure.

When a budget crunch came, as they always come eventually, organizational leadership could disband the GSS center of excellence without alienating any of the work units. There was no work unit likely to need the GSS frequently, and therefore no work unit was willing to sacrifice an internal position to keep the GSS center operational.

Even a superb business case for a GSS center of excellence was usually not sufficient to prevent its closure during a budget crunch. One GSS center that we observed reported an ROI of more than 600%, which was a conservative estimate, and yet it was closed. Several that we tracked had solid documentation of a \$1.5 million to \$1.7 million return on a GSS Center investment of less than \$300,000, and yet they were closed. The problems were several. First, the returns on GSS centers tended to be in cost savings and cost avoidance, so there was no one person in the organization who could look at a spread sheet and say, “there’s the 1.5 million we saved with GSS this year.” Further, because GSS centers tended to support special events and non-routine problem solving, the facilitators could not build a case for savings they might cause in the future. The conversation tended to go something like this:

Management: What have you done for me lately?

Facilitator: Here is the documentation that I saved you \$1.5 million last year.

Management: Doing what?

Facilitator: Oh, lots of things...requirements negotiation, vendor selection, product development, resource reallocation, we did that great BPR in Marketing...

Management: Well, clearly your documentation is sound, but I can't really find that \$1.5 million here in my budget. What are you going to do for me next year?

Facilitator: Oh, um...lots of things.

Management: Like what?

Facilitator: Well, I can't really say just now. People call on us when they've got a problem. We help them.

Management: I'm sorry, I can see you've been very helpful in the past. But the special problems you worked on last year have now been solved, and you don't know what you'll be doing this year. I'm in a budget crunch right now, and the money you're saving is for someone else's budget. We're going to have to disband the center.

Thus, even an astonishing business case for a GSS center of excellence may not be sufficient to prevent its closure.

Political Issues

Even if economic factors did not work against the long-term survival of a GSS Center of Excellence, there is a political issue that would be likely to make it self extinguishing. Consider the following. In order to succeed, a GSS facilitator must be

- Bright
- Articulate
- A problem-solver
- A people-person
- Good with technology

Consider further that, for economic reasons, the facilitator is likely to be working fairly high-up the organizational structure, and that they frequently come in contact with people of influence and power. Bright, articulate, problem-solving people-persons with a flair for technology are rare.

Field observations suggest that when these facilitators come in contact with movers and shakers, the movers and shakers quickly find other, more important things for them to do, and the facilitators get promoted away quickly. In which case, either that a person of lesser talent takes over the GSS, in which case the facility quickly fades to disuse, or another talented person takes over, only to be promoted away a few months later. We encountered this pattern in more than a dozen organizations.

Thus, economic and political factors combine against the long-term survival of GSS centers of excellence. While there are notable exceptions, in many cases, GSS centers of excellence that focus their efforts exclusively on serving the emergent needs of multiple business units tend to fade within 18 months to 3 years.

4. Practitioners and Repeated Methodologies

A comparison of the patterns of GSS usage across organizations that became self-sustaining and organizations that did not become self-sustaining revealed two distinct patterns that seemed to lead to long-term use.

Firstly, professional services organizations and consultants tended to become long-term users, wielding GSS on behalf of their clients. However, their clients tended not to become self-sustaining users; when the consulting engagement ended, so did GSS use in the client organization. Thus, GSS use by consultants did not tend to give rise to self-sustaining and growing communities of users.

Secondly, practitioners of repeated methodologies tend to establish self-sustaining and growing communities of users. Practitioners are not facilitators. Rather, they are professionals who use GSS to practice some repeated methodology to accomplish some important task in the regular course of their duties. Examples were auditors who conducted risk analysis, senior executives who practiced strategic planning, systems engineers who conducted requirements negotiations, and, of course, intelligence officers conducted situational assessments.

Conceptual Load for practitioners is nearly zero. Unlike facilitators, who must learn every nuance of a GSS to be ready for any eventuality, practitioners need only to learn the steps of their own methodologies. *First click this, then click that, then click the other, and then we're done.*

A given practitioner used only a fraction of the available GSS functionality. Often practitioners were completely unaware of and uninterested in any other capabilities the GSS. This point was illustrated clearly by an Air Force group that used GSS for strategic planning. They were surprised to learn that the Navy used the same GSS for intelligence analysis. Asked one, "Why

would they use a strategic planning tool to do intelligence analysis."

Because practitioners do not need to know the possibilities offered by GSS, their conceptual load is low. If the GSS methodology is effective, people can teach the steps to others without teaching them everything about the GSS. Therefore self-sustaining and growing communities of users tend to form around the practice of repeatable methodologies supported by GSS.

Conclusions

While the Center of Excellence approach to GSS deployment tends to be self-extinguishing, the practitioner / repeatable methodology approach appear to be self-reinforcing. The business case for a repeatable methodology is easy to build, and it tends to be a persuasive argument for continuing GSS use (paraphrased below):

"We now complete our requirements negotiations in ¼ the time it used to take. (Briggs & Gruenbacher, 2001)

"We complete our quality improvement projects on the production line in 1/10th the calendar days we used to require." (Growhowski, et al., 1990)

"We cut our situational awareness cycle from 30 minutes to under a minute" (Briggs, et al., 1998-99)

Practitioners typically do not work across organizational units on non-routine problems; they work within their unit on routine tasks. When a budget crunch comes, or when a shortage of skilled talent develops, the practitioners depend all the more on their GSS because to drop it would mean higher costs and longer project cycles. Thus, GSS use by practitioners tends to be self-reinforcing rather than self-extinguishing.

While practitioners often derive significant value from step-by-step methodologies based on GSS, they are not in a position to design these

methodologies for themselves. The methodologies must be created by highly-skilled, experienced GSS facilitators who understand the practitioners' needs, who understand group dynamics, and who understand how to use GSS to help the practitioners achieve their goals. It may therefore be a waste of a scarce resource to ensconce a good GSS facilitator in a GSS center of excellence to conduct one-off GSS events for people with special problems. The value created by a facilitator who leads one group at a time to success pales in comparison to the value created by a facilitator who designs one step-by-step methodology to be executed over and over again by thousands of practitioners.

Although at first it may seem counter-intuitive, there may be strong incentive for facilitators to become methodologists who create processes for others to execute in their absence. A facilitator can only charge for the hours spent preparing for and conducting an engagement. A methodologist can charge:

- To design the methodology
- To conduct pilot events based on the methodology
- To develop documentation for the methodology
- To develop training materials for the methodology
- To train practitioners and to train trainers.
- A subscription fee for every practitioner or organization that uses the methodology

There are very few people with the right mix of talent, skill, and personality to be effective GSS facilitators. Of those, many choose other professions, and those who choose GSS facilitation often move up and out to other jobs. Therefore GSS facilitators are likely to remain a scarce resource. It might therefore make sense for an organization to pay them well, to provide

incentives and perquisites to keep them engaged, and to focus them almost exclusively on using GSS to create leave-behind processes for others to run.

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