EXTENDING CRITICAL SUCCESS FACTORS METHODOLOGY TO FACILITATE BROADLY PARTICIPATIVE INFORMATION SYSTEMS PLANNING

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ABSTRACT

We extend critical success factors (CSF) methodology to facilitate participation by many people within and around the organization for information systems planning. The resulting new methodology, called “critical success chains (CSC),” extends CSF to explicitly model the relationships between IS attributes, CSF, and organizational goals. Its use is expected to help managers to (1) consider a wider range of development ideas, (2) better balance important strategic, tactical and operational systems in the development portfolio, (3) consider the full range of options to accomplish desired objectives, and (4) better optimize the allocation of resources for maintenance and small systems.

We trace the development of CSF and make the case for extending it. In two case studies, one at Rutgers University and another at Digia, Inc., we demonstrate the use of CSC in planning. At Rutgers, we use CSC to observe employees’ preferences for new systems features, to model the reasons why they think that the features are important to the firm, and to generate strategic IS project proposal ideas. At Digia, we use CSC to generate ideas for new financial services applications based on mobile communications technology for which Digia would be a part of the value chain. From our experience in the case studies, we define a practical procedure for data gathering and analysis to uncover and model CSC in the firm and to generate ideas for important IS projects.

Keywords: Critical success factors, CSF, personal construct theory, IS planning, laddering, evaluation, IS strategic planning, critical success chains, CSC, IS project selection, strategic grid, IS development portfolio.
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INTRODUCTION

Generating ideas for projects that will have the greatest impact on achieving the firm's goals is difficult [20, 31]. In most firms there is no shortage of ideas for new IS projects. With a steady stream of corrections, updates and new features requested for existing systems and with news of technological innovations appearing daily, managers have no problem finding many potential and seemingly worthwhile IS investments for the firm.

Finding projects with the most potential impact requires more, however. It requires imagining new systems that will transform the way the firm works, changing products, delivery channels, processes, and even the firm’s structure. It also requires, less dramatically, improved training, user support, and incremental system improvements. While knowledge of the firm and its customers, processes, and products that is necessary to generate such ideas may be richly distributed around the organization, critical attention to the mission of the whole organization is likely to be less available. The resulting deluge of system project proposals, mostly to support the incremental improvement of current activities, may camouflage important ideas for many firms. Executives have expressed dismay about their inability to confidently identify and value important IS project proposals [34, 47] to which they should allocate scarce firm resources.

IS planning (ISP) research has recognized this issue. Segars and Gover [59], for example, have identified important characteristics that lead to planning success, among them: (1) widespread participation among the firm’s employees to incorporate the ideas of many and (2) a focus on projects that have the most potential to be important for the firm. They have also recognized, as intuition might suggest, that incorporating the participation of many in ISP, while maintaining focus on projects that are important to the firm's objectives, is difficult and may lead to high planning costs [59].

Critical success factors (CSF) is a widely understood concept for identifying important performance objectives for the firm’s IT investments, e.g., [50]. The concept is simple and intuitively appealing: to identify needs for strategic systems, identify the small number of performance requirements on which the success of the firm depends [55].

In this paper we build on CSF to develop a new method for generating IS proposals for the firm. We begin with the strengths of CSF as a top-down concept for generating strategically focused IS project ideas and extend it to effectively incorporate participation by many in and around the organization. To accomplish this, we extend CSF to provide for the empirical identification of
performance objectives in the firm, using an application of personal construct theory (PCT) that is already well-regarded by business professionals. The new methodology, called critical success chains (CSC), explicitly models the relationships among system attributes, performance consequences and firm performance.

We present two case studies in which we use CSC for IS planning: the first, at Rutgers University, Camden Campus and the second at Digia, Inc. in Helsinki. At Rutgers we use CSC to empirically derive five organization-specific models of the IS features that participants want and the reasons why they want them. We use these models as the basis to generate a portfolio of four IS project ideas that generally focus on operations and infrastructure for the organization. At Digia, we use CSC to derive five CSC models for value chains for which Digia would play a part. Then we develop three project ideas for these value chains to which Digia would contribute and from which it would extract value. We then present a four-step guide intended to aid managers in the implementation of CSC in any organization.

CSC has the potential to benefit managers to develop the right portfolio of new IS projects for the firm. First, it allows for the economical participation of many in the organization in ISP, while keeping the focus on projects of potential importance to the organization. Broad participation is important because knowledge of potentially important opportunities is widespread in the organization and methods that restrict participation in the planning process effectively waste this knowledge, an important firm asset. Also, broad participation in ISP may help lead to user buy-in, important for successful implementation of IS plans. Secondly, the approach results in rich models of the relationships between IS attributes, CSF, and organizational objectives. These models may help developers to better understand why participants suggest particular IS project ideas because the ideas are anchored by related CSF performance and organizational objectives. Not incidentally, this may help developers to avoid costly design mistakes.

The remainder of the paper is organized as follows. First, we review applicable prior research. We briefly review prior research on ISP in order to understand what researchers have concluded about the best planning attributes. We discuss the development of CSF as an idea generation concept for planning. Then we consider personal construct theory and its application in marketing as a template for extending CSF as critical success chains. Second, we describe two case studies in which we apply CSC in a planning exercise at Rutgers and to develop a portfolio of new IS products at Digia, Inc. Third, we provide a step-by-step guide for implementing a CSC study. Finally, we conclude by discussing implications of the new method for managers and suggest directions for future research.
The paper makes a contribution to the ISP literature in four ways.

1. It makes the theoretical case to extend CSF to (1) provide for broad ISP participation, (2) keep ISP focused on what is important the firm, and (3) provide rich information to planners about relationships among system attributes, CSF, and firm objectives.

2. It defines CSC as a rich concept to model the relationships among IT attributes, CSF, and firm objectives for ISP.

3. It demonstrates the use of this extended planning concept in two planning situations, showing that its use in a real organization is feasible and produces good results.

4. It guides managers in the practical use of CSC in the firm.

**PLANNING FOR THE IS DEVELOPMENT PORTFOLIO**

IS planning research has suggested the importance of perspective and participation to achieve the right development portfolio. McFarlan used the “strategic grid” [3] to characterize the strategic importance of systems in terms of the impact of current systems and the application development portfolio on the firm. By the 1980s information systems served in strategic roles for some firms, while in other firms they played critical or non-critical operational roles [44]. Now most medium and large businesses have systems that would be scattered all across the strategic grid in terms of their importance to the firm, including some in the “strategic” cell, in which current and potential systems have strategic importance, others in the “turnaround” cell in which potential new systems have strategic impact, and many in the “factory” and “support” cells in which potential new systems may have important tactical and operational impacts. It is important to find the right balance of important strategic and non-strategic projects for the portfolio. To accomplish that requires ISP that is both strategic and participative.

For IS investments to help the firm to achieve its strategic objectives [20], ISP should be consistent with the firm’s explicit or implied strategy [65]. For ISP to be strategic, it must have a “top-down” perspective, i.e., be driven by information from senior managers [61]. Bottom-up methods for gathering ideas result in many more proposals than can possibly be implemented, most of which support existing methods of operation [37] and focus on cost cutting [12] rather than strategic objectives. Projects resulting from bottom-up processes tend to have little value for the firm.

ISP should, however, involve extensive participation. Implicit in the value placed on top-down planning is an idea that only senior managers can have a strategic focus [20]. True as this may largely be, others in the organization know much about what is important to the firm’s success. In addition, where important systems involve integration with suppliers and customers or where product
value is produced or embedded in systems, participation from outside the firm may be crucial, as the effectiveness of such systems is often determined by current and future supplier and customer needs and expectations [43]. Exclusive use of top-down planning effectively shuts the firm off from the effective use of this grass-roots knowledge [50], a big mistake in an era where quick, proactive adaptation to new environments is required [13].

This discussion points to potentially conflicting needs for ISP to be both strategic and participative. Indeed, according to Segars and Grover [59], for planning to be effective, it must be both strategic in focus and highly participative. ISP is expensive, however, [29, 39] and this need for top-down and participative planning [21, 52] may require excessive use of the firm's resources [40], unless new methodologies are invented to accomplish these goals economically.

**CRITICAL SUCCESS FACTORS**

CSF is widely used for IS planning. Indeed, it appears to anchor contemporary thought about ISP to the extent that most published research on ISP refers to CSF, e.g., [35, 50, 58] and IS planning practice generally incorporates CSF in one way or another, e.g., [4, 21].

The CSF concept resulted from nearly forty years of cumulative research about decision-making, planning, and information systems, e.g., [14, 12, 67]. Rockart [54] coined the term "critical success factors" to propose a method to help CEOs specify their own needs for information about critical firm issues so that systems could be developed to meet those needs. CSF are intended performance consequences of systems and behaviors within the firm that are related most strongly to the achievement of desired firm objectives. For example, a CSF for an auto rental firm may be the ‘availability of cars to match customer reservations’ because this performance objective is essential for customer satisfaction, which is essential for revenue growth. They are unique to the firm, depending on the firm's product line and intended product positioning. CSF have since been adapted for a broader range of uses, including performance evaluation [5], and information requirements determination [9], but most particularly for IS planning [8, 10, 61].

Senior managers have found CSF to be appealing for IS planning because they help justify the development of strategically important new systems, the benefits of which might be hard to quantify. They also focus IS planning on the most important business needs, rather than on technical or cost-cutting extensions of current systems [63]. In this role, CSF counterbalances the demands for system maintenance and operational level systems so that strategic initiatives are not left out of the development portfolio or starved for resources. It may lead to closer alignment of new IS with the strategic goals of the firm than other methods, such as cost-benefit analysis.
There is no universal procedure for CSF data collection and analysis [5]. Rockart suggested collecting CSF information in three to six hours of interviews with the CEO, but Rockart's concept originally focused narrowly on the CEOs information requirements and “[did] not attempt to deal …[with]… strategic planning [54].” As the problem and organizational scope of CSF broadened, consultants and researchers have used a variety of methods, such as “onion-technique” interviews and analysis of interrelated organizational activities [17], an a priori list of CSF from literature and a mailed questionnaire [57], and interviews followed by questionnaires [32], to implement CSF.

Jenster [35] advocated having the chief executive determine factors that are “most vital to the organization's success.” Rockart and Crescenzi [56] recommended initial interviews with five key executives and 10 other managers, followed by a series of workshops to fully identify the CSFs, measures, and development priorities. Shank, Boynton, and Zmud [61] suggested that participants each list corporate CSFs in preparation for interviews with outside consultants, followed by staff retreats to define IS capabilities and development infrastructure.

Today CSF is generally one of several concepts and methods employed in a planning profile that may include enterprise data modeling, enterprise process modeling, an application and database profile, feasibility and risk analysis, surveys, and interviews, e.g., [42, 62].

EXTENDING CSF: MOTIVATION AND THEORY

In this section we motivate the extension of CSF so that it better supports the development of a broad portfolio of IT investments for the firm, so that it makes economical use of a widely representative sample of participants in IS planning, and so that it provides rich models of desired IT features and the reasons why they are wanted. We introduce personal constructs theory (PCT) as the basis for an extended CSF model. Then we extend the CSF concept, introducing critical success chains (CSC), a new IS planning methodology.

Motivation

CSF works to insure that projects to support the firm’s strategic initiatives are recognized and justified. At least to the extent that it is well understood by senior managers, the strategic part of the development portfolio is well supported by CSF. Troublingly, however, in some organizations the idea of top-down planning may encourage a culture in which participants assume that everything that the organization needs is already known or that “there are strategic planners, upper level managers,” who are the only people with sufficient breath of knowledge to think about what is good for the organization [65]. This may result in suboptimal use of IT resources because knowledge from around the firm about what is important is potentially ignored [41]. In addition, an exclusive focus on senior
manager knowledge may miss other potentially important opportunities for IT investment, such as to
meet maintenance and operational needs, the factory and support quadrants of the strategic grid.
Senior managers might miss smaller systems and support needs that may disproportionately affect
firm performance as well as potentially strategic “turnaround systems.”

Originally, CSF was a way to insure that strategic needs were not starved for resources,
relative to operational needs that could be justified through cost-cutting, but to develop a complete
CSF model researchers recommended studying the views of personnel at various levels in the
organization, in addition to those at the executive level, e.g., [50, 55, 58]. “Grass-roots level” users
may represent an untapped reservoir of potential creativity that can be harnessed to support IT
innovation in the firm [11, 46]. Good use of such knowledge may be critical to the firm’s success
[13].

User involvement is also important because plans succeed only when implemented and
implementation occurs in an organizational context. Widespread user participation may contribute to
successful implementation, as users "buy-in" to the need for systems [20, 30, 33]. This provides us
with motivation to extend CSF to facilitate wide participation throughout the organization, while
keeping the focus on what is important.

Extensive user involvement in CSF planning is expensive, however, because of the intensive
interviewing required by the method and the level of understanding of the CSF concept required by
participants. In a CSF study, the participant provides the CSF’s directly and so has to understand what
a CSF is. While the CSF concept is widespread in business culture, many don’t understand it well
enough to express their ideas on the firm’s CSF without coaching, i.e., unless coached, participants
are likely to incorrectly volunteer solutions, e.g., system features, or firm objectives as CSF’s.

Another motivation to extend CSF comes from a need in planning for information richness
[58]. Implicitly, CSF analysis “discover[s] latent structure” in the needs of the organization by linking
"business goals and related causal success factors [4]”. It would benefit ISP to go a step further in
order to fully support planning for the future competitive needs of the firm. Rich information about
relationships between systems attributes, performance and goals is essential for planners and
developers to understand what must be done to gain and retain competitive strength [6]. Rich
information is multidimensional, i.e., it may need to describe IS attributes in terms of features and
their purposes, to qualify performance in terms of immediate system consequences as well as
activities closely related to desired end outcomes, and goals of processes and the organization [18].
Indeed, an excellent understanding of organizational objectives, the role of IS in the organization and
the relationships among systems in the organization essential for successful strategy execution [35].
The inherent appeal and wide acceptance of the CSF concept suggests that we should seek to extend CSF to accomplish the above objectives. If we can complement existing CSF theory with additional theory and methods to economically provide for ISP participation of many in and around the organization, while still focusing on systems, performance and goals that are important to the organization, and if we can make explicit the relationships implicitly discovered in CSF and to express them in a rich and useful manner, we can take advantage of the strengths of CSF, while making a contribution to managers’ ability to plan.

Theoretical Basis

Personal construct theory (PCT) was developed by George Kelly [36], a practicing school psychologist. To better understand how his patients and their teachers understood the world differently, he modeled how they saw the relationships between states of the universe, the consequences of those states, and the impact of those consequences on their individual values. These relationships, or personal constructs [49, p. 228], result from our individual observations and interpretations of events [36]. Each of us has individual multi-dimensional models (constructs) that describe the attributes and behavior of objects and events, their resulting consequences, and their effect on our values. A community’s collective knowledge about how the universe works results from communication of these interpretive and piecemeal constructs and their aggregation into socially constructed normal systems.

Figure 1 represents PCT’s generic relationships graphically. An individual observer notes that the state of a system has certain attributes. The observer uses his/her own constructs to conclude that these attributes have expected consequences. The consequences, in turn, have certain values for the observer.

[Insert Figure 1 about here]

PCT has been applied successfully to model decision making processes in several social scientific domains, including education [23], mental health [66], advertising [28], leisure [38], sales [27], and knowledge engineering [7, 22, 24].

PCT-based data gathering methods seek to elicit information about people's knowledge structures by observing how they differentiate among stimuli. One such methodology, called “laddering” [53], is used to model consumer value structures related to preferences for products and their features. The analyst uses a structured interviewing technique to collect chains of features, reasons, and values from a number of participants. The chains are aggregated across participants to
produce network models of how participants interrelate the constructs [26]. Such models can be used by product engineers to design new product features that have potentially high customer value.

**Applying PCT to extend CSF**

CSF are, by definition, expressed as performance consequences that are related to firm objectives [54]. When managers use CSF for planning, they implicitly use a three-element model of consequence that is similar to PCT. They assume that, if the firm develops a system with appropriate attributes, the use of this system will result in outcomes that are observable as changed CSF performance, which is, in turn, required to achieve important firm goals.

We have coined the term, critical success chain (CSC), to refer to this linkage of IS attributes to CSF to specific firm goals and we show it graphically in figure 2. CSC is an extension of CSF to incorporate the implicit importance relationships between attributes, CSF, and firm goals. For example, for a rental car firm, a system that allocates cars to locations (IS attributes) affects the availability of cars for customers with reservations (CSF performance). This availability is critical for customer satisfaction and market share (firm goals). This CSC, along with others for the firm, could be used to identify and evaluate the attributes of potential new strategic IS.

[Insert Figure 2 about here]

The extended framework, CSC, has a one-to-one relationship with PCT. Actually, it is a particular case of PCT, where the attributes are limited to information systems and their organizational context, the consequences are limited to the consequences of implementing such systems, and the values are either individual or corporate.

This allows us to apply methods for data collection and analysis to CSC that are based upon PCT applications that are already used successfully in other domains, such as product feature development. In these methods, similar individual personal constructs of a number of people are added together to produce socially constructed models of important relationships. Adapting laddering methods to CSC allows us to develop models that show the reasons why people prefer certain information system features. When the models are aggregated over a number of individuals they help analysts understand the ideas of community of people about the relationships between system features, performance consequences and firm or individual values and objectives.

**Case Studies**

In this section we apply CSC to IS planning in two demonstrative case studies. In the first, at Rutgers University, CSC is applied to a general IS planning task. In the second, it is used to develop a
portfolio of m-commerce applications for implementation across a multi-organizational value chain at Digia, Inc.

**Rutgers University**

To demonstrate the usefulness of the CSC model for ISP, we adapted "laddering study" methods for ISP and arranged to apply them to develop IS project ideas for Rutgers University at the Camden campus. Rutgers, Camden is a 5000-student, urban university unit, located in Camden NJ, a small town immediately adjacent to Philadelphia. The campus has three schools for law, business, and arts and science, which are considered part of a state-wide Rutgers University, but which operate relatively independently of schools on two other campuses at New Brunswick and Newark NJ.

To conduct the demonstration we solicited the participation of 18 managers and employees at Rutgers, including four senior managers (the provost, an associate provost, and two deans), eleven middle managers (associate deans, assistant deans and service department directors), and three tenure track faculty members. In selecting the participants, the objective was to select key members of the organization, representing senior management, middle management and representative skilled line employees. Everyone contacted agreed to participate and actually participated in the study.

To develop a list of viable IS projects to serve as stimuli in the data collection portion of the study, we asked for suggestions from each participant in a short pre-interview conversation done at the same time that we scheduled the interview appointment. Each participant was asked to briefly describe the functionality of an information system that would benefit the organization. The non-technical information collected from the participants included the project name, a general description of its purpose, the system inputs and outputs, who would use the system, and its expected benefits. Later we rewrote each description in a standard 50 to 100-word format. Most of the study participants had already thought of at least one idea for an IS that they thought would benefit the organization and were eager to tell us about it. One of the participants was unable to think of an idea for an IS project.

We scheduled interviews with the participants over a two-week period, asking the participants to plan for one-hour meetings. We expected interviews to last an average of about 40 minutes each. Most of the interviews were completed within one hour, although two took slightly longer. In each interview we showed the participant descriptions of three randomly assigned information systems suggested by other participants and asked him or her to rank order them in terms of their importance to the organization. For the highest ranked system idea, we asked the participant "why is that system important to Rutgers—Camden?" When the participant responded with a reason, the interviewer asked, "Why is that important to Rutgers?" The questioning was repeated several times until the
participant was unable to continue because he or she had reached an ultimate value or goal for the organization. Next, the participant was asked, with respect to the first reason given, “What was it about the system that makes you think it would do that?” This question was repeated until the participant could not continue, i.e., the participant had reached a concrete feature or attribute that he or she expected would be part of the project idea. The questions were repeated for the second most highly ranked of the three project ideas. The third ranked idea was ignored.

The data from each interview was recorded as one or more chains, representing the participant's models of the relationship between system attributes or features, performance consequences, and the relationship of these consequences to organizational goals. The performance consequences represent the organization's CSF, in the view of the participant. The chains are personally constructed CSC. Interviewing the 18 participants resulted in gathering 149 chains, an average of 7.7 chains from each participant. An example chain is shown in Figure 3.

Every participant expressed his or her ideas using unique statements. Consequently, we needed to analyze the concepts used by the participants in the chains and interpret them into consistent constructs across participants. In an interpretive, agglomerative clustering process, two analysts independently clustered and relabeled the concepts used by the participants into consistent constructs. In successive passes, we read through the list of concepts and combined and relabeled those that were most similar, stopping when additional combinations would appear to result in the loss of substantial information.

Prior laddering research, e.g., [38, 53], suggests using a simple inter-rater reliability measure, percentage of agreement between two independent coders, to ascertain whether individual statements are coded consistently and to an appropriate level of specificity, so that similar personal constructs will combine well in analysis, while not too much information is lost in the process. We compared the independently created constructs and reconciled all of the differences by consensus. The initial agreement was approximately 80%. The analysts judged that actual coding differences were insubstantial; representing mere differences in labeling or aggregation level, and that little or no value resulted from the independent coding.

The resulting analyzed data contained 81 constructs, including descriptive system attributes, performance outcomes, and goals. We mapped the constructs into a table with 149 rows, representing the chains, and 81 columns, representing the constructs. In each row, a one represented a construct contained in the chain and a zero represented a construct absent from that chain. We converted the table into a statistical database.
To aggregate the personally constructed CSC into socially constructed CSC for the organization, we clustered the chains (the rows), using Ward’s method [2, pp 43-44], to minimize the within cluster variance in the constructs contained in each cluster. We chose a six-cluster solution, based on pseudo F and t tests. We aggregated two of the clusters because they contained identical elements and moved two chains from one cluster to others, based on our interpretation of the meaning of the chains. This resulted in a 5-cluster solution. We mapped the clustered chains into CSC maps, a separate map for each cluster. In the maps, we represented constructs by circles, the area of each of which was proportional to the number of participants in the sample that mentioned the construct, and we linked the circles by lines representing the links in the chains. Each map represents a specific firm CSC. Figures 4-6 represent three of the five resulting CSC maps.

A CSC map represents a consensus model consisting of, from left to right, descriptions of desired system attributes, the resulting desired performance outcomes (CSF), and associated organizational goals. The network models cross levels of abstraction, connecting nodes by "reasons why" links, relationships that indicate importance, rather than causality, although the relationship may often be causal. Strictly speaking, the horizontal dimension represents a 'state—consequences—value' dimension, rather than downstream causality. Since the relationships are bi-directional and not necessarily always causal, feedback isn't explicitly modeled.

[Insert figures 4, 5 and 6 starting about here]

Figure 4 shows a model representing the effect of information access and support for grant proposals (system attributes), on research productivity, university reputation, grants, and faculty development (CSF), which ultimately is expected to affect success in terms of resources (organizational goals). The number in each circle represents the number of participants mentioning the construct. Figure 5 shows a model for "student recruitment and quality," in which effective communication for marketing to students is related to attracting large numbers of quality students. This is related to organizational goals, including program resources and improved reputation. Figure 6 shows a model relating access to information about teaching, administration and students, to student satisfaction, and ultimately to good alumni relations, enrollment, and program resources.

The fourth model, not shown, describes how advanced multimedia teaching technology, with appropriate technical support and access to information, would affect teaching quality, which would affect the preparation of students for jobs, student placement, enrollment, the school's reputation, faculty recruitment and program resources. The fifth model described relationships between information access and communication with students, effective operations, and student service, marketing and accountability.
The CSC maps developed in the first part of the study were used as the starting point for guided ideation by systems professionals to develop strategic IS proposals. In two, two-hour group workshops, one at the local campus and the other at the main computing center offices, we met with representative IS professionals. The brevity of the workshops resulted from a desire to demonstrate the efficacy of the method while economizing on the use of valuable IS professional staff time. The participants were selected to represent a variety of technical specialties and included professionals who were involved in systems development projects. There were four participants at each of the sessions. During these sessions, each participant received a copy of each of five models. The figures were distributed one at a time, explained, and then discussed. Participants were asked to think about ideas for feasible IS to address each of the CSC. They were told that the objective of the meeting was to use their expertise, without resorting to outside information, to produce 'back-of-the-envelope' level proposals that briefly described feasible IS projects that addressed performance in terms of the models described by the CSC maps. The projects should be specified briefly in terms of a project name, description, the likely project architecture, resources required, cost, risk, and expected impact on the organization.

The richness of the information in the models helped the participants in the technical workshops to focus on generating project ideas consistent with the models of firm performance embedded in the CSC. Comments from workshop participants, however, suggest that even more richness would be desirable. Technical personnel in the workshops expressed wishes that they could ask questions to participants of the first part of the study about details of the desired system attributes, e.g., "Would you want to be able to make video recordings in the classroom?" This raises a question about whether there might be advantages to including system user representatives in the technical workshops.

Presentation of each of the CSC models resulted in a great deal of discussion among the workshop participants. Consequently, the brevity of the workshops limited the number of proposals that could be discussed. In the end four strategic project ideas were produced.

A summary of the proposals generated is shown in Table 1. It is interesting to note the wide range in the scale and character of the four project ideas. As might be expected, two of the ideas are for multi-million dollar applications development projects. These are the kind of projects that we would ordinarily expect to characterize as "strategic." Of the other two ideas, one, which outlines a plan for enhanced technical support for teaching innovations, doesn't advocate building a new IS. The other involves incremental investments in innovative classroom technology similar to what is already in use. These latter ideas are strategic in their intent, i.e., they focus on performance objectives, which
are explicitly linked to the success of the organization in terms of its major goals. They are, however, different in character from what the analysts expected in response to requests for ideas for IS projects to satisfy the needs expressed by the CSC models.

[Insert Table 1 about here]

**Digia, Inc.**

We used CSC at Digia to develop a portfolio of financial services applications to consider implementing across a multi-organizational value chain that might include banks, mobile network operators, wireless appliance manufacturers, retailers, and information intermediaries (infomediaries).

Digia is a research and development firm, founded in 1996, specializing in innovative software applications for wireless communication. Its current strategic focus is on the creation of personal communication technologies and applications for the next generation wireless information devices (WID), such as Smartphones and Communicators. Digia enables WID manufacturers, i.e., the largest mobile handset manufacturers, mobile operators and related firms to shorten substantially their product development cycles. It is a private corporation, with substantial ownership by founders, Pekka Sivonen, Mika Malin and Jarkko Virtanen, and by firms, such as Cisco Systems, General Electric, Intel, Sony and Sonera, and venture capital firms. Its 2000 revenue was about USD 5.5 million.

In fall 2000 Digia chairman, Pekka Sivonen, approached us with a request to “give [him] financial cocktails for mobile commerce.” He wanted a portfolio of potential applications for Digia to develop to meet the need for financial services delivered by the next generation wireless devices. It was imperative to insure that the applications developed by Digia were “killer cocktails,” i.e., so well embraced by customers that they helped to insure the acceptance of the next generation wireless devices in a way similar to the way VisiCalc helped to insure the acceptance of the PC by business.

Since development, implementation and use of the desired applications would involve people up and down the value chain, it seemed desirable to obtain input from a representative group of involved people from outside the company, including bankers, risk investors, mobile telecommunications operators, researchers, and potential end users. Most of these people would be from outside the firm.

To elicit participation we developed two lists of potential participants, experts and end users. For potential expert participants, the analyst worked with Digia’s chairman and a staff assistant to develop a list that included a cross-section of Finland’s most relevantly knowledgeable scientists, professionals, and managers. For end-users we decided that it would be desirable to elicit participation from sophisticated communications technology users, people who would be likely early
adopters of attractive new mobile commerce applications. To avoid excessive analyst influence in the selection of participants, several faculty members at the Helsinki School of Economics, not including the analysts, were asked to nominate professional, managerial, executive, and other sophisticated end-users for participation. The resulting combined list of nominated participants contained 40 names.

We attempted to contact each of the nominated participants by telephone to elicit participation in the study, schedule an appointment, and elicit a system idea for use as stimulus. Every one of the nominated participants that could be reached by telephone agreed to participate. Eight people couldn’t be reached, attributable to a combination of successful gatekeeping activities and the influence of the approaching Christmas season. The resulting 32 participants included 18 outside experts and 14 potential end-users, including just one Digia employee. The experts included 3 IS development managers, 4 academic researchers, and 12 vice presidential level (minimum) executives from m-commerce related industries. The potential end-users included 5 managers and executives from a variety of industries, 4 professionals, and 2 university students. All of the participants were from the Helsinki, Finland vicinity and all were mobile telephone users.

To elicit ideas for use as stimuli, participants were asked to name the first thing that came to mind when they thought about financial services that could be provided with the next generation mobile devices. All but 2 of the participants provided ideas. Since the responses seemed to group naturally into four sets, we rewrote them as four bland descriptions, from which participants could infer specific features.

The majority, all but five, of the interviews were done at the participant’s work premises. Participants seemed much more at ease in interviews at their own work premises, especially when it was in a conference room, away from interruptions, rather than in the participant’s office.

The interviews averaged 50 minutes and ranged from 30 to 90 minutes. The first 5 to 10 minutes were spent on warmup conversation and discussion of the interview objectives. The participant was then shown the four system descriptions and asked to rank order the best two. Generally the participants volunteered ideas about system features. The analyst then asked the participant a series of questions to collect chains of attributes, CSF consequences, and firm objectives, similar to what was done in the Rutgers study. If they had trouble visualizing the technical environment, they were shown pictures depicting a number of prototypes for next generation wireless equipment. The interviews were tape-recorded.

Following the interviews, an analyst listened to the 32 tapes and recorded the chains. A total of 147 chains were recorded, an average of 4.6 per participant. This process took four weeks. In two
cases the chains were somewhat difficult to construct from the interview tapes because of the manner in which the participants responded.

We began the analysis by clustering the unique individual statements into consistent constructs across participants. Two analysts took turns clustering the unique statements into constructs until the statements had been clustered into 114 constructs.

Next the chains were clustered in the manner of the Rutgers study. The analysts generated clustering solutions with three to 10 clusters, then produced CSC network models based on various solutions to evaluate them in terms of their understandability and meaningfulness. They settled on a five-cluster solution, resulting in five CSC maps.

The ideation workshop was held at the Digia offices. After discussion with the analyst, the firm chose the participants to include both business and technical R&D people. Six people participated from the firm, including the chairman of the board, the Nokia Key Account Director, two business development managers and two engineering managers.

The workshop was scheduled for five hours on a single day, with a fancy lunch provided to participants to enhance enthusiasm for the tasks. It began with a 15-minute introduction to the CSC method and the study and a discussion of the purpose of the meeting. Participants were instructed that the objective was to examine and discuss each CSC map as a group, then come up with a project idea that would address the desired consequences and values expressed in the models, including a name, short description, architecture, business model, players, customer segment(s), benefits for players and customers, revenues and market size, profit model for the developer company, resources needed and risks involved, all at a “back-of-the-envelope” level of detail. Asked if they could call for information from colleagues in the building, they were told that they were “on [their] own and should use teamwork and their own expertise to solve problems.”

Beginning with CSC map 1 (figure 7), the analyst explained the map and participants began a very animated discussion, with every member participating and participants taking turns leading discussion at the flip chart, taking notes, and writing out and drawing models of the project. During the discussion there were several questions about the individual statements behind the CSC map labels. Discussion of the first model took 2.5 hours, but after that participants seemed to have learned the process and discussions progressed more quickly.

The application idea for Map 1 is found in Table 2, is called Personal Transaction Assistant. It is an application for personal digital assistants, communicators, and smart phones that controls the information flow between infomediaries and customers. Once the customer has created an individual
profile, the software controls the flow of information and handles the negotiation with the infomediaries. The end user benefits in terms of individualism, thrift, and convenience, objectives indicated by CSC Map 1 in Figure 7. Benefits to the mobile operations would come from additional paid network volume and revenue from trusted third party services. The retail party benefits from improved scale economies and reduced product inventory.

[insert table 2 about here]

From Map 2, not shown, participants proposed the My Financial Advisor (MFA) applications. MFA is a combination of applications that create a trouble-free and intelligent way of receiving financial information in real time. It would be a portfolio of analyzed, customized, and raw data. An analyst’s role could include a portfolio manager, who refines the data manually and creates recommendations for customers. Value accrues to the end-user in the form of valuable information, available anytime, anywhere and to the analyst and infomediary in the form of fee revenue.

Next, the participants turned their attention to the CSC Map 3, not shown. After a short discussion, someone in the group said, “there is no game for us here. Let’s move on.” Digia wouldn’t be a part of any value chain developed from this model, so there was no point in pursuing it, although it might have been interesting to another firm, e.g., in the banking industry.

Looking at CSC Maps 4 and 5 (Figures 8 & 9), the participants decided that they were looking at similar models, perhaps from different perspectives, and decided to treat them as if they were one model. The discussion resulted in the idea for the Mobile Wallet, described in Table 3. The mobile wallet allows customers to make payments for small transactions, i.e., 0.1 to 50 Euro, anonymously and for medium sized transactions, i.e., up to about 500 Euro, from a wireless device using credit or debit card accounts. For the customer, value accrues as convenience and flexibility while mobile. For other parties, value accrues in the form of reduced costs or increased fee revenue.

[insert table 3 about here]

Digia representatives were very enthusiastic about the results of the workshop. After the workshop Digia’s Chairman remarked that the workshop “positively...exceeded [his] expectations [about] the results...” Digia planned to use the resulting three project ideas in planning new products and services for release in 2002 and beyond, however, since this use of the results involved proprietary plans that the firm regards as trade secrets, the exact use of the results cannot be revealed here.

Digia plans to continue using the CSC method in IS planning. According to Digia product analyst, Markus Ahonen, the firm regards CSC favorably because (1) the method seems to work well and it is easy to see why it works, (2) the interviewer collecting data for the method needs no special
abilities or skills, and (3) the resulting CSC maps are very helpful in understanding how people think about an issue.

Workshop participants completed work on discussing the five CSC maps and creating the tables for the proposed applications for the three ideas within the five hours allotted for the workshop. The contents of Tables 2 and 3, as well as that for My Financial Advisor, were hand written in the workshop and rewritten later for clarity.

**CSC Implementation Guide for Managers**

From our experience at Rutgers and Digia, we were able to define a general procedure to apply CSC to ISP. The CSC method is described here in four steps, represented in Table 4. In the first three steps, analysts work with participants to develop graphical CSC models of the organization. In the fourth step they work with IS development personnel, managers and customers to generate feasible ideas for IS projects. Here we summarize the steps in the process.

| Prestudy preparation: | First, determine the organizational and business scope of the study, in terms of lines of business, business units, and value chain components. Limiting the scope of a study to a single line of business, a narrow product line, or within a single facility or division, focuses the study and limits its complexity. Who should participate depends on the study scope, e.g., whether it includes supply chains, channels, operations, infrastructure, and/or R & D. Depending on this scope, it may include representative members of customer or supplier organizations, outside experts, potential users and representative members of senior management, middle management, professional or 'journeyman' level line employees within the firm. When selecting the participants, no theoretical considerations dictate a minimum or maximum number. Our experiences suggest that 20 to 60 participants are generally sufficient and manageable. Laddering research indicates that nothing prevents the use of a much larger number, as many as 90 or more [38], if justified by the complexity of the issues under study, however, consider subdividing a large study. A very large number of participants increases the complexity of analysis and is only justified to the extent that marginal participants contribute additional ideas. When soliciting project participation, obtain ideas in advance from study participants for use as stimuli in the interviewing process. Alternately, user requests for new systems could be used as stimuli. |
| Participant interviews: | To structure the interviews, present each participant with a subset of the project ideas and ask him to rank-order them in terms of importance to the organization. At Rutgers, we presented participants with three ideas from which to choose; at Digia they chose from |
four ideas. For the higher ranked stimuli, ask the participant "Why would this project be important to the organization?" or, if the participant is a customer, "why would this project be important to you?" to elicit expected performance impacts. Then, ask a series of "why is that important to the organization (you)?" questions to collect data on associated concepts ending with the organization's goals. Finally, ask a series of "what about this system makes you think it would do that?" questions to elicit associated concepts ending with specific attributes of the system. The responses should be recorded during the interview as linked chains. At Digia we tape recorded the interviews and the analyst transcribed chains of statements later, but this seemed to be much less efficient than recording chains during the interview. Recording chains on paper in view of the participant provides a visual clue about the data collection objectives of the interviewer, thus facilitating efficiency as participants quickly learn to anticipate the next question. Several chains of concepts are obtained from each participant.

**Analysis:** Interpret the individual statements to classify each into consistent constructs across participants, so that uniquely worded statements with similar meanings are given the same label. At Rutgers two analysts did this part of the analysis independently, but differences in classification by the two analysts appeared inconsequential. At Digia two analysts worked sequentially, making several passes on the data to perform this classification. This proved to be much more efficient and it produced agreement easily as differences in classification were reconciled iteratively. Map the chains into a table with each chain in a row and each construct in a column. The value in a cell is one if the construct appears in the chain, zero otherwise. Use cluster analysis to cluster the chains, minimizing variation in the constructs within clusters. Transform the resulting clusters into network CSC models, representing the constructs as nodes linked by links from the chains and arranging the nodes to minimize crossing links. The area of each node is proportional to the number of participants mentioning the related construct. The resulting models may require some simplifying tweaking to improve readability. Redundant links, i.e., link A—C, if A—B and B—C exist, may be removed. Excessively complex models may be simplified by deleting outlier concepts, the mention of which falls below a cutoff point, such as twice, set by the analyst. The CSC models aggregate constructs collected in the interviews and represent socially constructed models of relationships in the firm between proposed system attributes, CSF performance, and firm objectives.

**Ideation workshops:** Workshops allow technical professionals to use their expertise to help managers and customers to produce feasible project ideas to accomplish the objectives of the CSC models. Select participants with diverse technical skills, e.g., analysis and design, software engineering, telecommunication, and database management. Our experience suggests that
participation by business analysts, as we did at Digia, and selected external customers may also be very helpful, particularly when the scope of analysis includes IT supported products and channels. At the workshops, explain the CSC concept to participants and present the organization’s CSC models. Participants use their technical and business expertise to identify feasible project ideas that address the relationships identified in the models. The ideas are developed to a ‘back-of-the-envelope’ standard, so that participants can identify many ideas. Details can be added later, for those projects interesting enough to pursue further. For each system, the participants label the system, briefly describe its nature, its likely architecture, the resources required to develop it, its cost, likely sourcing, and magnitude of risk, and its expected impact on the organization.

We allocated a fairly small amount of time for the ideation workshops. The two hours allocated to workshops Rutgers were clearly insufficient, but the participants at Digia were satisfied that they had sufficient time in the five hour workshop to finish the desired tasks. This was helped by the narrow focus of the study. The time required for the workshops is fairly independent of the number or organizational participants, however, more complex models, generated by more participants or broader study scope, may suggest the need for longer workshops in order to take full advantage of the information.

**IMPLICATIONS**

Clearly, information systems are potentially very important to firm performance, e.g., [19, 48], so it is critical for managers to identify IS projects with high potential for positive impact. For several reasons, use of CSC has the potential to positively affect the portfolio of IS projects available to the firm. The CSC method can result in better information from wider participation, provides rich information important for planning, helps keep focus on what is important for the firm, is likely to result in a more complete portfolio of ideas for systems across the strategic grid, and may help with user buy-in for eventual development.

**CSC effect on planning at Rutgers and Digia**

Because better information is a key determine of ISP success [51], wide participation among members of the organization, as well as beyond its boundaries to the whole value chain, is very important. Participation helps increase the chance that information about CSF is complete, since knowledge about what is important to the firm is not a monopoly of the executive committee. A larger, more representative participant group helps to ensure that knowledge about what is important to the firm is captured, even if it hasn’t recently been the subject of discussions in the executive suites.
Additionally, researchers have recognized the importance to strategic decision-making of understanding, based on collection, interpretation, and communication of rich information, rather than reliance solely on the deterministic use of normative firm models [6]. Use of the CSC method results in rich models that are valuable to communicate importance relationships within the firm to developers, potentially helping them to propose systems that effectively meet the needs of the firm.

CSC helped participants stay focused on what was important to the organization. At Rutgers the initial ideas presented to the analyst were "bottom-up" ideas. In nearly every case they were fairly closely related to the job activities of the person suggesting them. It seems likely that many of these ideas were of little value for the organization. When participants focused on the ideas suggested by others, however, they adopted a "strategic" perspective. It appeared that each participant approached the task of explaining relationships to the analyst from the perspective of his or her own understanding of what was important to the organization.

Of course, it isn't known whether any particular participants understood the strategy of the organization in the same way that senior managers understand it. Quite the contrary, the fact that participants understand what is important to the organization differently than do senior managers is what makes it worthwhile to study their ideas. Various participants, including middle and lower level managers, customers, etc. may know things that are important to the firm that senior managers don't know, often because they involve smaller issues that fall below the level of the executive’s 'radar' or because they are ideas that come from different cultures, e.g., those of customers, suppliers, electricians, or the Japanese subsidiary. Helping senior managers understand ideas that would not have occurred to them is one of CSC’s contributions. Of course, in the end, senior managers will have to evaluate the ideas and will, for one reason or another, reject some them. That’s their role.

**CSC and the firm’s planning profile:**

CSC can make an important contribution to the firm’s IS planning profile. The IS planning process involves four principle tasks: generating ideas, evaluation, feasibility and sourcing study, and making the decisions. In one way or another, explicitly or implicitly, every IS planning process uses a profile of activities to accomplish these tasks. Tools intended to produce firm specific business models, such as enterprise data modeling, process modeling, and entity relationship modeling [42], as well as participative activities, such as focus groups, retreats, and surveys, support the idea generation task. Proforma financial analysis, discounted cash flow, and options pricing methods support the evaluation task. Application risk assessments, assessments of technical, organizational, and operational feasibility and analysis of application sourcing options, i.e., in-house or outside
development, application packages, or outsourced service, are intended to support feasibility study. The decision making activity, while an artifact of the firm’s management culture, is supported by institutional features, such as the IT coordinating committee.

CSC is particularly targeted to the idea generation phase of IS planning. Its outcome is firm-specific models and ideas for new systems to accomplish objectives implicit in the models. In addition, CSC provides some implicit support for the second and third activities. CSC helps to screen potential ideas to bring forward what participants think will be important for the organization, implicitly supporting the evaluation task. Additionally, because the workshop participants are chosen for expertise in business and technical functions, it is expected that ideas that emerge from the ideation workshops will have a *prima facie* feasibility.

Nonetheless, there shouldn’t be any expectation that CSC will produce a portfolio of project proposals that are ready to be considered by the IT steering committee. These ideas will require substantial additional analysis before they are ready to be considered for implementation. They require financial analysis, using such tools as discounted cash flow, ROI, and real options pricing, to determine whether they’re likely to be worthwhile. They require qualitative analysis of technical, development and operational feasibility. Ideas that incorporate new businesses will require business plans. The sourcing decision may be important. Ideas that incorporate new products may require focused marketing studies to validate implicit conclusions. Finally, proposals require decisions about whether to proceed at an appropriate level of authority.

Consequently, CSC should supplement other planning methodologies, rather than displacing them. For example, intensive CSF interviews might be worthwhile to understand the views of key firm managers, who may individually have much to say about what is strategically important for the firm. Such participants may want to present their views in more expansive and less structured format than is facilitated by CSC. Focus group interviews, individual interviews, and surveys may be more effective data collection methods for when the firm wants to target particular participants with inquiries about bounded domains.

Exactly how CSC should fit into the planning profile of a particular organization is beyond the scope of this paper and is likely to differ for different organizations. Managers should develop the firm’s IS planning profile so that ideas can be turned into viable project proposals that are ready to be approved by the IT steering committee or its organizational equivalent. It is crucial to this process that managers see CSC as one tool that can contribute effectively to helping to make sure that the firm uses resources to build IS that will be effective and important in contributing to the achievement of the firm’s goals.
CSC and the IS development portfolio.

Ideas resulting from CSC are likely to represent a more diversified portfolio of potential IT investments than ideas from other methods. While use of CSF alone is likely to result in project ideas that are worthy of the attention of senior managers, including the most obvious high impact projects, system investments all across the strategic grid are likely to be required for the firm. At Rutgers workshop participants saw opportunities to use the CSC models to propose solutions that did not always require the development of major new IS applications. The richness of the information provided by the CSC method allowed participants in the ideation workshops to consider relatively inexpensive solutions to important IS needs. This characteristic of the CSC method may help planners to come up with more elegant and economical IS solutions for some business problems. In some areas of the firm, potential payoffs don’t justify large IS investments. In these areas, however, support investments intended to make current systems work better can still be very important. In other areas, particularly where high levels of investments have been made in the past, managers need to be concerned with making the relatively low profile IS investments necessary to better integrate these prior systems into operations and to take advantage of what people in the organization have learned about how to use systems better.

Going beyond the strategic grid, for today’s firm, the IS development portfolio must include consideration of systems to integrate resources and suppliers with the firm and to deliver products and services to customers. At Digia, participation in planning by a widely representative group of outside experts and potential end-users helped to ensure that planning could be based on ideas about what was important that might not otherwise have come to the attention of planners in a top-down ISP effort. In addition, the CSC maps provided planners with rich information about the reasons why participants preferred particular features. This helped planners to better understand how to think about applications that would satisfy the preferences.

Finally, it is important that the results of a planning process gain wide support for implementation [25]. In the CSC models every participant can see the results of her contribution to the results. The resulting knowledge that her contribution has explicitly become a part of the firm's strategy may be a powerful motivator for the employee to become an advocate for the successful implementation of the resulting plans.

ISP using CSC is economical. The procedures used to apply CSC at Rutgers and Digia allowed participants to be included easily and their output absorbed into resulting CSC models. Data collection is efficient because CSC interviewing is very structured and it isn't necessary for the
participants to understand any underlying concepts of the methodology in order to participate. Less than five minutes were required to explain the data collection process to each participant. The time required for each interview averaged somewhat less than an hour at Digia and Rutgers. The marginal resources required to add an additional participant each study was approximately that of the interview, approximately one hour of the participant's and the analysts' time for each additional participant. The other resources required for a CSC study are all fairly fixed.

This cost effectiveness makes it practical to collect data from many participants in the firm. In addition, the CSC analysis aggregates similar ideas across participants, increasing the practicality of such widespread participation. Of course, CSC don't replace extensive interviews with senior executives, however, when we want to expand data collection beyond the executive suite, CSC data gathering seems likely to be a cost effective means to do so.

Avoiding IS planning pitfalls with CSC

The outcome from the use of CSC may help managers avoid four major pitfalls of IS planning.

1. **Limited executive perspective.** No matter how conscientious executives are about scanning the business environment, they are likely, as a group, to be blind to some perspectives about what is important to the firm, its customers, the community, operations, technology, and other domains of interest. An efficient means to bring other viewpoints into the planning process is critically important to the firm’s ability to respond proactively to its needs for new systems.

2. **Bias toward large, strategic projects.** Without an effective mechanism for widespread planning participation, while avoiding a blizzard of ideas, managers have no effective way to consider potentially important tactical and operational level projects, the returns from which, relative to project size, may be very high. CSC brings important smaller project ideas to light, as well as ideas that don’t require new systems.

3. **Failure to consider the full range of options for accomplishing objectives.** By effectively modeling the reasons for participant preferences for system features, CSC helps managers to consider the full range of options to achieve objectives, such as new systems, maintenance, and user support.

4. **Squeaky wheel, FIFO, budgets, and other suboptimal processes for allocating resources to maintenance and the development of small systems.** Maintenance and
tactical and operational systems can use up a substantial portion of the firm’s development resources. CSC can make a contribution to solving this problem by introducing importance to the firm as an effective criterion for the emergence of ideas for such non-strategic systems into the planning process.

CONCLUSIONS

Contributions

This paper makes an important contribution to IS literature by recognizing a need in ISP, developing an extension of planning theory to meet that need, defining a procedure to apply the theory, and ascertaining that the procedure works well in practical planning exercises. We observed that research has found that ISP, to be successful, should be formal, strategically focused, and top-down, yet widely participative and able to provide rich information for developers. Meeting these seemingly inconsistent objectives is costly for the firm. We used research literature from IS planning, CSF and PCT to make the theoretical case for a PCT application to extend CSF to accommodate ISP’s performance demands, coining critical success chains as a new planning concept for IS. In case studies we adapted a practical application of PCT from the market research literature to IS planning. We then used our experience in the case studies to produce a guide for the practical use of CSC for ISP.

CSC makes a potential contribution to ISP practice in terms of participation, economy, strategic focus, information richness, and user buy-in for development. Using the CSC method, planners can economically incorporate participation from as many members of the organization as desired. Marginally, additional participation requires less than one hour per participant. Furthermore, with this widespread participation, unlike with straightforward bottom-up planning, ISP retains its focus on ideas that have potential importance to the organization.

Our experience affirms our strong a priori belief that this method may be successfully applied in practice. One measure of its practicality is its reception by the participants. Everyone contacted about the study in each organization agreed to participate and participants exhibited substantial enthusiasm for the concept in interviews. At the ideation workshops, technical staff became animated by the task of translating the relationship models into feasible projects. “For once, someone is asking us ‘how?’” said one workshop participant, “rather than proposing a solution without consulting us.”

Would managers want to use such a method for ISP? We think so. Digia is a firm where managers understand that they absolutely have to get IT innovation right. Digia plans to use CSC for new ISP studies and is working with the authors to extend CSC to IS requirements planning. The CSC
method is quite similar to methods currently in use to apply PCT to develop ideas for new product features that address customers' models for how product features impact product performance and resulting customer values. One of the authors of this paper has successfully applied such methods to develop product feature proposals for a number of US 'Fortune 100' firms. In addition, researchers have advocate the use of PCT for general problem solving in the firm [1] and have advocated the application of qualitative methods to solve IS design problems, e.g., [6].

Limitations

There are limitations to the present study. Firstly, the case studies reported here don't, by design, provide strong evidence that the CSC procedure works better for developing strategic project proposals, than use of CSF or any alternative idea generation technique. Proof that CSC results in richer information, makes better use of strategic knowledge distributed around the organization, and is less biased or more economical, must await further study. It should be noted, however, that such proof is not required to establish the value of CSC because it is not intended to replace CSF or any other planning method. Rather, CSC is an extension of CSF that may be used to complement other planning methods. For example, CSF data might be collected from senior executives using Rockart and Crescenzi's [56] method, while the CSC procedure might be used to collect planning input from many other employees and from customers.

Secondly, as from the use of any interpretive procedure, results from use of CSC are somewhat dependent on the skill and attentiveness of the analysts. However, this is not more, and arguably less, true for CSC than for other planning methods, e.g., [15, 16, 45].

Thirdly, some of the ideas expressed by participants may turn out to be inconsistent with those of other participants. No attempt is made to reconcile the ideas of participants. The CSC method is additive. Ideas that are very different will end up in different models because of the clustering process to minimize variance within the models.

Future directions

Future research to develop the CSC concept is planned. An important task, albeit a difficult one [50], will be to explicitly test whether the CSC model produces more satisfactory solutions than other planning processes. Does the use of CSC result in better business and IT strategic alignment, better understanding of processes, procedures and technologies, better cooperation to implement the strategies, and improved planning capabilities [60]? Developing studies to investigate these questions will be challenging because of the importance of providing valuable planning services for firms while comparing the efficacy of different methods. The authors are now soliciting participation from firms
interested in participation in such studies. Empirical studies could compare the data and project ideas resulting from studies using CSF vs. CSC and from other data collection methods, such as focus groups, vs. CSC. Studies could also evaluate the CSC method, using marketing research methods, as an attractive planning methodology for managers.

Use of CSC may be extended to use in IS project requirements determination, to business process reengineering, or for general strategic business planning. Researchers advocate the integration of business and IS planning [64]. These three arenas rely heavily on understanding needs of the organization and the needs of both internal and external customers. The CSC model and method would seem to be very appropriate for developing complete descriptions of those needs. Planned studies will explore the use of CSC for requirements determination. Requirements determination is similar to IS planning, but at a lower level of aggregation and with a need for multiple levels of abstraction within a study. Can CSC be adapted for effective use to plan the requirements for an IS? We believe that the answer is “yes.”
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Table 1. IS project ideas generated from technical workshops to address CSC models.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
<th>Likely Architecture</th>
<th>Resources</th>
<th>Cost</th>
<th>Risk</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Financial System</td>
<td>Reengineer university-wide accounts payable/receivable systems to enable managers to reduce redundant data entry, track orders, control spending, plan budgets.</td>
<td>Centralized DBMS, Unix based</td>
<td>Inside high-level champion, outside BPR consultants, inside team incl. 6 business &amp; 12 technical staff</td>
<td>$10-20 million</td>
<td>BPR projects always risky. Narrow focus, well defined objectives limit risk.</td>
<td>Improved budget management, centrally and locally. Effective purchasing. Elimination of redundant local systems and activities increases efficiencies.</td>
</tr>
<tr>
<td>University Student Advising and Accounting System</td>
<td>Reengineer university-wide systems for registration, student advising, and accounting for students so that students can interact with university system, determine courses needed, register and pay for courses.</td>
<td>Centralized DBMS, rule-based system, WWW user interface</td>
<td>Presidential championship, outside BPR consultants, participation from best key people in university, 1/2 to 1 person from each unit that serves students. Students involved.</td>
<td>$10-50 million</td>
<td>BPR projects always risky. This project very risky even with presidential buy-in. Dependent on willingness to simplify rules for graduation and charging. Every program unique fees, grades, rules, schedules. Incremental implementation possible if deans cooperate to specify grad rules.</td>
<td>Self service student advising. Automated binding agreements with students for graduation requirements. Increased student satisfaction. Efficiencies from reduced routine advising. Cost of doing nothing: University mired in use of ad hoc, unmaintainable local systems without oversight. Students dissatisfaction with increasing tuition &amp; fees with poor service.</td>
</tr>
<tr>
<td>Title</td>
<td>Description</td>
<td>Likely Architecture</td>
<td>Resources</td>
<td>Cost</td>
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</tr>
<tr>
<td>High-level Teaching</td>
<td>Personnel support for teaching innovation, including equipment support at teaching site, content creation support (Java, voice, video), and faculty teaching releases for content development.</td>
<td>n. a.</td>
<td>Support: Teaching equipment (1 per school @ $30K per year). Content creation (1 per 4 faculty in intensive development over year @ $35K per year). Teaching releases (4 one semester per school per year @ $70K)</td>
<td>$135K per year per school</td>
<td>Minor level of risk. Individual efforts to develop course material may fail. Impact dependent upon continued scale up of high performance classroom facilities and other capital investments and continued infrastructure support.</td>
<td>Portfolio of technology intensive teaching capability, based on WWW, multimedia, distance video, etc. Organizational knowledge of teaching technology. Option on future investments in teaching technology.</td>
</tr>
<tr>
<td>Technology Support</td>
<td></td>
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</tr>
<tr>
<td>Smart Classroom Pair</td>
<td>Two classrooms with facilities to deliver multimedia based instructional content to local and remote students, using video, monitors at each seat, large screen projection, etc.</td>
<td>Local video with voice and web server, central communication infrastructure</td>
<td>Outside consultant, input from faculty, local development staff (part time over one year).</td>
<td>$250-500K</td>
<td>Technology well known so low functional risk. Substantial risk of mismatch with user needs.</td>
<td>Impact dependent on match with needs to support technology intensive course content. No independent impact on organizational goals.</td>
</tr>
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</tbody>
</table>
Table 2. ‘Back-of-the-envelope’ description of the Personal Transaction Assistant, an application idea developed from CSC map 1 (figure 7) at the Digia ideation workshop.

<table>
<thead>
<tr>
<th>PERSONAL TRANSACTION ASSISTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
</tr>
<tr>
<td><strong>Supply chain players</strong></td>
</tr>
<tr>
<td><strong>Our customers for this system</strong></td>
</tr>
<tr>
<td><strong>Our profit model</strong></td>
</tr>
<tr>
<td><strong>Benefits for players and customer's</strong></td>
</tr>
<tr>
<td><strong>Risks</strong></td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
</tr>
</tbody>
</table>
Table 3. ‘Back-of-the-envelope’ description of the Mobile Wallet, an application idea developed from CSC maps 4 and 5 (figures 8 and 9) at the Digia ideation workshop.

<table>
<thead>
<tr>
<th><strong>MOBILE WALLET</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>The means to conduct small amount transactions (FIM 1-10) with your mobile device. Anonymity of money up to transactions of FIM 300</td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
<td>Security, Authentication, Synchronisation/replication, Database (SIM/Smart Card), Profile, User interface</td>
</tr>
<tr>
<td><strong>Supply chain players</strong></td>
<td>Bank, Shop, Customer, Loyalty card providers, Trusted 3rd party (SmartTrust), Device manufacturers, Credit card issuers</td>
</tr>
<tr>
<td><strong>Our customers for this system</strong></td>
<td>Banks, Shop, Credit card issuers</td>
</tr>
<tr>
<td><strong>Our profit model</strong></td>
<td>Free application, License fees from various plug-ins for different players</td>
</tr>
<tr>
<td><strong>Benefits for players and customer's)</strong></td>
<td>End users: no coins, security aspect. Shop: more difficult to rob and lower fixed costs. Bank: transaction fees, avoidance of costs from plastic cards</td>
</tr>
<tr>
<td><strong>Risks</strong></td>
<td>Lack of demand, reaching the critical mass, lack of standards, Microsoft, customer resource management (CRM)</td>
</tr>
</tbody>
</table>
Table 4. A four step procedure to implement the critical success chain (CSC) method for IS project idea generation

<table>
<thead>
<tr>
<th>CSC PROCESS</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prestudy Preparation</strong></td>
<td>Determine scope to manage complexity.</td>
</tr>
<tr>
<td>Determine scope &amp; participants.</td>
<td>Collect project idea stimuli.</td>
</tr>
<tr>
<td><strong>Data Collection</strong></td>
<td>Ask participant to rank-order stimuli on importance.</td>
</tr>
<tr>
<td>Elicit personal constructs from org. members.</td>
<td>Ask series of “why would this system be important…” questions to collect consequence and value data.</td>
</tr>
<tr>
<td></td>
<td>Ask series of “what is it about this system that makes you think it would do that…” questions to collect attribute data.</td>
</tr>
<tr>
<td></td>
<td>Record answers as linked chains.</td>
</tr>
<tr>
<td></td>
<td>Collect several chains from each participant.</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>Interpret individual statements and label consistently across participants.</td>
</tr>
<tr>
<td>Aggregate personal constructs into CSC models.</td>
<td>Cluster chains.</td>
</tr>
<tr>
<td></td>
<td>Map clusters into network models.</td>
</tr>
<tr>
<td><strong>Ideation Workshops</strong></td>
<td>Recruit workshop participants with technical and business skills.</td>
</tr>
<tr>
<td>Elicit feasible strategic IS from technical and business experts and customers.</td>
<td>Evaluate CSC network models and develop ‘back-of-envelope-level’ ideas for IS projects that satisfy the relationships implicit in the models.</td>
</tr>
<tr>
<td></td>
<td>Create brief system descriptions and network business value models for each idea.</td>
</tr>
</tbody>
</table>
Figure 1. Personal constructs theory (PCT).
Figure 2. Critical success chain (CSC).
Survival of Rutgers, Camden
Recruit better faculty
Build university's reputation
Higher research productivity
Easier access to information
Online access to full image research articles

Figure 3. Example chain collected from participant at Rutgers University.
Figure 4. CSC network map for "Excellence through Research" at Rutgers University.
Figure 5. CSC network map for "Student Recruitment and Quality" at Rutgers University.
Figure 6. CSC network map for "Student Satisfaction with Service Levels."
ELECTRONIC WALLET IN MOBILE INTEGRATED DEVICE ALWAYS WITH YOU

ABILITY TO CUSTOMIZE AND FILTER

INTELLIGENT AGENT SEEKING INFORMATION

ELECTRONIC RECEIPTS

INTEGRATED DEVICE ALWAYS WITH YOU

EXCELLENT SERVICE QUALITY

APPLICATION ATTRIBUTES

TIME & PLACE INDEPENDENCE

USE MOST APPROPRIATE DEVICE

MORE FREE TIME

ALLOCATE TIME TO IMPORTANT THINGS

INFORMATION ANALYSIS – DATA MINING

MAKE MONEY

BEING UP TO DATE

ACHIEVEMENT

IN CONTROL OF LIFE

INDIVIDUALISM

THrift

APPLICATION ATTRIBUTES

PERSONAL GOALS

CRITICAL SUCCESS FACTORS

Figure 7. CSC map 1, Digia Inc.
Figure 8. CSC map 4, Digia, Inc.
Figure 9. CSC map 5, Digia, Inc.