Reducing I.T. Project Management Failures: A Research Proposal

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Abstract

Failures rates of Information Technology (I.T.) projects remain high, even after decades of efforts to reduce them. However, most efforts to improve project success have focused on variations within the traditional project management paradigm. We argue that a root cause of high I.T. project failure rates is the traditional paradigm itself, as promulgated by, e.g., PMBOK. Discussions with an expert panel resulted in the formulation of a new paradigm described in this paper: Value-Driven Change Leadership (VDCL). This paper proposes empirical research to ascertain the role of the new paradigm in reducing I.T. project failure rates. The initial phase of our research, reported in this paper, resulted in a survey questionnaire and pilot data from several I.T. projects. The paper describes the research methodology for an empirical study to investigate the role of VDCL in reducing I.T. project failure rates.

1. Introduction

In this paper we propose empirical research that aims to reduce failure rates of I.T.-intensive projects. We hope that the conference reviews and discussions will further improve the proposed research. In this paper, we first present a review of the literature about I.T. project failure rates over the past few decades. We argue that the root cause of high failure rates is the traditional way of thinking about project management. We then describe Value-Driven Change Leadership (VDCL), a new set of principles about project management formulated by an expert panel. Finally, based upon results from a pilot phase, we describe a research methodology for studying the effect of VDCL on I.T. project success or failure.

2. Literature review

Various researchers have grappled with the question of what constitutes project success or failure. We distinguish two schools of thought. Following Drucker's [12] distinction between efficiency ("doing things right") and effectiveness ("doing the right things"), we call them the "efficiency" and "effectiveness" schools of thought. The efficiency school of thought defines success as the project's *management* being successful, as evidenced by criteria such as cost and schedule performance (see, e.g., the Project Management Body of Knowledge ("PMBOK") [36]). The efficiency school focuses on activities and resources and takes an internal view of the project [33]. The effectiveness school of thought defines success as the project's *outcomes* being successful, as evidenced by criteria such as profits (see, e.g., [11]). The effectiveness school takes an external view of the project and focuses on outcomes and stakeholders. Some authors argue for a combination of efficiency and effectiveness measures [3], with different measures appropriate at different stages of the project life cycle [34].

2.1. Failure rates have been high for decades

Researchers such as Robert Glass have chronicled various projects that failed [15]. Over the past 15 years or so, the series of CHAOS studies by the Standish Group [42] has pointed to (high) project failure rates. The Standish Group reported in 2006 that 19% of I.T. projects were canceled before they were completed, and 46% were completed and operational, but were over budget, late, and/or completed with fewer features and functions than originally specified. 35% of I.T. projects were delivered on time, on budget and as specified. (It must be noted, however, that some researchers have argued that the Standish Group may have favored data from failed projects, see, e.g., [19]). Recent research in the UK found that 9% of projects had been abandoned and that, on average, projects overshot budget by 13% and schedule by 20% and underdelivered on scope by 7%. Of course, project termination does not necessarily equal project failure.

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Certain projects may incur less losses by terminating rather than continuing, and "If you don't try some risky projects, you'll lose your competitive edge" [6],

I.T. project failure rates have been found to depend on project size as measured, e.g., in person-months [39] or in function points [17]: The larger the project size, the larger the probability of failure.

Concern about (high) project failure rates has been raised not just for the past 15 years, but for at least 40 years. In the late 1980's, research in the U.S.A. found that 16.5% of software projects "rarely or never have cost overruns" while "fully 41% always or usually do" with cost overruns averaging 33% [31]. In the early 1980's, research in the U.S.A. found that among I.S. development projects the median cost overrun was 33.5%, the median overrun in person-days was 36%, and the average schedule overrun was 22% [17]. That same research found that 17.5% of software projects are "rarely or never delivered late, while 32.9% are always or usually late." In the 1970's, Hank Lucas wrote his Ph.D. dissertation on "Why Information Systems Fail" [22]. In 1968, NATO sponsored a conference that coined the term "Software Engineering." The conference included discussions about "software crisis" and "software failure," noting that "it is large systems that are encountering great difficulties" [25]. As reported in [37], one of the conference participants, J. Licklider, had reported that "at one time, at least two or three dozen complex electronic systems for command, control and/or intelligence operations were being planned by the military. Most were never completed. None was completed on time or within budget." The fact that some of these references date back so many years supports the notion that I.T. project failure rates have been high for decades, despite efforts to reduce them during that time.

Failure rates appear to fall into two categories: One category is concerned with project *activities:* how much the project schedule and costs were over or under the original estimates. The other category is concerned with the project's *end product*: Was it completed at all, how much/well it is used, and how well did it correspond to the original requirements. Either category of project failures have been a concern for decades despite numerous attempts to reduce them.

2.2. Failure factors and success factors

During the past several decades, numerous studies have been conducted to determine the influence of various factors on I.T. project success and/or failure. Several factors were found to contribute to project success, including clearly defined goals, executive support, project leadership, scope management, planning, project organization, communication with stakeholders, skilled personnel, user involvement, risk management, tools, timely progress feedback, adaptability to unexpected events. See, for example, [9], [34], [27], [49]. Other factors were found to contribute to project failure, e.g., lack of general agreement on project goals, use of an inappropriate software development methodology, dissimilarity to previous projects, requirements volatility, and inadequate technology base or infrastructure ([13], [45]). Some factors contribute to project success or failure dependent on their presence or absence, e.g., clearly established success criteria, goal commitment of the project team, adequate project team capability [5].

A number of these factors and associated management techniques have been part of the traditional way of thinking about project management, as promulgated, e.g., in PMBOK. PMBOK focuses on activities and resources and focuses on on-time and on-budget completion of project activities. Related success factors include scope management, detailed planning, and risk management. Critical Chain [16], a related method, focuses on bottlenecks in critical resources. PRINCE2 [28], which focuses more product-based planning with a Product Breakdown Structure (PBS), also has a significant overlap with PMBOK.

Additional success- or failure factors stem from other ways of thinking about project management. At least six different "perspectives" on project management have been recognized [20], with the task perspective dominating PMBOK. The other perspectives are the leadership perspective (team effectiveness, leadership styles), the system perspective (e.g., inadequate technology base or infrastructure), stakeholder perspective (e.g., agreement regarding project goals), transaction cost perspective (e.g., goal commitment of the project team), and the business-by-project perspective (e.g., focus on project results).

2.3. Project management paradigms

To improve project management practices, managers can engage in single-loop learning and/or double-loop learning [4]. In single-loop learning, they attempt to correct failures merely by "changing actions," but not changing their way of thinking about project management. For example, they pay more attention to activities on the project's critical path. In double-loop learning, managers attempt to correct failures by "first examining and altering the governing variables and then the actions," ([4], p. 8-

9). That is, the managers first question the relevancy of their existing way of thinking. For example, rather than focusing on activities on the critical path, they focus on the project's intended business results.

Improving project management practices based on success- and failure factors that are consistent with PMBOK requires single-loop learning. Improving project management practices based on other factors that do not fall into the traditional paradigm requires double-loop learning. However, neither seems to have reduced the high rate of project failures. We conclude that, in order to reduce failure rates, there is a need to develop and test yet other project management paradigms. This is what we set out to do in our research program, on which this paper reports.

3. Value Driven Change Leadership

To develop a new way of thinking about project management, we convened a series of meetings with a group of 20 experienced I.T.-project managers. These resulted in a set of fundamental principles for project management that we call "Value-Driven Change Leadership" (VDCL). This paper describes VDCL as well as the proposed methodology for empirically testing the extent to which VDCL influences project failure rates.

3.1. Expert panel

The group of experienced I.T.-project managers consisted of 17 men and 3 women, whose length of experience managing I.T. projects ranged from 10 to 40 years (average 20 years). Most have extensive experience in I.T. consulting across a wide variety of industries.

We were interested in finding out how these experienced I.T. project managers think about project management in ways that differ from PMBOK. Over the period of a year, the group met several times and reviewed, ranked and refined a list of factors of project management perspective other than the task perspective. The result was a set of fundamental principles that the members agreed reflect how they think about project management. We call the set of principles Value-Driven Change Leadership (VDCL).

While the group's experience is in the management of projects *within I.T.* and the principles are aimed particularly at *I.T.* projects, we believe that VDCL may well be applicable to project management in other domains as well. That, however, is a topic beyond the scope of this paper.

3.2. Projects, portfolios, programs and strategies

It is important to note that VDCL is a framework for thinking about the management *of projects*, whether done individually or in the context of a program and/or portfolio of projects. In recent years, there has been growing attention on the management of programs and project portfolios directed at achieving broad, long-range, strategic business objectives, as evidenced by the growth of PMOs and project governance boards in business organizations. While VDCL principles may overlap with methods of program management and portfolio management, they focus on *project* management.

3.3. Fundamental principles

VDCL consists of nine fundamental principles organized into three overlapping themes. The three themes are "value-added over budget/schedule," "business solution over architecture framework," and "human change over repeated activities." We have adopted this "x over y" formulation of these themes from the Agile Manifesto (agilemanifesto.org) to emphasize new ways of thinking while not discarding existing ways. The VDCL themes and the fundamental principles are described next.

3.3.1. Value-added over budget/schedule. According to traditional project management metrics, a project that is completed ahead of schedule and under budget is a success. However, if a project's costs exceed the benefits, executive management may well consider it a failure. Also, according to traditional project management metrics, a project that is completed behind schedule and over budget might be labeled as a failure. However, if a project's benefits exceed the costs, executive management may well consider it a success. As one of the members of the expert panel remarked: "Firms invest in I.T. to create value, not software." Given VDCL's emphasis on I.T. (projects) adding value to an organization, one I.T. executive we know said: "There are only 'business' projects, some have more I.T. than others."

Delivering benefits and managing value to the customer have been recognized as important activities for project leaders, see, e.g., [2], [9], [23], [40], [46], even across different stakeholders [21]. Consistent with such views, the expert panel views the project manager as responsible for the business results obtained from the projects, which is an "intrapreneurship" view of project management, as advocated in [44]. According to VDCL, project leaders must balance not only project cost and

schedule (efficiency), but also project results both tangible, such as financial return, and intangible, such as company image (effectiveness), see [24], [32].

Three principles address the theme of value-added. For purposes of this study we define value-added as the net change in financial results due to the organization's and/or third-party stakeholders' adoption of the project's end product (for example, employees, customers, or business partners making productive use of a new I.T. system). While we acknowledge that projects often provide intangible results such as second order effects, our focus is on business results that are quantifiable and measurable. Our panel believes that more executives and project managers should demand that project outcomes be quantified. For example, the value of "compliance" may be quantified by the cost savings of non-compliance. "Opportunity expansion" may be quantified using option valuation. As one panel member put it: "If a project is expected to generate largely intangible results, I will provide largely intangible investments."

The first principle, which we label V1, is "measuring business results over measuring process conformance." To measure business results, the expert panel found it important that all key stakeholders understand and agree on what the project's value-added and outcomes should be, and that they agree on clear success metrics. Furthermore, everybody working in the project (team members, subcontractors, etc.) should also understand and agree with the value-added and outcomes and related success metrics. In order to align incentives towards those metrics, project participants should have a personal stake in the success or failure of the project.

The second principle (V2) is "managing the business case over abandoning the business case." Before they start, many projects are approved on the basis of a business case. Nonetheless, the expert panel felt that projects are often managed on the basis of budget and schedule, but not on the basis of the business case. In effect, the business case is often abandoned after the project is approved. The expert panel felt that the business case should guide the project not only before it starts (to clarify success metrics, evaluate project alternatives), but also during its execution (to evaluate change requests and trade-off decisions), and after the end-product has been delivered (to analyze actual business results). At the same time, the panel was not optimistic about many firms' desire or ability to keep track of their projects' business results. Such non-tracking hinders learning what the impact of a project was on business results, which in turn may perpetuate project failures into the future.

The third principle (V3) is "quantifying the financial impact of risks over identifying a list of risks." The expert panel felt that qualitative and quantitative risk analysis as described by PMBOK are not sufficient and that risks should also be analyzed as to their impact on the long-range financial results of the projects.

3.3.2. Business solution over architecture framework. The expert panel felt that all too often I.T. projects, particularly medium-sized ones, disregard an explicit architecture of the end product, thereby contributing to the rate of project failures. Architecture is important for project management because it impacts all nine knowledge areas in PMBOK (e.g., scope management and integration management). Although project managers do not need to be architects themselves, they do need to ensure that architecture of the end product gets adequate explicit attention in the project and is reflected in the project plan [29]. After all, in the words of one panel member: "Ignoring the architecture of a system is rather like ignoring the core of a skyscraper. Skyscrapers are not built wall by wall, but floor by floor, around the core." We define architecture as a representation or description of the structure of the specific end product, which includes 1) the configuration of modules (of the system) that perform important functions that are common within the end-product: by "common" we mean functions that are needed frequently by end-users and/or by other functions, or functions that are similar in functionality. 2) The relations (Input/Output and Control) among the modules. 3) The specific syntax of the interfaces to the modules, i.e., the specification of how modules should be accessed or invoked. This view advocates systems thinking as the basis for project management [26]. It is important to note that by architecture we do not mean infrastructure. Infrastructure (e.g., .NET) is a super system that offers functionalities that can be used by the project's end product.

Three principles address the theme of architecture. The first (A1) is "designing business solutions over debating generic frameworks." In the view of the expert panel, some projects address architecture by debating generic technology frameworks (e.g., SOA, Zachman, or .NET). Instead, the focus should be on a specific solution designed for specific business goals (as addressed in the value theme) with a specific structure.

The second principle (A2) is "releasing frequently over releasing with one big bang." While PMBOK

neither requires nor explicitly suggests multiple releases of the end product, other approaches such as Agile Development [7] and SCRUM [43] do. These latter approaches essentially assume that all releases of a system are based upon a stable architecture. The VDCL panel argued that a first release should establish the architecture for all subsequent releases, i.e., the first release builds on an existing architecture or delivers a new architecture. Each release delivers incremental business benefits by addressing the highest (remaining) priorities and risks, business as well as technical risks.

Each architecture will have advantages and disadvantages and different risks associated with it. Consequently, an important principle, "flexible architecture" (A3), is that alternative architectures be developed before the project starts and possibly built into the end product, see, e.g., [44].

3.3.3. Human change over repeated activities. By definition, a project is about something new. Introducing something new into an organization causes organizational change. In other words, organizational change is inherent in projects and should be a part of project management. What is organizational change all about? To paraphrase the mantra of President Clinton's presidential campaign, "It's the people, stupid." It is about human change.

Three principles address the theme of human change. The first (L1) is "changing organizations over delivering products." Simply delivering an end product is not sufficient: the organization must be prepared to adopt the new end-product for effective use. Organizational change may involve changes in jobs, workflows, organizational structures, responsibilities, collaboration with others, required skills and the like. Preparing the organization for organization change requires executive support, on-going communication, training, managing opposition, tying recognition and rewards to the project's value-added, and so on [8].

The second principle (L2) is "improving activities over repeating activities." When projects continue to fail over time, that suggests a failure to learn from failures [1]. Instead of repeating the same project activities, they must be replaced or improved over time. The expert panel argued that in any project, time must be taken to learn from previous projects, contemporaneous projects and the project itself. Project team members must take time to evaluate project activities, learn from other projects, and explore new ideas for improvement.

The third principle (L3) is "developing human relations over interchanging resources." The expert panel argued that people (inside or outside a project) should not be viewed as interchangeable resources. Instead, they should be viewed as a "whole person," with unique skills and experiences, personal as well as professional. Project activities get done on the basis of trust and common ground [47]. Instead of negotiating differences, this principle advocates "agree-to-agree," i.e., find items on which there is agreement and start working on those. Over time, trust and fruitful human relations develop that enable things to get done.

3.4. Different from traditional paradigm

If the traditional paradigm as represented by PMBOK can be characterized as "managing activities towards on-time/ on-budget based on the PERT chart of tasks," then VDCL can be characterized as "changing people towards adding value based on the architecture of the end-product."

We believe that the VDCL paradigm is applicable for projects that construct end products *and* that also make design decisions that positively affect the project's value-added. In traditional construction projects, e.g., of submarines or buildings, the end products are constructed from detailed blueprints that are largely completed before construction begins. During construction, builders can make only minor design changes. In I.T.-intensive projects, however, detailed designs may not exist, and during system construction, programmers and analysts make many design decisions, including about key functionalities of the end products. As noted by a reviewer, this raises the issue of what the "scope" of the project is. In the view of our expert panel, VDCL principles apply from the phases of project approval, planning, and definition, i.e., before design, all the way through project justification after installation. The panel experts view delivery of business results as the overarching objective of the project, and consider anything that significantly affects the business results to be "in scope."

4. Research hypothesis

Our research is aimed at testing the extent to which adherence to VDCL principles influences project success. We recognize that traditional methods of project management also intend to increase project success, although they are largely concerned with schedules and budgets, i.e., with project *efficiency*. However, as noted, a project that is completed under budget and ahead of schedule is not necessarily a success, and a project that is completed over budget and/or behind schedule is not necessarily a failure. Success also depends on the

extent to which project outcomes meet end-item requirements and satisfy customer needs, i.e., on the end-item's *effectiveness*. In our view, traditional methods of project management are necessary but not sufficient for project success. We intend to test whether VDCL's nine principles are both necessary and sufficient for project success—either alone or in combination with PMBOK's nine knowledge areas.

We hypothesize that each VDCL principle contributes to greater project success. That is, we view each of the principles as an independent variable and project success as the dependent variable. Details about the variables are described later.

In statistical terms, the hypotheses are:

For principle i = 1 … 9:

H_{0i}*: Principle i has no impact on project success.*

H_{1i}*: Principle i has an impact on project success.*

(That impact may be positive or negative)

There can, of course, be interaction effects: The combination of two or more VDCL principles may impact project success more (or less) than any one alone. We recognize that besides VDCL principles other factors also affect project success; these include traditional management methods as advocated by PMBOK, as well as characteristics of the project, e.g., size, complexity, technology, experience of the project manager, etc. To be sure, this paper describes empirical research still to be done and, informed by a pilot phase, proposes a research methodology.

5. Research methodology

To test our hypotheses we intend to formulate a structural equation model (SEM). Our SEM will contain only "formative" constructs, defined as such according to the four decision rules given in [30] for determining whether a construct is reflective or formative. (In fact, one of the examples offered in [30] for the construct "operational excellence" is similar to our dependent variable, project success.) The four rules are: 1) Individual measure items in the survey instrument define a construct; thus, any change in the item would cause a change in the construct. 2) When multiple measure items are used to define a single construct, each aims at measuring a particular, unique feature of the construct. Thus, the items are not interchangeable and none of them can be dropped. 3) Since the individual measure items of a single construct tap different, unique aspects of the construct, they ordinarily should not covary with each other. 4) Different measures of the same construct do not necessarily have the same antecedents or consequences. To illustrate, consider the application of these decision rules to the first VDCL theme "Value/outcome over budget/ schedule." 1) Three items (principles V1, V2, and V3) *define* the construct (the "Value" theme). Causality is directed from the items to the construct. The more that V1, V2 and V3 are true on a given project, the higher the project ranks on the Value theme. 2) The principles V1, V2, and V3 are not interchangeable. Each item is orthogonal: Each of the principles (e.g., V3, quantification of risk) represents a separate aspect of the "Value" theme, and to drop any of them would alter the meaning of the Value construct. 3) The items V1, V2, and V3 might covary, although they do not have to, and there are no apparent reasons why they should. 4) Each of principles V1, V2, V3 may have different antecedents and consequences. For example, stakeholders agreeing on measures of value (V1) is different from quantifying the financial impact of risks (V3).

Content validity in models with formative constructs can be performed by experts [30], and in our research the panel of experts validated the constructs for both the dependent variable (project success) and the independent variables (the VDCL themes and principles).

We will collect empirical data about projects that were completed some time ago. We chose to do this since it would provide evidence of each project's financial outcomes (our measure of success), whereas data from projects not yet completed would not.

5.1. Independent variables

In our research design, project success is influenced by the extent to which the VDCL fundamental principles and the PMBOK knowledge areas were applied during the project; i.e., the independent variables are the VDCL principles and the PMBOK knowledge areas. Project success may also be influenced by project characteristics such as the duration and size of the project, experience of the project manager, etc. In our research design, these are control variables.

We model each VDCL fundamental principle and each of the three VDCL themes ("Value", "Architecture," "Change") as an independent variable, the latter to enable statistical analysis with coarser variables.

As argued above, traditional project management techniques as described in the nine PMBOK knowledge areas (time management, cost management, scope management, etc.) likely also influence project success. In our model, each knowledge area will also be an independent variable. Besides knowledge areas, PMBOK describes 44 project management processes (activity sequencing,

activity resource estimating, cost control, etc.)—an average of five processes per knowledge area. We decided not to model these processes as independent variables since doing so would greatly increase the size of the survey instrument and, we feared, perhaps significantly reduce the response rate.

5.2. Dependent variable

As argued above, we believe that project leaders must focus not only on project cost and schedule (efficiency), but also on tangible project results such as financial return and intangible results such as company image (effectiveness). For purposes of this study, we plan to use Net Present Value (NPV) of the project's net cash flows as the dependent variable [14]. We will adopt as the timeframe for calculating NPV the period during which the project was expected to deliver the business results. In practice, we expect periods of three to five years. For longer timeframes, the net cash flows of later years would probably be discounted to nearly zero. To make projects comparable, we will normalize NPV as a percentage of the project's expenditures. NPV expresses net cash flows—the difference between (incremental) cash receipts and expenditures—adjusted for the time value of money by dividing by an appropriate discount rate. We acknowledge that for some projects, e.g., I.T. infrastructure upgrades, the option value, not NPV, is the correct success measure [10]. We intend to address such projects in future research. We also acknowledge a point raised by one reviewer, namely, that a firm may not have kept track of NPV or its constituent measures. (We note that the absence of such measures may contribute to subsequent project failures.) If during our pilot phase these issues prove predominant or too burdensome, we will consider modifying our dependent variable.

5.3. Project-related characteristics

Since a project's success is likely to be influenced not only by VDCL principles and PMBOK knowledge areas, but also by various characteristics associated with the project itself, we plan to collect data about characteristics of the project, the project manager, and the organization for which the project is performed.

Project characteristics include three measures that usually appear in the project's original business case or similar project justification at the start of the project: expected project duration (elapsed time), expected project total expenditures (in $US), and expected incremental benefits (cash receipts). Data about the industry in which the project was performed includes the business function(s) or process(es) that the project addressed, and whether the project manager reported to I.T. or a business function. Data about characteristics of the project manager includes age, gender, number of years of project management experience, PMP and/or other certifications, highest degree obtained, etc. Data on characteristics of the organization for which the project is performed includes the organization's age and revenues, the industry or industries in which it operates, and whether it is for-profit (publicly-traded, or privately-held), not-for-profit, or governmental. Our statistical analyses will control for these project-related characteristics.

5.4. Survey questionnaire

Data for the independent and dependent variables and project characteristics will be collected via a survey questionnaire. Our intention is to represent each independent variable—VDCL principle and PMBOK knowledge area—by one statement in the questionnaire. (The Appendix to this paper shows various statements that represent the VDCL principles. The pilot phase will enable us to select the best statement for each principle.) Respondents will rate the extent to which they adhere to that principle/knowledge area using a 5-point ordinal Likert scale of increasing maturity levels, per CMMI [41]. One reviewer suggested we use multiple statements to represent each independent variable, e.g., three statements per variable. However, we fear that doing so would make the number of statements too large (more than 100) and, as a result, greatly reduce the response rate. We note that with only one statement per variable, the level of granularity of statements in our questionnaire will be similar to that of other well-known research studies, e.g., [35], [40].

The dependent variable, project success, is comprised of several variables—cash receipts, expenditures, and project duration—combined into a single ratio-scaled variable: NPV as a percentage of total project expenditures.

Many control variables are ordinal and ratio-scaled variables, e.g., PMBOK certification (Yes or No), level of project risk (Very Low to Very High), number of years of experience, and so on.

5.5. Sample selection and subjects

For our sample we will survey completed medium-sized I.T.-intensive projects for which a business case or similar justification was approved before the project started. We will not survey

projects for which the original justification was primarily the project's option value and/or its intangible results. We define medium-sized projects as having a duration (elapsed time) of between one month and one year, with a peak number of project personnel between three and 50. "I.T.-intensive" means that Information Technology was a substantial part of the project's end product.

We plan to contact various companies in the Chicago area and ask each company to identify one or more pairs of I.T. intensive projects, each pair with one project that was successful and one that was a failure, in the opinion of executives at the company. In this way, we expect to keep the sample unbiased as to success or failure, and also expect the dataset to contain considerable variability in the values of the dependent variable. At same time, within each pair we expect less variability in the values of uncontrollable variables, such as, company culture, industry, etc.

For each project, questionnaires will be filled out by multiple respondents, e.g., the project manager, the business executive who was accountable for the project, team members, etc. This will provide a 360-degree view of the project, see [48].

5.6. Statistical Analysis

As explained earlier, our structural equation model (SEM) contains only formative constructs. For such a model the statistical analysis is components-based rather than covariance-based [30]. Accordingly, we intend to apply the method of partial least squares (PLS) and use SmartPLS software, version 2.0.M3 [38].

6. Preliminary results

To date we have pilot tested the questionnaire with managers on four projects. We met with each project's manager, gave the manager a copy of the questionnaire, and asked for a verbal answer to each and every statement. Typically, the project manager would summarize various things that had or had not been done in the project, which enabled us to determine whether or not he correctly understood the question. If he did not, we clarified the question during the interview and modified the wording before the next interview. Finally, and occasionally with prompting from our side, the manager summarized the answer as a numerical value on the Likert scale.

As it turned out, most of the questions were understood correctly without requiring clarification, although a few had to be rephrased. We will continue to gather data from more projects until we are satisfied that further changes to the questionnaire are not necessary to improve the respondents' comprehension of the questions.

7. Conclusions

Clearly, a pilot sample size of four cases is too small to draw conclusions regarding a hypothesis. Yet, even within such a small sample, however, we observed considerable variability in the responses to most questions. This leaves us hopeful that statistical analyses will reveal effects of certain variables on project success.

Our analysis may result in a number of possible conclusions. Whatever the results, they will be interesting. If VDCL principles significantly improve the chance of project success, then adhering to them will lead to fewer project failures. If VDCL principles do not affect project success, then that would suggest that a seemingly reasonable framework about how to manage projects—originated and validated by seasoned I.T. project management experts—makes no difference, and that, therefore, project success must rely on something else. Similar conclusions may emerge concerning the nine PMBOK knowledge areas.

7.1. Implications for practitioners

The implications of our intended research results are important, regardless of the eventual conclusions. If certain VDCL principles have a significant effect on project success, project managers may want to adopt management practices related to such principles. If certain VDCL principles do not affect project success, then (despite the endorsement of seasoned I.T. project management experts) project managers may want to disregard them. The findings might have similar implications regarding the PMBOK knowledge areas.

8. Discussion and further research

This paper is a research proposal. It describes our conceptual thinking based on a literature review, our research methodology, and our pilot testing (ongoing at the time of the writing of this paper). Consequently, there are no results from our empirical research yet. Depending on the eventual outcome, additional research may also be needed as to the applicability of VDCL, viz.: For which type of project is VDCL particularly applicable and for which type is it not? Does it apply to construction of buildings as well as construction I.T. systems? We

hope the discussions at this conference will improve our proposed research into reducing failure rates of I.T. projects,

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10. References

[1] T.K. Abdel-Hamid, S.E. Madnick, "The Elusive Silver Lining: How We Fail to Learn from Software Development Failures", Sloan Management Review, Fall 1990, pp. 39-48.

[2] Andersen E.S., K.V. Grude, and T. Haug, Goal Directed Project Management: Effective Techniques and Strategies, Second Edition, Kogan Page, London, UK, 1984.

[3] R. Atkinson, "Project Management: Cost, Time and Quality, Two Best Guesses and a Phenomenon, It's Time to Accept Other Success Criteria", International Journal of Project Management, Vol. 17, No. 6, 1999, pp. 337-342.

[4] Argyris, C., On Organizational Learning, Blackwell, Oxford, UK, 1995.

[5] B.N. Baker, D.C. Murphy, D. Fisher, "Factors Affecting Project Success, Project Management Handbook, 1988.

[6] B. Boehm, "Project Termination Doesn't Equal Project Failure", Computer, September 2000, pp. 94-96.

[7] Cockburn, A., Agile Software Development, Addison Wesley, Boston, 2002.

[8] Conner, D.R., Managing at the Speed of Change, Villard Books, New York, 1992.

[9] Cooke-Davies, T., "The 'Real' Success Factors on Projects", International Journal of Project Management, Vol. 20, 2002, pp. 185-190.

[10] Q. Dai, R.J. Kauffman, S.T. March, "Valuing Information Technology Infrastructures: A Growth Options Approach", Information Technology Management, Vol. 8, 2007, pp. 1-17.

[11] A. De Wit, "Measurement of Project Success", International Journal of Project Management, Vol. 6, No. 3, August 1988, pp. 164-170.

[12] Drucker, P., The Effective Executive, Harper Collins, New York, NY, 1967.

[13] Ewusi-Mensah K., Software Development Failures: Anatomy of Abandoned Projects, The MIT Press, Cambridge, MA, 2003.

[14] M. Freeman, P. Beale, "Measuring Project Success", Project Management Journal, Vol. XXIII, March 1992, pp. 8-17.

[15] Glass R.L., Computing Calamities: Lessons Learned from Products, Projects, and Companies that Failed, Prentice Hall, Upper Saddle River, NJ, 1999.

[16] Goldratt, E.M., Critical Chain, North River Press, Great Barrington, MA, 1997.

[17] A.M. Jenkins, J.D. Naumann, J.C. Wetherbe, "Empirical Investigation of System Development Practices and Results", Information & Management, Vol. 7, 1984, pp. 73-82.

[18] C. Jones, "Fifty Questions a Chief Executive Should Ask About Software", Software Productivity Research LLC, February 25, 2007.

[19] M. Jorgensen, K. Molokken, "How Large Are Software Cost Overrruns? A Review of the 1994 CHAOS Report", Information and Software Technology, Vol. 48, No. 4, Apr. 2006.

[20] B.J. Kolltveit, J.T. Karlsen, K Gronhaug, "Perspective on Project Management, International Journal of Project Management, Vol. 25, 2997, pp. 3-9.

[21] S. Lipovetsky, A. Tishler, D. Dvir, A. Shenhar, "The Relative Importance of Project Success Dimensions", R&D Management, Vol. 27, No. 2, 1997, pp. 97-106.

[22] Lucas, Jr. H.C., Why Information Systems Fail, Columbia University Press, New York, 1975.

[23] S. Male, J. Kelly, M Gronqvist, D. Graham, "Managing Value as a Management Style for Projects", International Journal of Project Management, Vol. 25, 1997, pp. 107-114.

[24] Murphy T., Achieving Business Value from Technology: A Practical Guide for Today's Executive, John Wiley & Sons, 2002.

[25] P. Nauer, B. Randell, "Software Engineering: Report on a conference sponsored by the NATO Science Committee", Conference held in Garmisch, Germany, Oct 7-11, 1968.

[26] Nicholas, J., H. Steyn, Project Management for Business, Engineering, and Technology, 3rd edition, Butterworth-Heinemann, Burlington, MA, 2008.

[27] M.M. O'Connor, L.H. Reinborough, "Quality Projects in the 1990's: A Review of Past Projects and Future Trends", International Journal of Project Management, Vol. 10, No.2, may 1992, pp. 107-114.

[28] Office of Government Commerce, Managing Successful Projects with PRINCE2, The Stationary Office, Norwich, UK, 2005.

[29] Paulish, D.J., Architecture-Centric Software Project Management, Addison-Wesley, Upper Saddle River, NJ, 2002.

[30] S. Petter, D. Straub, A. Rai, "Specifying Formative Constructs in Information Systems Research", MIS Quarterly, Vol. 31, No. 4, December 2007, pp. 623-656.

[31] D. Phan, D. Vogel, J. Nunamaker, "The Search for Perfect Project Management", Computerworld, September 26, 1988, pp. 95-100.

[32] Phillips J.J., T.W. Bothell, G.L. Snead, The Project Management Scorecard: Measuring the Success of Project Management Solutions, Butterworth Heinemann, 2002.

[33] J.K. Pinto, D.P. Slevin, "Project Success: Definitions and Measurement Techniques", Project Management Journal, Vol. 19, No. 1, 1988, pp. 67-72.

[34] J.K. Pinto, D.P. Slevin, "Critical Success Factors across the Project Life Cycle", Project Management Journal, Vol. 19, No. 3, 1988, pp. 67-75.

[35] J.K. Pinto, D.P. Slevin, "Critical Success Factors in Effective Project Implementation" Chapter 20 in Project Management Handbook, 2nd edition, pp. 479-512, edited by D.I. Cleland and W.R. King, Van Nostrand Reinhold, Co., New York, NY, 1995.
[36] Project Management Institute, Project Management Body of Knowledge, 2003.
[37] B. Randell, "Software Engineering in 1968", in Proceedings of the 4th International Conference on Software Engineering, IEEE Press, Piscataway, NJ, 1979, pp. 1-10.
[38] C.M. Ringle, S. Wende, A. Will, SmartPLS, University of Hamburg, Hamburg, Germany, 2005, http://www.smartpls.de
[39] C. Sauer, A. Gemino, and B. Reich, "The Impact of Size and Volatility on IT Project Performance", Communications of the ACM, Vol. 50, No. 11, November 2007, pp. 79-84.
[40] A.J. Shenhar, D. Dvir, Reinventing Project Management, Harvard Business School Press, Boston, MA, 2007.
[41] Software Engineering Institute, Capability Maturity Model Integration Version 1.2, http://www.sei.cmu.edu/cmmi
[42] The Standish Group, "Chaos", 2006. Available via www.standishgroup.com
[43] J. Sutherland, "Agile Development: Lessons Learned from the First Scrum", Cutter Agile Project Management Advisory Service: Executive Update, Vol. 5, 2004, pp. 1-4.
[44] Tedesco, P., Common Sense in Project Management, Thomson Course Technology, Boston, MA, 2006.
[45] A. Tiwana, M. Keil, "The One-Minute Risk Assessment Tool", Communications of the ACM, Vol. 47, No. 11, Nov. 2004, pp. 73-77.
[46] Ward J., Daniel E., Benefits Management: Delivering Value from IS & IT Investments, John Wiley & Sons, 2006
[47] Weisbord M., Janoff S., Future Search: An Action Guide to Finding Common Ground in Organizations & Communities, Berret-Koehler, San Francisco, 2000.
[48] J.W. Weiss, J. Shenette, "360-degree Strategic Leadership Team Alignment: Profile of an Intervention Program", Proceedings of the 41st Hawaii International Conference on System Sciences (HICSS), IEEE, 2008.
[49] Yourdon E., Death March, Second Edition, Prentice Hall, Upper Saddle River, NJ, 2004.

11. Appendix: Survey questions

This Appendix shows various statements representing the VDCL principles. Respondents will be asked to rate each statement on a 5-point Likert scale representing increasing maturity levels (1=Ad-hoc, 2=Managed, 3=Defined, 4=Quantitatively Managed, 5=Optimizing). These levels are modeled after CMMI, and defined in the questionnaire.

1. From the perspective of value-added (taking into account benefits and costs) for the organization, this project was a success.
2. Throughout the project, all stakeholders agreed on, and all team members understood, the project's purpose and measures of success.
3. All team members had a stake in the success or failure of the project.
4. From beginning to end of the project, the project was focused on value-added for the organization.
5. The initial project plan was focused on value-added for the organization.
6. When making decisions about change requests, the potential change's impact on value-added was taken into account.
7. The project's value-added for the organization was assessed after the end-item was put into operation.
8. When considering various risks, the financial impact of the risks on the project's value-added was calculated.
9. The project plan reflected the architecture of the end-item (i.e., common modules, interfaces among them and interfaces with underlying infrastructure).
10. The end-item was delivered in multiple releases.
11. In the planning for the release(s) of the end-item, the highest priorities (business as well as technical) were addressed first (80/20 rule).
12. The first release established the end-item's architecture.
13. The project plan called for value-added resulting from each release.
14. During initial project planning, backup options were developed for the end-item's architecture and/or (business) functions.
15. The project leadership focused on people-to-people relationships/interactions.
16. The project leadership focused on agreeing-to-agree and finding common ground.
17. Throughout the project, expectations were managed well.
18. Throughout the project, team members reflected on their project activities.
19. Throughout the project, team members analyzed, evaluated and negotiated alternatives.
20. During the project, learning occurred about how this project could (have been) run better.
21. The project plan included activities to prepare the organization for the end-item.
22. Throughout the project, organizational change (to adopt the end-item) was managed.