The influence of software developers’ creative style on their attitudes to and assimilation of a software process innovation

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Abstract

This study examines outcomes associated with differences in software developers’ creative style, based on Kirton’s adaption–innovation theory. Propositions were developed and tested to identify the relationship between software developers’ creativity and their attitude to a technological innovation that altered the software development process in their organizations. Based on adaption–innovation theory, we expected that innovators (i.e. more innovative employees) would demonstrate higher levels of job satisfaction and performance than adaptors (i.e. less innovative employees), after approximately 4 months of using the innovation. We conducted a survey of 220 developers in two firms that had recently replaced mainframe-based software development with client/server development. Our results demonstrate a pattern of relationships among employees’ creative style, attitude to the innovation, job satisfaction, and performance which we believe have important implications for managers responsible for implementing other technological innovations.

Keywords: Creativity; Innovativeness; Implementation; Mandatory adoption; IS professionals

1. Introduction

Understanding the factors that influence the successful adoption of technological innovations has been a long-standing concern for both IS researchers and practitioners. For over 25 years, researchers have sought to understand the factors and processes that lead to successful implementation of new technologies [39,58,65,68,69,82,87]. One rich stream of research has investigated the factors that influence technology acceptance for voluntary individual-level innovations [1,8,25,26,70,98,105], i.e. where users independently decide to adopt an innovation and do not need to coordinate their adoption with other adopters. IS researchers have recognized, however, that for some adoption scenarios, adoption is neither voluntary [85], nor independent of other users [30]. Understanding the factors that influence implementation outcomes when adoption is involuntary and occurs within a network of other interdependent adopters is just as critical as understanding voluntary adoption scenarios, although the more complex scenario has received much less attention from IS researchers [37].
Leonard-Barton has noted the greater “implementation complexity” [61] that characterizes innovation adoption occurring at the organizational-level, where employees are either mandated to adopt the innovation or are subject to varying degrees of “managerial influence” [62]. Innovation adoption under this scenario is often more complex, in part, because it occurs in two stages, and because adopters often need to coordinate their use of the innovation with other adopters [30,61]. This scenario of employees adopting a technological innovation that has been mandated by the firm’s management has alternatively been labeled an authority innovation decision [88,116], two-stage implementation [67], or as a secondary adoption process [60]. Regardless of the label, the point is that the choice of whether or not to adopt the innovation resides not with the individual adopter, but rather is mandated by management [37]. For such mandatory innovations, prior research has suggested that we examine users’ attitudes to the innovation and their post-adoption job satisfaction as meaningful outcomes of adoption [66,114], rather than focusing on their intentions to adopt the innovation or their level of usage.

The question of what factors or processes lead to successful innovation within this more complex scenario bears further examination [30,37]. The innovation management literature has considered the general question of why certain individuals or work environments are more innovative than others [88,116]. Often labeled as research on creativity or innovation, these same issues have begun to attract considerable interest within the IS community [18,84]. Recently, IS researchers have shown interest in better understanding individual innovativeness and the situational determinants of innovative environments [20,78]. One unresolved issue is whether individual creativity or innovativeness is a personal trait or a state of behavior [75]. While one current focus of research has taken the approach that creativity is a state that is subject to situational influences and can be deliberately improved by training or changes in the work environment [21,22,78,97], other researchers believe that creativity and innovativeness are individual attributes or traits that remains fairly stable over time and resist manipulation [15,52,77,99]. According to Agarwal and Prasad [2], the belief that people demonstrate consistent innovative behaviors across a broad range of domains—so-called global innovativeness [33] “was hypothesized in early work as a personality trait that is possessed by all individuals to a greater or lesser degree” [2, p. 206]. We proceed from this assumption that creativity is a stable individual trait, while acknowledging the general controversy of whether it is a trait or state. IS researchers have similarly disagreed over whether microcomputer playfulness—a construct related to innovativeness in using IT—is a trait or state [111,113,115].

This assumption that creativity and innovativeness represent stable facets of cognitive style is consistent with other accumulated evidence that individuals’ cognitive style affects their problem-solving and decision-making behavior in distinctive ways [42,49,99]. For example, cognitive style is known to be related to the types of solutions that students and managers produce for business problems [16]. Given this perspective that creativity and innovativeness are traits, this study investigates the relationship between IS professionals’ creative style and their attitudes to and ability to assimilate a technological innovation. While we acknowledge that it is also important to understand situational and organizational-level factors that shape technological adoption outcomes [75], our focus is deliberately on individual-level factors.

The remainder of the paper is structured as follows. Section 2 reviews one theory of individual creativity, adaption–innovation theory, as well as IS literature on creativity and innovation. In Section 3, we introduce our research framework and we define a set of propositions regarding software developers’ creative style and its relationship to several outcomes related to adoption of a technological innovation. Section 4 describes the research design and measures, Section 5 presents the findings, and Section 6 discusses the implications of this study for IS managers, change managers, and researchers.

2. Literature review

2.1. Overview of Kirton’s adaption–innovation theory

One theory for explaining differences in individual creativity was developed by British psychologist Michael Kirton, who identified two different styles
of creativity: adaptors and innovators [55]. While individuals labeled as adaptors exhibit a preference for remaining with the status quo or for incremental improvements to existing routines and processes, innovators are comfortable with—and actually prefer—environments characterized by more radical changes. Perhaps, in part, due to innovators’ greater risk-taking and sensation-seeking behavior, they are less tolerant of fixed routines and more accepting—even welcoming—of disruptions to the status quo. Building on Kirton’s early work on adaption–innovation theory [55,56], Foxall and Bhate ([34], p. 196) describe adaptors as: “characterized by order, precision, concern for accuracy of details, conformity, discipline, efficiency and . . . working] within the existing frame-of-reference.” In contrast, they characterize innovators as people who “exhibit a marked preference for tangential thinking, challenging rules and accepted procedures, and breaking with established methods” ([34], p. 196).

Although adaptors and innovators, as conceptual categories, represent polar opposites, Kirton’s survey instrument (the Kirton adaption–innovation inventory, or KAI), is an interval-level scale which scores individuals along a continuum from strong innovators to strong adaptors [46,47]. The KAI inventory has been extensively validated and has been shown to have desirable psychometric properties [6,7,9]. In addition, both the theory and the scale specify three correlated sub-concepts that comprise creative style: originality, efficiency, and rule-conformity. These sub-concepts are distinct, but related facets of an individual’s creative style [101]. Kirton defines innovators as those scoring high on originality, but relatively low in their emphasis on efficiency and rule-conformity as guiding principles of behavior. Adaptors show the opposite pattern, with a strong orientation to efficiency and rule-conformity, but less emphasis on originality.1

Many studies have confirmed the existence of this three-factor structure for the KAI inventory [9,36,101] and have demonstrated strong convergent and discriminant validity, using “second-generation, contemporary approaches” to validation [6,7], such as confirmatory factor analysis. Taylor, a psychometrician who conducted research on the KAI inventory, has postulated a fourth factor comprising the scale, which he labels preference for change or stability. In one of the most in-depth analyses of the factor structure of the KAI inventory, Taylor demonstrated a slightly different, four-factor set of results [102], with innovators scoring high on originality and preference for change, and low on rule-conformity and efficiency.2 This is an intriguing insight for our purposes, since preference for change or stability is the one subconstruct that should, in principle, be most closely related to one’s ability to assimilate change, including new technologies.

2.2. Research on creativity and information systems

There has been a recent surge of interest in the IS community regarding creativity and innovation, with research examining questions such as how to make the IS organization more creative [14,19,21,22,24,40,50,51,78], how IT can make managers more creative [28,71,72], and how creative individuals use IT differently than their less-creative peers [34,59]. There has been an interest in how differences in novice computer users’ cognitive style influences various outcomes, such as their ability to use IT in novel ways or to develop creative solutions to business problems using IT [64,86]. Research has shown that creative style is associated with the extent of computer use—including both the frequency of computer usage and the variety of different software applications used [34]. These results have been replicated among both senior managers and MBA students [35]. In the user training literature, Sein and co-workers have demonstrated a relationship between end users’ cognitive style, the training method employed, and users’ subsequent performance in applying their IT skills on various tasks [10,91,94]. The critical insight from the latter studies is that learning to use a new technology is enhanced when there is a fit between the training method employed and users’ preferred cognitive style. Some contrary findings do exist, however. Most

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1 This, of course, means that all the items that capture efficiency and rule-conformity are reverse-scored to attain a total score that represents the individual’s creative style or innovativeness [55,102].

2 This preference for change factor incorporates several items that previously loaded on the originality factor, and is moderately correlated with originality. It also includes one item that previously loaded on rule-conformity.
studies have shown that having an innovative creative style is positively correlated with IT use [34,35], but one recent study showed that innovators delegate more IT use to subordinates or IT specialists, while having less hands-on use themselves [59].

Although understanding the influence of end users’ creativity on their technology use has received much attention—particularly, for novice users—similar studies have not been replicated with more experienced IT users. It is well known that the factors that influence IT acceptance and usage are different for experienced users compared to novices [100], perhaps because users’ beliefs about a technology change after their initial experiences using it [45,54]. It would therefore appear important to examine the relationship between creative style and both the acceptance and assimilation of a technological innovation for experienced users, rather than to assume that the same results derived from novice users can be generalized to them. In this paper, we consider how such individual differences in creative style influence IS professionals’ ability to assimilate a technological innovation that alters the nature of software development [107]. Specifically, we examine the implications of creative style for IS professionals’ attitudes to client/server development following its mandatory adoption in their organizations. We also consider how both creative style and employees’ attitudes to the specific innovation influence their job satisfaction and performance several months after adoption.

Consistent with the definition of two-stage adoption [39,88], in our scenario, client/server development was adopted first at the organizational-level, and subsequently by various IS workgroups within each firm [37]. Software developers in these workgroups were required to use client/server development in performing their work. In the following section, we develop and test a theoretical framework to predict how creative style influences experienced IT users’ attitudes to the innovation (client/server development) as well as their job satisfaction and performance. Our findings provide interesting insights regarding the relationship between creativity and individuals’ ability to assimilate new technologies, as well as implications for managing the introduction of other technological innovations.

3. Research framework and propositions

Fig. 1 presents our research framework that forms the basis for our study. This section explains the rationale underlying each proposition depicted in Fig. 1. We note that all propositions are offered within the context of a technological innovation that significantly changes the work of IS professionals.

Fig. 1. Preliminary conceptual framework. All solid arrows indicate positive anticipated relationships. Dotted-line arrows indicate no anticipated relationship. In the latter cases, we state a null hypothesis to represent the lack of an anticipated relationship.
who are engaged in software development work [107,109].

Since innovators have a creative style that predisposes them to prefer novelty and change in their routines, whereas adaptors are comfortable with the status quo, it follows logically that innovators should have more positive attitudes to their job when they are mandated to adopt a technological innovation that significantly changes the nature of their work processes. Thus, we propose as follows.

**Proposition 1.** *Software developers who are innovators will report higher levels of job satisfaction following mandatory adoption of client/server development, compared to adaptors.*

Since IS professionals who develop software will use client/server development on a regular basis in their work, their attitudes to this technological innovation are likely to influence their job satisfaction, following adoption. This is because employees who enjoy working with client/server development—i.e., developers who find it to be useful, easy to use, or more compatible with prior work practices—will be more satisfied with their work, compared to their co-workers who dislike the same features of the innovation. Hence, we predict that:

**Proposition 2.** *Software developers’ attitudes to client/server development will be positively related to their job satisfaction, following their mandatory adoption of the innovation.*

Since there are three sets of core attributes that have been labeled “core attributes” [106] and have been widely studied [1,2,76], we state a separate variation on **Proposition 2** for each of these attributes (perceived usefulness, ease of use, and compatibility).

**Proposition 2a.** *Software developers’ attitudes to client/server’s usefulness will be positively related to their job satisfaction, following their mandatory adoption of the innovation.*

**Proposition 2b.** *Software developers’ attitudes to client/server’s ease of use will be positively related to their job satisfaction, following their mandatory adoption of the innovation.*

**Proposition 2c.** *Software developers’ attitudes to client/server’s compatibility with the prior approaches for software development will be positively related to their job satisfaction, following their mandatory adoption of the innovation.*

It is unclear what relationship creative style may have to software developers’ beliefs and attitudes regarding an innovation. Although one could argue that less innovative employees may judge the innovation to be more difficult to use and they may offer this as an excuse for their reluctance to adopt or accept the innovation, the precise nature of the relationship between innovativeness and ease of use may not be so straightforward. As an alternative explanation, one might argue that innovators may not perceive an innovation as easy to use, yet they may be willing to expend the necessary effort to learn and assimilate the technology, despite their misgivings [108]. Similarly, there is no a priori reason to expect that innovators will perceive a given technological innovation as more useful or more compatible with their prior work methods, compared to adaptors [53]. The literature does not provide us with any rationale to assume a direct relationship between creative style and individuals’ attitudes regarding a specific innovation. As one example, Agarwal and Prasad [2], in their examination of a domain-specific form of innovativeness—which they label personal innovativeness with IT—do not anticipate a direct relationship between personal innovativeness with IT and employees’ attitudes to a technological innovation, nor do they find a direct relationship in their study. While Agarwal and Prasad posit that personal innovativeness with IT will moderate the relationship between employees’ attitudes to an innovation and their intentions to use it, they do not claim a direct relationship. Given the lack of prior evidence for such a direct relationship between creative style and individuals’ perceptions of an innovation, we state the following proposition in null form.

**Proposition 3.** *Software developers’ creative style will not be associated with their attitudes to client/server development.*

Since there are three sets of core attributes that we consider, we state a separate proposition (in null form) for each one.
Proposition 3a. Software developers’ creative style will not be associated with their attitude to client/server development’s usefulness.

Proposition 3b. Software developers’ creative style will not be associated with their attitude to client/server development’s ease of use.

Proposition 3c. Software developers’ creative style will not be associated with their attitude to client/server development’s compatibility with the prior methods of working.

Although prior research has shown that innovators have a general preference for change, compared to adaptors [55,56,102], there has been little research on the performance implications of such differences in creative style. It seems plausible, however, that when required to adopt a mandatory technological innovation, innovators will perform better than adaptors, due to their penchant for originality and their greater preference for change [2,102]. There is some support for this notion in the management literature, which has shown that several personality traits—including a construct called “openness to experience”—have a positive correlation with job performance. Tett et al. [103,104] conducted a meta-analysis of 97 prior studies that examined the relationship between employees’ personal attributes and job performance, demonstrating a highly significant correlation (Pearson’s $r = +0.25; p < 0.000$) between “openness to experience” and job performance, across a broad range of job types. Since the openness to experience construct examined by Tett et al. is similar to the preference for change dimension of Kirton’s measure of innovativeness, it is reasonable to expect that creative style will be similarly related to job performance in our study. We believe that such a result is especially likely given the context of software developers who have recently adopted an innovation that changes their work processes. Thus, we anticipate as follows.

Proposition 4. Software developers who are innovators will be perceived as having higher levels of job performance by their managers, following adoption of client/server development, compared to adaptors.

Since the job performance scale that we employ for measuring software developers’ performance (described later) specifies four separate “facets” of software developers’ performance, we offer a separate proposition for the relationship between creative style and each facet of performance.

Proposition 4a. Software developers who are innovators will be perceived as having higher levels of technical/analytical skills, following adoption of client/server development, compared to adaptors.

Proposition 4b. Software developers who are innovators will be perceived as having higher levels of business knowledge, following adoption of client/server development, compared to adaptors.

Proposition 4c. Software developers who are innovators will be perceived as having more positive attitudes to the job, following adoption of client/server development, compared to adaptors.

Proposition 4d. Software developers who are innovators will be perceived as having more positive attitudes to the job, following adoption of client/server development, compared to adaptors.

Although conventional wisdom says that job satisfaction and performance are related, prior management research has generally not substantiated this belief. Given the notoriously inconsistent findings regarding the relationship between employees’ job satisfaction and their performance [11], we do not expect to find a direct relationship between employees’ job satisfaction and their performance, following adoption of client/server development. We acknowledge that some variability in the prior literature exists—with some studies finding no association between satisfaction and performance, and others finding a weak, but positive correlation (in the range of $r = +0.10$), however, this generally has not been regarded as convincing evidence of a relationship between these constructs. It is possible, of course, that the relationship between employees’ job satisfaction and performance may be stronger during periods of change—such as during restructuring, re-engineering, or following adoption of a technological innovation. We are unaware of any studies, however, that have examined the association between satisfaction and performance under these conditions. Thus, we state the following proposition in null form.
**Proposition 5.** No relationship is expected between software developers’ job satisfaction and their job performance, following mandatory adoption of client/server development.

As with the earlier propositions, since there are four facets that capture software developers’ job performance, we could state an equivalent null hypothesis for each dimension. To conserve space, we simply state that we do not expect to find a positive relationship between job satisfaction and any of the four facets of developers’ performance (technical/analytical skills, business knowledge, communication skills, and job attitudes).

The final relationship in the research framework is that between employees’ attitudes to a technological innovation and their job performance. We do not anticipate a relationship between software developers’ attitudes to client/server innovation and their job performance. For example, we anticipate no association between software developers’ perceptions of client/server’s usefulness, ease of use, or compatibility and the four facets of their job performance. We therefore state Proposition 6 in null form and Fig. 1 shows a dotted-line arrow from “attitudes to client/server development” to job performance construct, which denotes this null hypothesis.

**Proposition 6.** There will be no relationship between software developers’ attitudes to client/server development and their job performance, as evaluated by their managers.

Since we considered three “core attributes” [1,2,106] of client/server development earlier, we state a separate variation on Proposition 6 for each one.

**Proposition 6a.** Software developers’ attitudes to client/server’s usefulness will be unrelated to their overall job performance—or any facet of their job performance.

**Proposition 6b.** Software developers’ attitudes to client/server’s ease of use will be unrelated to their overall job performance—or any facet of their job performance.

**Proposition 6c.** Software developers’ attitudes to client/server’s compatibility with the prior approaches for software development will be unrelated to their overall job performance—or any facet of their job performance.

4. Research design and measures

4.1. Developing the survey instrument

We developed two versions of a survey to be administered in a disk-by-mail format: an “employee” version for software developers and a “manager” version for their direct supervisors. The “employee” survey version was distributed to software developers within two firms that had migrated from mainframe-based development to client/server development approximately 4–6 months previously. By virtue of their membership in these firms, each respondent had been required to adopt client/server development and to make other changes to their work processes to accommodate the innovation, rather than voluntarily adopting it for individual use. The “manager” survey version was sent to the supervisor of each developer after the developer had responded to the “employee” version.

Disk-by-mail is a process of presenting survey questions to respondents on a diskette that is mailed to each respondent, and which they, in turn, return by mail. Prior research has demonstrated several benefits of the disk-by-mail approach, including researchers’ ability to randomize question order, to alter the presentation of specific questions based on responses to a prior question, as well as generally higher response rates than paper-and-pencil surveys [13,48,90,92,110]. The employee survey was administered to 220 IS professionals who worked as software developers in two firms—an financial services firm and a chemical engineering firm. Prior to administering the survey, a longitudinal field study was conducted in each firm to understand the context and implementation processes related to client/server development [37]. Approximately, 12–15 interviews were conducted in each firm to provide general background information about each firm’s history, corporate culture, the structure and functions of the IS department, as well as the steps taken to migrate the software development workforce from mainframe-based software development to client/server development. Following these field studies, the survey was developed and distributed to
the software developers, and subsequently to the IS managers.

Each software developer received a computerized, disk-based survey and was requested to complete the survey using a Windows-based PC, and return the disk by mail. The employee survey contained items capturing all constructs in the research framework, except for job performance. The response rate was 55%, with 118 developers returning usable surveys. Shortly, after each developer responded to the survey, the “manager” survey version was mailed to the direct supervisor of each “employee” respondent. As part of this “manager” survey, each IS manager was requested to provide an evaluation of the skills and job performance for their direct subordinates who had previously returned the employee survey. The manager response rate was 61%, with 72 completed responses. The number of completed surveys, was thus, 118 for the employee survey and 72 for the manager survey.3

4.2. Measures

The “employee” survey asked each respondent to report their attitudes to client/server development, using standard measures for perceived usefulness and ease of use [16,17], as well as for compatibility [76]. Job satisfaction was measured using the satisfaction with work scale of the job descriptive index scale [96], incorporating certain modifications recommended by management researchers [12]. The employee survey included basic demographic questions (age, gender, level of education) and other descriptive questions about respondents’ job history (job title, duties, years in the company, years in the present job, and total years in the IS profession).

Since we did not expect that creative style would be the sole factor that influenced software developers’ job satisfaction, we included additional items in the survey to serve as potential control variables. For example, one well-known theory in the psychology of job design, known as person–environment fit theory [27,44,63], argues that job satisfaction is determined by the fit between employees’ needs/interests and opportunities provided by the job to fulfill these needs/interests. Since we believed that such a fit between the person and the job environment would likely explain some of the variance in employees’ job satisfaction, 21 additional items from the job preference inventory [27,73] were included to capture employees’ job needs/interests, and the corresponding items from the job characteristics inventory [27,95] to capture their feedback about whether these needs were satisfied by the job. The latter scales allowed us to control for a critical set of factors that influence employees’ job satisfaction—the extent to which their needs/interests are fulfilled by their present jobs.

Software developers were also asked to complete the KAI to assess their creative style, using a reduced version of the KAI scale [36]. The 20-item “abridged” version of the KAI scale [101], which has demonstrated certain advantage over the conventional, 32-item version, was used for this study. Foxall and Hackett [36] argue that the shorter version of the scale “leads to slightly firmer conclusion, based on the size of the correlations they produce [with dependent variables] and their statistical significance” (p. 496). We incorporated all KAI inventory items corresponding to Taylor’s preference for change or stability sub-construct [102] into the 20-item scale, bringing the total number of KAI inventory items to 23 items.

The manager version of the survey requested each IS manager to provide an assessment of each employee respondent’s skills and level of performance on 24 different skills and behaviors, based on Goldstein’s performance evaluation scale for programmer/analysts [41]. As originally developed and validated by Goldstein, this instrument measures four facets of IS professionals’ performance: (1) technical/analytical skills; (2) business knowledge; (3) communication skills; and (4) job attitudes.

4.3. Data analysis

Three methods were used to analyze the survey data: internal reliability analysis, factor analysis, and multiple regression analysis. Internal reliability analysis and exploratory factor analysis were used to evaluate each construct’s internal consistency (Cronbach alpha) and to establish whether each construct was uni-dimensional or multi-dimensional. Table 1 shows, for each multiple-item scale, the internal

3 An agreement with our university’s research ethics committee prevented us from asking any IS manager for a performance evaluation for any subordinate that had neglected to respond to the employee survey.
reliability results. For internal consistency, values above 0.80 are generally considered high, and values between 0.7–0.8 are also considered acceptable [79]. For those scales demonstrating an initial Cronbach alpha of less than 0.80, or for scales with items that loaded poorly on the overall construct, Table 1 indicates whether one or more items were deleted from the scale, and the revised Cronbach alpha value. The last column of Table 1 also indicates whether the construct was expected to be multi-dimensional, based on prior research.

Next, an exploratory factor analysis was conducted separately for each multi-dimensional construct in the framework. Since prior research had shown most of the constructs in the model to be multi-dimensional (e.g. for attitude to new technology, KAI inventory and job performance), multiple factors were expected to emerge from the exploratory factor analysis. Researchers have advocated that we confirm whether our measurement scales are uni- or multi-dimensional, rather than to just assume uni-dimensionality [93]. Table 2 shows, for each multi-dimensional construct,
the separate factors that emerged from the factor analysis, as well as the internal reliability for each factor. Factor scores were computed for each factor and saved for use in the multiple regression analysis. Multiple regression was used to test each proposition stated earlier, as depicted in Fig. 1. Control variables were included in the regression analyses, including demographic variables and items corresponding to person–environment fit theory [27]. We attempted to include various demographic variables as controls (age, gender, and education level), as well as three measures of job tenure (tenure in the company, tenure in the IS profession, and tenure in the current job position). None of these demographic variables were significant for any of the propositions, except in predicting employee job performance. Given the lack of significant findings for these demographic variables, we do not mention them in the following sections, except for the one proposition where they demonstrated a significant effect (for Proposition 4, job performance).

5. Results

Proposition 1. Software developers who are innovators will report higher levels of job satisfaction, following mandatory adoption of client/server development, compared to adaptors.

We analyzed the influence of creative style on job satisfaction, using multiple regression analysis to identify the specific effect of creative style after controlling for other factors that influence job satisfaction, as predicted by person–environment fit theory [27,63,73]. Results appear in Table 3. When creative style and the control variables corresponding to person–environment fit theory were included, 44% of the variance in job satisfaction was explained. Although much of this variance was explained by these control variables alone (without including creative style), we found that creative style added a statistically significant increment to the amount of variance in job satisfaction explained, which was significant at $p < 0.05$. Specifically, innovators showed higher levels of job satisfaction, compared to adaptors, after controlling for the items corresponding to employees’ needs/interests and the extent to which these needs/interests were fulfilled by the job. Thus, Proposition 1 is supported.

Proposition 2. Software developers’ attitudes to client/server development will be positively related to their job satisfaction, following their mandatory adoption of the innovation.

Results from Table 4 show that developers’ job satisfaction was significantly related to all three attitudes regarding client/server’s usefulness, ease of use and its compatibility with employees’ prior approaches to software development. All findings were statistically significant ($p < 0.05$). Software developers who perceived the technological innovation to be useful or easy-to-use were more satisfied in their jobs, as were those developers who perceived the innovation to be compatible with prior approaches to software development. Thus, Proposition 2 is supported.

Proposition 3. Software developers’ creative style will not be associated with their attitudes to client/server development.

Since we examined three sets of attitudes to the client/server innovation in this study, we evaluate each proposition separately.

<table>
<thead>
<tr>
<th>Table 3</th>
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<tbody>
<tr>
<td>Regression of job satisfaction on creative style</td>
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<tr>
<td>Proposition number</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Control variables</td>
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<tr>
<td>P1</td>
</tr>
</tbody>
</table>

Dependent variable: job satisfaction.

* $p < 0.05$.

** $p < 0.01$. 
Proposition 3a. Software developers’ creative style will not be associated with their attitude to client/server development’s usefulness.

Proposition 3b. Software developers’ creative style will not be associated with their attitude to client/server development’s ease of use.

Proposition 3c. Software developers’ creative style will not be associated with their attitude to client/server development’s compatibility with the prior methods of working.

We separately examined the relationship between creative style and employees’ perceptions of each “core attribute” (usefulness, ease of use, and compatibility). Results (not included here) showed no statistically significant findings, and thus, we conclude that creative style was not related to software developers’ attitudes to client/server development. Innovators were no more likely than adaptors to perceive client/server to be useful, easy to use, or compatible with prior mainframe-based approaches to software development. Since we did not expect to find any relationship between creative style and employees’ attitudes to client/server development, Proposition 3 is supported.

Proposition 4. Software developers who are innovators will be perceived as having higher levels of job performance, following adoption of client/server development, compared to adaptors.

Results for these analyses appear in Table 5. Although the relationship between software developers’ creative style and their overall job performance was not statistically significant, there was a positive trend in this direction ($p < 0.10$). The correlation between creative style and performance was moderately large ($r = +0.16$), and the regression results showed that creative style explained about 3% of the variance in developers’ overall job performance, as evaluated by their managers. Since our test for Proposition 4 required merging the managers’ and employees’ survey responses, and given the smaller number of completed manager survey ($n = 72$), it is possible that the statistical test lacked sufficient power to identify an effect.

To understand the underlying dynamics of this non-significant trend between creative style and overall job performance, we conducted additional, separate multiple regression analyses to determine whether employees’ creative style was related to any of the four job performance facets on which managers evaluated them (as specified by Proposition 4a–d). We tested these specific propositions separately and, where positive findings did emerge, we probed further to identify which dimensions of creative style (originality, preference for change, rule-conformity, or efficiency) were responsible for the observed results. For example, in probing the explanation for the moderate correlation ($r = +0.16$) between creative style and overall job performance, we noted that the originality sub-construct was the one factor that was related to overall job performance ($r = +0.19; p = 0.06$). This demonstrates that the non-significant trend between software developers’ creative style and their job performance can best be explained by the fact that developers scoring high on the originality dimension of the KAI inventory had higher overall job performance. We examine the separate propositions for each facet of job performance as follows.

Proposition 4a. Software developers who are innovators will be perceived as having higher levels of job performance following adoption of client/server development, compared to adaptors.

Table 4
Regression of job satisfaction on attitudes to client/server development

<table>
<thead>
<tr>
<th>Proposition number</th>
<th>Independent variable</th>
<th>Correlation coefficient ($r$)</th>
<th>Variance explained ($r^2$)</th>
<th>Adjusted $r^2$</th>
<th>$F$-statistic</th>
<th>$p$-value (one-tailed test)</th>
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<tbody>
<tr>
<td>P2a</td>
<td>Client/server is useful</td>
<td>+0.26</td>
<td>0.07</td>
<td>0.06</td>
<td>8.70</td>
<td>0.002**</td>
</tr>
<tr>
<td>P2b</td>
<td>Client/server is easy to use</td>
<td>+0.29</td>
<td>0.08</td>
<td>0.07</td>
<td>10.40</td>
<td>0.001**</td>
</tr>
<tr>
<td>P2c</td>
<td>Client/server is compatible</td>
<td>+0.18</td>
<td>0.03</td>
<td>0.03</td>
<td>4.05</td>
<td>0.023*</td>
</tr>
</tbody>
</table>

Dependent variable: job satisfaction.

* $p < 0.05$.

** $p < 0.01$. 

Table 5
Regression of overall job performance and four facets of performance on creative style

<table>
<thead>
<tr>
<th>Proposition number</th>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Correlation coefficient ((r))</th>
<th>Variance explained ((r^2))</th>
<th>Adjusted (r^2)</th>
<th>(F)-statistic</th>
<th>(p)-value (one-tailed test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4</td>
<td>Overall performance</td>
<td>Creative style (KAI total score)</td>
<td>+0.16</td>
<td>0.03</td>
<td>0.01</td>
<td>1.91</td>
<td>0.09*</td>
</tr>
<tr>
<td>P4</td>
<td>Overall performance</td>
<td>Originality</td>
<td>+0.19</td>
<td>0.03</td>
<td>0.02</td>
<td>2.45</td>
<td>0.06*</td>
</tr>
<tr>
<td>P4a</td>
<td>Technical skills</td>
<td>Creative style (KAI total score)</td>
<td>+0.10</td>
<td>0.00</td>
<td>0.000</td>
<td>0.75</td>
<td>0.19</td>
</tr>
<tr>
<td>P4a</td>
<td>Technical skills</td>
<td>Preference for change</td>
<td>+0.25</td>
<td>0.06</td>
<td>0.05</td>
<td>4.44</td>
<td>0.02*</td>
</tr>
<tr>
<td>P4b</td>
<td>Business knowledge</td>
<td>Creative style (KAI total score)</td>
<td>+0.09</td>
<td>0.01</td>
<td>−0.01</td>
<td>0.55</td>
<td>0.23</td>
</tr>
<tr>
<td>P4c</td>
<td>Communication skills</td>
<td>Creative style (KAI total score)</td>
<td>+0.09</td>
<td>0.01</td>
<td>−0.01</td>
<td>0.54</td>
<td>0.24</td>
</tr>
<tr>
<td>P4c</td>
<td>Communication skills</td>
<td>Efficiency</td>
<td>−0.16</td>
<td>0.03</td>
<td>0.01</td>
<td>0.13</td>
<td>0.09*</td>
</tr>
<tr>
<td>P4d</td>
<td>Job attitudes</td>
<td>Creative style (KAI total score)</td>
<td>+0.20</td>
<td>0.05</td>
<td>0.03</td>
<td>2.91</td>
<td>0.04*</td>
</tr>
<tr>
<td>P4d</td>
<td>Job attitudes</td>
<td>Originality</td>
<td>+0.21</td>
<td>0.04</td>
<td>0.03</td>
<td>3.18</td>
<td>0.04*</td>
</tr>
<tr>
<td>P4d</td>
<td>Job attitudes</td>
<td>Preference for change</td>
<td>+0.29</td>
<td>0.08</td>
<td>0.07</td>
<td>6.31</td>
<td>0.01**</td>
</tr>
</tbody>
</table>

Demographic control variables

<table>
<thead>
<tr>
<th></th>
<th>Technical skills</th>
<th>Age</th>
<th>−0.24</th>
<th>0.06</th>
<th>0.05</th>
<th>4.28</th>
<th>0.04*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure in IS profession</td>
<td>Business knowledge</td>
<td>Tenure in IS profession</td>
<td>+0.30</td>
<td>0.09</td>
<td>0.07</td>
<td>6.11</td>
<td>0.02**</td>
</tr>
<tr>
<td>Tenure in company</td>
<td>Business knowledge</td>
<td>Tenure in company</td>
<td>+0.21</td>
<td>0.05</td>
<td>0.03</td>
<td>3.06</td>
<td>0.08**</td>
</tr>
</tbody>
</table>

Table 5 shows the regression results for regressing each job performance facet on creative style. If certain dimensions of creative style were related to these job performance facets, the significant results are displayed, as well. The \(p\)-values in the table are for one-tailed tests, with the exception of tests for demographic control variables, for which no relationships were expected.

* \(0 < 0.10\).
* * \(p < 0.05\).
* * * \(p < 0.01\).
technical/analytical skills, following adoption of client/server development, compared to adaptors.

The relationship between overall creative style and technical/analytical skills was not statistically significant, however, software developers’ preference for change was moderately correlated with managers’ evaluations of their technical/analytical skills, a statistically significant result \((r = +0.19; p = 0.02)\). This indicates partial support for Proposition 4a. The other sub-constructs comprising creative style (originality, rule-conformity, and efficiency) were unrelated to employees’ technical/analytical skills.

**Proposition 4b.** Software developers who are innovators will be perceived as having higher levels of business knowledge, following adoption of client/server development, compared to adaptors.

The relationship between creative style and business knowledge was not statistically significant, nor were any of the sub-constructs comprising creative style related to managers’ evaluations of respondents’ business knowledge. We found no support for Proposition 4b.

**Proposition 4c.** Software developers who are innovators will be perceived as having higher levels of communication skills, following adoption of client/server development, compared to adaptors.

The relationship between creative style and developers’ communication skills was not significant overall, however, the efficiency sub-construct of creative style was negatively correlated with managers’ evaluations of respondents’ communication skills \((r = -0.16; p < 0.10)\). This indicates partial, but weak support for Proposition 4c, which is consistent with the notion that innovators have higher job performance.\(^4\)

**Proposition 4d.** Software developers who are innovators will be perceived as having more positive attitudes to the job, following adoption of client/server development, compared to adaptors.

The relationship between developers’ creative style and their managers’ assessment of their job attitudes was moderately large \((r = +0.20; p < 0.05)\). This statistically significant relationship can be explained by a strong correlation between developers’ preference for change and managers’ assessment of their job attitudes \((r = +0.29; p < 0.01)\), as well as a moderate correlation between their originality and managers’ assessment of their job attitudes \((r = +0.21; p < 0.05)\). In contrast, employees’ scores on the two remaining KAI factors (efficiency and rule-conformity) were unrelated to managers’ assessment of their job attitudes. These results indicate strong support for Proposition 4d. The overall creative style score was thus statistically significant in explaining managers’ evaluations of developers’ job attitudes, a result due to innovators’ higher scores on the originality and preference for change dimensions of the KAI inventory.

5.1. Summary of Proposition 4 results

While the global relationship between software developers’ creative style and managers’ assessment of their overall job performance \((r = +0.16; p < 0.10)\) fell short of statistical significance at conventional levels, the originality dimension of creative style was positively related to developers’ overall job performance \((r = +0.19; p = 0.06)\), preference for change was related to their technical/analytical skills \((r = +0.19; p = 0.02)\), and both the originality and preference for change dimensions were related to managers’ assessment of their job attitudes \((r = +0.29, p < 0.01\) for preference to change; \(r = +0.21, p < 0.05\) for originality). There was also weak support for a negative correlation between efficiency and communication skills \((r = -0.16; p < 0.10)\), which is also consistent with innovators having higher job performance.\(^5\) In summary, the trend we noted between developers’

\(^4\)The direction of this relationship supports Proposition 4c. The correlation between efficiency and communication skills was negative; this means that individuals scoring high on efficiency (i.e., adaptors, by definition) had lower ratings of their communication skills, while individuals scoring low on efficiency (i.e., innovators, by definition) had higher communication skills ratings. This finding was in the expected direction, supporting Proposition 4c.

\(^5\)This finding does not mean that innovators are not “efficient” or that “efficient” people have poorer communication skills. It does show, however, that software developers who are focused on particular behaviors that correspond to the efficiency dimension of the KAI inventory are perceived as having weaker communication skills. These behaviors correspond to the four items on the KAI inventory that capture the efficiency sub-construct.
creative style and their managers’ assessment of their overall job performance \((r = +0.16; p < 0.10)\) can best be understood in terms of innovators having stronger technical/analytical skills (as perceived by their managers), due to their greater preference for change, and also due to their more positive job attitudes, resulting from their greater preference for change and higher levels of originality.

Finally, we found some relationships between the demographic control variables and specific facets of job performance. Employees’ age was negatively related to managers’ assessment of their technical/analytical skills, while their tenure in the IS profession was positively related to managers’ assessment of their business knowledge. We retained these demographic variables in our regression analyses involving job performance (Propositions 4–6), since they were statistically significant. We offer some observations regarding these intriguing findings in Section 6.

**Proposition 5.** No relationship is expected between software developers’ job satisfaction and their job performance, following their mandatory adoption of client/server development.

We stated the previous proposition in null form, because we anticipated no significant relationship between employees’ job satisfaction and performance. Contrary to our expectation, Table 6 shows that employees’ job satisfaction was indeed significantly related to most facets of their job performance. The regression results demonstrate a relationship between employees’ satisfaction and job performance, which was statistically significant \((p < 0.05)\). This was a surprising result, as it contradicts prior management research showing no direct relationship between satisfaction and job performance. The relationship between employees’ job satisfaction and various facets of their performance ranged zero for technical/analytical skills to moderately high for performance facets such as communication skills \((r = +0.28; p < 0.01)\), and their attitudes to the job \((r = +0.30; p < 0.01)\).

Using separate regression analyses to examine the relationship between satisfaction and the four facets of performance, we discovered that employees’ job satisfaction is strongly related to their managers’ assessment of their communication skills, business knowledge and their attitudes to the job (but not with their technical/analytical skills). Given the discrepancy between this positive observed relationship between software developers’ satisfaction and job performance, compared to the lack of such findings in the management literature, we consider possible explanations for our results and their implications in Section 6.

**Proposition 6.** There will be no relationship between software developers’ attitudes to client/server development and their job performance, as evaluated by their managers.

We separately analyzed the relationship between job performance and software developers’ attitudes to client/server development—focusing on the three core attributes of usefulness, ease of use, and compatibility. We found no significant relationships between attitudes and developers’ overall job performance, nor any of its facets (results not shown here). This lack of findings between developers’ attitudes and job performance supports Proposition 6 (as well as the subpropositions 6a–c).

### Table 6
Regression of overall job performance and four facets of performance on job satisfaction

<table>
<thead>
<tr>
<th>Regression test</th>
<th>Dependent variable</th>
<th>Correlation coefficient ((r))</th>
<th>Variance explained ((r^2))</th>
<th>Adjusted (r^2)</th>
<th>F-statistic</th>
<th>p-value (two-tailed test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5</td>
<td>Overall performance</td>
<td>+0.20</td>
<td>0.04</td>
<td>0.03</td>
<td>3.00</td>
<td>0.04*</td>
</tr>
<tr>
<td>P5a</td>
<td>Technical skills</td>
<td>+0.13</td>
<td>0.02</td>
<td>0.01</td>
<td>1.29</td>
<td>0.13</td>
</tr>
<tr>
<td>P5b</td>
<td>Business knowledge</td>
<td>+0.24</td>
<td>0.06</td>
<td>0.04</td>
<td>3.88</td>
<td>0.03*</td>
</tr>
<tr>
<td>P5c</td>
<td>Communication skills</td>
<td>+0.27</td>
<td>0.07</td>
<td>0.06</td>
<td>5.21</td>
<td>0.01**</td>
</tr>
<tr>
<td>P5d</td>
<td>Job attitudes</td>
<td>+0.30</td>
<td>0.09</td>
<td>0.08</td>
<td>6.72</td>
<td>0.01**</td>
</tr>
</tbody>
</table>

Independent variable: job satisfaction.

* \(p < 0.05\).

** \(p < 0.01\).
6. Discussion

In this section, we summarize our findings and discuss their implications for practitioners (including IS managers and change managers), as well as implications for researchers.

6.1. Summary of findings

Our results supported the majority of our propositions, as shown in Table 7. These results demonstrated full support for four propositions (P1, P2, P3 and P6), partial support for one more proposition (P4), and clearly disconfirming one proposition (P5). Fig. 2 shows the relationships that were supported by our study. While it is not surprising that software developers’ attitudes to a mandatory technological innovation are positively related to their degree of job satisfaction (P2), this is the first study is to our knowledge to demonstrate that their creative style is also related to job satisfaction (P1). Ours is also the first study to examine the relationship between creative style and IS professionals’ job performance (P4). While the relationship between creative style and performance was not as strong as we had anticipated ($p < 0.10$) (perhaps owing to limited statistical power in analyzing the smaller sample size of managers’ results), there is strong evidence that at least some of the sub-constructs that comprise creative style on Kirton’s instrument—particularly, originality and preference for change—were related to specific facets of software developers’ performance—namely, their technical/analytical skills and their job attitudes. While this provides only partial support for the global relationship that we expected to find between developers’ creative style and job performance, it nevertheless, offers more precise implications for managing technological change, since it pinpoints how specific behaviors that comprise creative style are related to specific aspects of software developers’ performance.

Employees who are innovative—that is, who demonstrate a creative style that favors “tangential

Table 7
Summary of results

<table>
<thead>
<tr>
<th>Proposition number</th>
<th>Results from study</th>
<th>Is proposition supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Creative style was positively related to employees’ job satisfaction</td>
<td>Yes (full support)</td>
</tr>
<tr>
<td></td>
<td>(i.e. innovators had higher job satisfaction than adaptors)</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Attitudes to client/server development (usefulness, ease of use, and compatibility)</td>
<td>Yes (full support)</td>
</tr>
<tr>
<td>P3</td>
<td>Creative style was not related to employees’ attitudes to client/server development (usefulness, ease of use, and compatibility)</td>
<td>Yes (full support)</td>
</tr>
<tr>
<td>P4</td>
<td>Creative style was related to employees’ overall job performance, however this relationship was a trend ($p &lt; 0.10$), but not statistically significant at conventional levels. Creative style was related to specific facets of job performance, as shown later</td>
<td>Yes (weak support)</td>
</tr>
<tr>
<td>P4a</td>
<td>Employees’ preference for change or stability was related to their technical/analytical skills</td>
<td>Yes</td>
</tr>
<tr>
<td>P4b</td>
<td>Neither employees’ overall creative style (not any of its sub-constructs) were related to employees’ business knowledge</td>
<td>No</td>
</tr>
<tr>
<td>P4c</td>
<td>Employees’ overall creative style was not related to their communication skills; however, their predisposition toward efficiency was associated with poorer communication skills. Since a predisposition toward efficiency is characteristic of adapters (less innovative employees), this finding is consistent with our proposition</td>
<td>Yes</td>
</tr>
<tr>
<td>P4d</td>
<td>Employees’ overall creative style was related to their job attitudes; this finding was due to the higher level of originality and greater preference for change among innovators</td>
<td>Yes</td>
</tr>
<tr>
<td>P5</td>
<td>Employees’ job satisfaction was positively related to their overall job performance. In addition, job satisfaction was also related to their managers’ evaluation of three facets of their performance (business knowledge, communication skills, and job attitudes), but not to their technical/analytical skills. These positive findings were not anticipated, and thus, disconfirm our proposition</td>
<td>No</td>
</tr>
<tr>
<td>P6</td>
<td>Employees’ attitudes to client/server development (usefulness, ease of use, and compatibility) were unrelated to job performance or its facets.</td>
<td>Yes (full support)</td>
</tr>
</tbody>
</table>
thinking, challenging rules and accepted procedures, and breaking with established methods” ([34], p. 196) are likely to be more positively pre-disposed to experimenting with an innovation, and will have more positive attitudes to their jobs, when confronted with mandatory adoption of a technological innovation. Based on our results, highly-innovative employees (innovators) have stronger technical/analytical skills, perhaps owing to their greater willingness to experiment with the specific innovation at hand. Moreover, we speculate that the higher technical/analytical skills that managers reported for the innovators may also be the cumulative result of their prior efforts to assimilate other prior innovations with greater enthusiasm and success, compared to their less-innovative peers (adaptors). While our results cannot be directly extrapolated to voluntary innovation adoption scenarios, one possible explanation is that innovators’ higher level of technical/analytical skills (as evaluated by their managers) is a by-product of their prior experiences with adopting other technological innovations—whether voluntary or involuntary. Research conducted at the organizational-level has argued that a firm’s absorptive capacity [5,17] is, in part, determined by the number of prior technologies that the firm has adopted. The same detailed processes responsible for enhancing absorptive capacity at the firm level may also take place at the individual-level, with the result that employees’ technical/analytical skills reflect their degree of absorptive capacity, which is, in turn, shaped by their prior adoption experiences with other innovations (voluntary or mandatory).

6.2. Implications for practitioners (IS managers and change managers)

To work as an IS professional today is to be confronted with an ongoing stream of technological changes. Implementing new technologies is a substantial challenge, both for change managers and IS managers who oversee implementation [32,81], but also for IS professionals who must learn to use them [31]. As the tools, methods, and languages for developing software have rapidly evolved over the past decade from mainframe-based to client/server and, more recently, to web-based tools and languages (e.g. Java and Active Server Pages), IS professionals must undergo constant learning and assimilation of various changes to their roles, responsibilities, work processes, and relationship with users. Although IS researchers have examined implementation issues surrounding software process innovations6 for well over a decade, most prior studies have focused

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6 Fichman coined the term software process innovation to denote “changes to an organization’s process for producing software applications—changes in tools, techniques, procedures or methodologies” ([31], p. 23).
on macro-level factors that influence organizational outcomes—such as the organization’s implementation strategy or the innovation’s compatibility with existing practices [4,5,81,117]. The role of micro-level factors, such as individual differences that may influence employees’ reactions to and success in assimilating such innovations has been generally overlooked. Examples of software process innovations that have received much attention include structured development methods [60], integrated-CASE tools [81,84], object-oriented development [32], and more recently, open-source software development [29], but the importance of micro-level factors has generally been ignored.

Despite a long-standing interest in individual differences in other areas of IS research, dating back to Zmud’s early work [118] and continuing to the present time [3,112,114], scholars studying the implementation of software process innovations have paid little attention to understanding how these micro-level factors may influence IS professionals’ attitudes and behaviors related to assimilating such innovations. This research is one step toward resolving this gap. By demonstrating the importance of individuals’ creative style as a stable attribute that affects how IS professionals assimilate a mandatory technological innovation, we have underscored the importance of such micro-level factors. Our findings demonstrate that software developers’ creative style is an important construct to understand for managers charged with implementing technological innovation. Our study shows that software developers’ creative style influences their job satisfaction, technical proficiency, and job attitudes when they are confronted with using an innovation that alters the software development process.

While we believe that managers responsible for implementing technological innovations should understand how creative style may be implicated in employees’ reactions to adopting a mandatory technological innovation, our findings should not be construed as proving that having all employees who are innovators is desirable, or that adaptors are undesirable in the IS workplace. Such an interpretation is not warranted by our findings, for two reasons. First, there were some contrary trends in our data which indicated that certain attributes of adaptors more favorably disposed them to higher job satisfaction and higher ratings of their communication skills, all else being equal. This insight is based on some non-significant trends in our data ($p < 0.10$), whereby respondents scoring high on the rule-conformity dimension of creative style (adaptors, by definition) had higher levels of job satisfaction and communication skills, than those scoring lower on rule-conformity. While these non-significant trends are in opposition to the prevailing evidence from our study showing that innovators generally exhibit higher levels of job satisfaction and performance, they are but one reminder that there are benefits to both creative styles—including the adaptor style. This is consistent with Kirton’s early formulation of adaption–innovation theory [55], which argues that neither the innovator nor the adaptor approach to creative style is better than the other; they are merely different styles by which individuals approach creativity, and each style has its advantages and disadvantages. Second, even within the IS profession, organizations do not necessarily require all employees to be innovators, since innovators’ creative style may not fit all job roles or work environments. Given their greater preference for change and dislike for fixed routines, innovators’ creative style may serve as either an asset or a liability, depending on the specific job role, organizational culture, and work environment. All employees, at some point, need to work in a fixed routine, and for some employees, routine tasks may be a substantial component of the job, as indicated by prior research on maintenance programmers [23]. IS professionals who are innovators may be dissatisfied with the constraints of maintenance programming, system operations, or even certain forms of new software development work—such as using legacy tools and languages. Employees who are adaptors may experience greater fulfillment in such work environments, compared to innovators [109]. While this study examined the relationship between IT professionals’ creative style and several outcome variables for a particular job role (new software development) and within a particular context (following mandatory adoption of a technological innovation that significantly alters the software development process), IS practitioners must observe caution in generalizing these results to other job roles whose requirements differ, or other contexts—particularly, work environments lacking a substantial change component.
6.3. Implications for researchers

There are three implications of our findings for researchers that we wish to highlight. The first implication concerns the lack of common-method bias in our results, given the fact that all the job performance data was derived from a set of respondents (managers), who were distinct from the respondents that provided the balance of the data (software developers). Unlike much cross-sectional survey research, which potentially suffers from the common-method bias of a single respondent providing both independent and dependent variables at the same point in time, our study avoids this common-method bias. The second implication is that, although we did not expect to find a relationship between job satisfaction and performance, our unexpected finding is noteworthy. It appears that, at least in the context of implementing a significant, mandatory change in work processes [107], employees’ job satisfaction is related to their job performance. Our data show a moderately high correlation between software developers’ satisfaction and their job performance ($r = +0.21$), and an even stronger relationship between job satisfaction and specific facets of their job performance such as communication skills, business knowledge, and job attitudes. These findings run counter to our stated proposition (P5) and also appear to contradict many prior studies that showed no direct relationship between job satisfaction and performance [11]. It may be that, under the scenario of implementing mandatory change, employees’ satisfaction and their job performance will be related, whereas in a more stable environment—for example, one or more years after implementation of the change initiative is completed—that this positive correlation between satisfaction and performance will be attenuated. This, of course, is extrapolating beyond the data at hand and should be substantiated by future research. The relationship we observed between software developers’ job satisfaction and performance, although unexpected, is one of the most critical findings of our study.

The third implication of our study is the intricate pattern of relationships between certain dimensions that comprise innovators’ creative style (high levels of originality and preference for change) and specific facets of their job performance (especially their technical/analytical skills and job attitudes). This means that, for firms seeking to implement a technological innovation, change managers may achieve better results by involving employees who are innovators in the early, pilot phases of adoption. Given their greater willingness to experiment and their preference for novelty, innovators may best serve as early adopters or lead users for any technological innovation within their organizations. This means that managers responsible for overseeing introduction of an innovation should permit innovators to experiment with and identify possible applications for a technological innovation, as well as potential implementation problems, before seeking to implement the innovation more broadly [4]. When managers are ready to implement the innovation broadly throughout the target population, they should provide the innovators with opportunities to serve as opinion leaders [88] to assist in diffusing the technology innovation throughout the organization.

Taken as a whole, we believe that our results have value for researchers—not just because they validated most of the propositions—but also, in part, due to the implicit contradictions among certain findings. We highlight some of these contradictions here as potential questions for researchers to investigate in the future. Since contributions to knowledge often occur through surprising or contradictory findings [83,87], these contradictions may serve as triggers for future research on how creative style affects IT professionals’ skills, attitudes, or behavior in the workplace.

First, why is an innovative creative style positively correlated with job satisfaction (P1), but not with overall job performance (P4), when job satisfaction and performance are so strongly correlated themselves (P5)? Second, why do certain facets of software developers’ job performance appear to be negatively correlated with age (specifically, their technical/analytical skills), while others appear to be positively correlated with their job tenure (specifically, business knowledge)? Obviously, age and job tenure are highly correlated. Do certain employee abilities truly become stronger with experience (e.g. business knowledge), while others atrophy over time (e.g. technical/analytical skills), or are managers’ lower evaluations of older developers’ technical/analytical skills a form of self-fulfilling prophecy, based on their assumptions that “old dogs can’t learn new tricks?” Since our job performance data were based upon managers’ subjective evaluations of employees’ skills rather than an
objective assessment, it is possible that older IS professionals’ technical/analytical skills are no different, as a whole, than the skills of their younger peers. It may be instead that IS managers believe that older workers cannot pick up new skills as readily as their younger co-workers and consequently, managers provide fewer opportunities for older workers to do so. Are older IS professionals truly handicapped when it comes to adopting software process innovations [30], relative to their younger peers, or are the observed results simply a self-fulfilling prophecy? These are important questions that bear further investigation. We are engaged in additional analysis of both field study and survey data to help tease apart these intriguing questions involving the relationship between demographic variables (age and job tenure) and software developers’ job performance and their ability to learn new technical skills [37].

6.4. Limitations and directions for future research

As with all studies, there are certain limitations to this study. We acknowledge that this research has focused on one instrument for measuring creative style, derived from a specific theory of creativity, Kirton’s adaption–innovation theory [54]. In addition to Kirton’s theory, there are other frameworks and instruments for assessing creativity or closely-related constructs, such as learning style and cognitive style. These include psychologist Kolb’s theory of individual learning styles, and the accompanying Kolb learning styles inventory [57], the innovation style profile [46], the creative problem-solving profile [47], and the Flynn and Goldsmith [33], Goldsmith and Hofacker innovativeness scale [43]. Recently, Agarwal and Prasad [2] also introduced a new construct that focuses on innovativeness specifically related to IT usage, which they labeled personal innovativeness with IT. Their measure of personal innovativeness with IT is a domain-specific measure of innovativeness [33] focused on a specific context (IT adoption and usage), which distinguishes it from other so-called “global” measures of innovativeness. Of these alternate theories and measures of creativity, Kolb’s theory of learning styles has received the most attention in the IS literature [10,80,94], however, his instrument (the Kolb learning styles inventory) has been criticized as demonstrating poor reliability and inconsistent factor structure [38,89]. We acknowledge the existence of many other such measures of individual creativity, innovativeness, or cognitive style, and note that different results may have occurred if different measures had been employed. We also reiterate that the instrument that we did choose, the KAI inventory has repeatedly been shown to have desirable measurement properties, based upon repeated studies that have used and validated it [6,7,9,36,102].

One final limitation of our work is the fact that our survey was conducted with software developers in just two firms, and these firms were migrating from a very traditional approach for software development (mainframe-based development) to client/server development, a substantial change in their work processes—as indicated by our field studies and by the literature [37,107,109]. While our study was conducted in firms from two different industries (financial services and chemical engineering) that were characterized by dissimilar corporate cultures, it is possible that different results might occur within other firms, and we encourage other researchers to replicate our study in other industries and corporate cultures. Innovations can range on a continuum from incremental to radical, and our findings may not be generalizable to other technologies that represent only very incremental changes, or changes that are much more radical in nature than the specific innovation that we investigated. Moreover, we know that the degree of “radicalness” of a given innovation depends, in part, on the old technology or work processes that it replaces within a particular context [81].

We believe that the findings from our study are not specific to the adoption of a particular innovation—such as client/server development—but should generalize to adoption of other technological innovations, including more recent software process innovations such as Java programming, and Active Server Pages. We also argue that these findings may generalize to end user adoption of technological innovations such as the World Wide Web, personal digital assistants (PDAs), and global positioning systems (GPSs), and that IS researchers may benefit from considering creative style in their studies of adoption. While we anticipate that our findings should be generalizable to other types of innovations and work environments, these empirical questions can only be substantiated through ongoing research. We encourage researchers
to apply our research model to investigate the adoption of other innovations where the adopters may be either IS professionals or end users. We also encourage researchers to apply our research framework to understand implementation outcomes for the same innovation in different contexts, i.e. where the specific innovation may represent an incremental change in one context versus a more radical change in another context. By using our research framework and replicating our study with different innovations and in different organizations, other researchers may identify whether the findings and implications described here are indeed generalizable to other innovation types and organizations.

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