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Abstract:

Research in the information systems (IS) field is presently under pressure to justify its value by speaking to its impact on professional practice. This paper presents a simple model that enables researchers to identify and differentiate their research's impacts. More specifically, I distinguish between those impacts that occur through directly engaging academic practice with professional practice, and those that occur through diffusion of practices, both academic and professional. I also discuss several conjectures about IS research impacts after analyzing my model.

Keywords: Information Systems Field, Research Impacts, Diffusion of Practices.

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I. INTRODUCTION

Academic research in the information systems (IS) field is presently under institutional pressure to justify its value by speaking to its actual, not just intended or imagined, impacts on professional practice. At a meeting of the senior scholars of the Association for Information Systems (AIS) held at the 2012 International Conference on Information Systems (ICIS) in Orlando, a group was formed to take up this issue and consider how to address it. I wrote this paper to support this initiative[1].

To begin, note that the institutional pressures on academic research are broad ones and not aimed only at the IS field. Business schools in particular have had the usefulness of their research and their educational approach questioned (see, e.g., Pfeffer & Fong, 2002). Speaking to "mounting criticism from both inside and outside business schools", the American Association of Collegiate Schools of Business (AACSB) has responded with a controversial study. In it, they note that "existing faculty policies and systems have caused too much emphasis on counting journal articles and favored basic research over other forms of scholarship such as contributions to practice and teaching" (AACSB International, 2010 p. 4). The study recommends that future accreditation require business schools to report on their research impacts.

Government support (or lack thereof) of academic research has been one important source of institutional pressure, and the social sciences, perhaps unsurprisingly, have felt this in particular. In one response, an impact of social sciences project has been undertaken at the London School of Economics and Political Science (LSE), one of its products being the practical *Handbook on maximizing the impact of your research* (see LSE Impact of Social Sciences Project, 2010). One of its recommendations: "36. Academics should move beyond simply maintaining a CV and publications list and develop and keep updated an 'impacts file' which allows them to list occasions of influence in a recordable and auditable way.".

Of course, recommendations such as these, while well intentioned, can come across as "show me (or else)" suggestions, putting academics and their schools in a largely defensive posture with regard to research impacts. The institutional pressure is, in effect, ratcheted up in academia itself. Academics are asked to spend more of their time and effort attending and attesting to the reception of their work, rather than letting it speak for itself or relying on public evaluation alone. Whether their research would ultimately be made more impactful and beneficial to society through such reporting and auditing measures is, however, an open question.

The IS field, with close ties to both business schools and the social sciences, faces its own set of challenges as to the usefulness of its research. With its focus on information technology (IT), it faces perhaps higher expectations than other fields that it certainly should contribute significantly to practice, while, at the same time, to the extent it *is* practically oriented, it may face criticism from fellow academics that it is altogether too much so. Or, worse, that it is practically oriented without actually being useful to practitioners. So it may sting some when one of its own, now a business school dean, writes, "Looking beyond our academic institutions, we—IS academics—are not, in general, perceived as relevant by IS practitioners. They do not turn to us (the IS academics) for help with their most significant problems. They do not, in general, read what we write." (Ginzberg, 2012, p. 7).

Ouch, indeed. But when we in the IS field step back from the heat generated by such comments, in the broader context, how should we understand the substance of the research impacts themselves? What are they, where should we look for them, and how would we recognize them if found? In this brief paper, I frame these questions in terms of a simple research-impacts model. I make several conjectures about IS research impacts after analyzing the model. A brief analysis indicates that impacts are diverse and accumulate over time in ways not easy to assess and measure. I also offer several suggestions for enabling IS academics and others to obtain a more sophisticated understanding of these diverse impacts.

[1] Following up from the ICIS 2012 meeting, a Senior Scholars' Forum on "The Impact of IS Research: Is it enough? How do we expand? How do we document?" was organized and held at the ICIS 2013 meeting in Milan, December 15-18, offering broad discussion of the research impacts issue. Fred Niederman co-chaired the forum and led the discussion. Kevin Crowston, Helmut Krcmar, and Phillip Powell were panel participants. A report will appear in Communications of the AIS.

Communications of the Association for Information Systems

II. RESEARCH IMPACTS MODEL

Fundamentally, how do research impacts occur? Putting this in the broadest perspective, a recent paper identifies:

> *eight ways useful ideas flow from campus to society: (1) Students carry ideas and skills to jobs in industry, government, and the nonprofit sector; (2) Academic researchers publish results in journals, which are read by users in the public and private sectors; (3) Academics present their ideas at conferences, seminars, and other events that bring them into contact with potential users; (4) Industry sponsors a focused research project by an academic scientist; (5) Groups of companies and academic scientists collaborate in cooperative research projects; (6) An academic researcher enters into an individual consulting arrangement with a company; (7) Academic researchers engage in entrepreneurial ventures that do not involve university-owned intellectual property; (8) University licenses intellectual property to a private firm or spins off a startup company.* (Malakoff, 2013, pp. 750-1)

In the present paper, then, I advance a simple model that touches on these points and ties them together to elucidate how research impacts occur. This model, a macro-process model, offers a broad portrayal, rather than a description of the micro-processes that would provide a more refined explanation. However, it enables us to make some useful observations. While the model is a general one, I apply it here to the IS field in particular.

The model's essence is its portrayal of the basic interactions between academic and professional practices, such that one can identify and differentiate research impacts[2]. Figure 1 provides an overall sketch. For analytic purposes, the model breaks academic practice down into linked research, publication, and education components. Thus, research leads to publication (while also relying on it), which serves education (and responds to its expressed needs).

Beyond the linked effects in academia, the model distinguishes between two forms of impact: (1) those that occur through *direct engagement* of academic practice with professional practice, and (2) those that occur through *diffusion of practices*, both academic and professional, in their respective institutional fields (see, e.g., Phillips, Lawrence, & Hardy, 2004). As I show next, the model's various effects come together to generate some very different impacts on practice. I elaborate on each basic form.

Direct Engagement

Research impacts from direct engagement are seen as occurring through the research itself, through its publication, or through subsequent education (see Figure 1). The three vertically oriented double-headed arrows suggest that the impetus for engagement can originate with either academic or professional practice. Both practices have their respective motivations to engage because each looks to the other for validation and support. Thus, academia is presumed to be committed to preparing individuals for professional practice, and practitioners as professionals seek specialized knowledge and accreditation that affirms and confirms their practice in the public interest[3]. I discuss each of the three forms of direct engagement in turn.

Research Engagement

Direct engagement of academic research with professional practice can, according to both the substance of the research and the methods employed, take various forms. In the IS field, for example, action research may entail helping a firm implement a new system (Baskerville, 1999). Design science research may involve working with an industrial partner to develop an innovative software tool (Hevner, March, Park, & Ram, 2004). In both cases, the research impacts are intended, relatively immediate, and specific to the engagement.

A broader impetus for direct research engagement can come from government agencies, such as the U.S. National Science Foundation (NSF) and professional practice organizations (such as the Society for Information Management, SIM), which may provide financial support to encourage it. SIM's Advanced Practices Council has a long history of soliciting and supporting academic and practitioner research collaborations, in studies of broad professional interest, for instance[4].

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[2] The focus here is on research that impacts professional practice. Note that some research may have broader social impacts not mediated by changes to professional practice; however, it falls outside the scope of my attention.

[3] Pelikan (1992) provides background and perspective on universities and their relationship to professions. The motivation for engagement between IS academics and professionals also arises naturally from the notion of the IS field as "a market of ideas in which scholars (and practitioners) exchange their views regarding the design and management of information and associated technologies in organized human enterprise" (Lyttinen & King, 2004, p. 221). See also King and Lyttinen (2006) and Hirschheim and Klein (2012).

[4] See http://www.simnet.org/?page=About_APC

In other IS research, such as in those field studies where the researcher is granted access to a site for study purposes, but where there may be no commitment toward improving a specific practice, there are nevertheless likely to be impacts even if unintended because it is widely understood that the observed may not be unaffected by the observation. However, as these impacts may be inadvertent, they are likely to be less observable and can be problematic to assess.

Certain other IS research (such as studies that employ analytic models or are based in the analysis of secondary data) that may involve negligible direct engagement and may not impact professional practice until it is concluded and enters the publication process, where it then has another opportunity for engagement. Even then, because it may be esoteric, its findings may be problematic to convey or may not at first be seen to have immediate relevance to professional practice. The broader publication process here often carries the burden of making the important findings known.

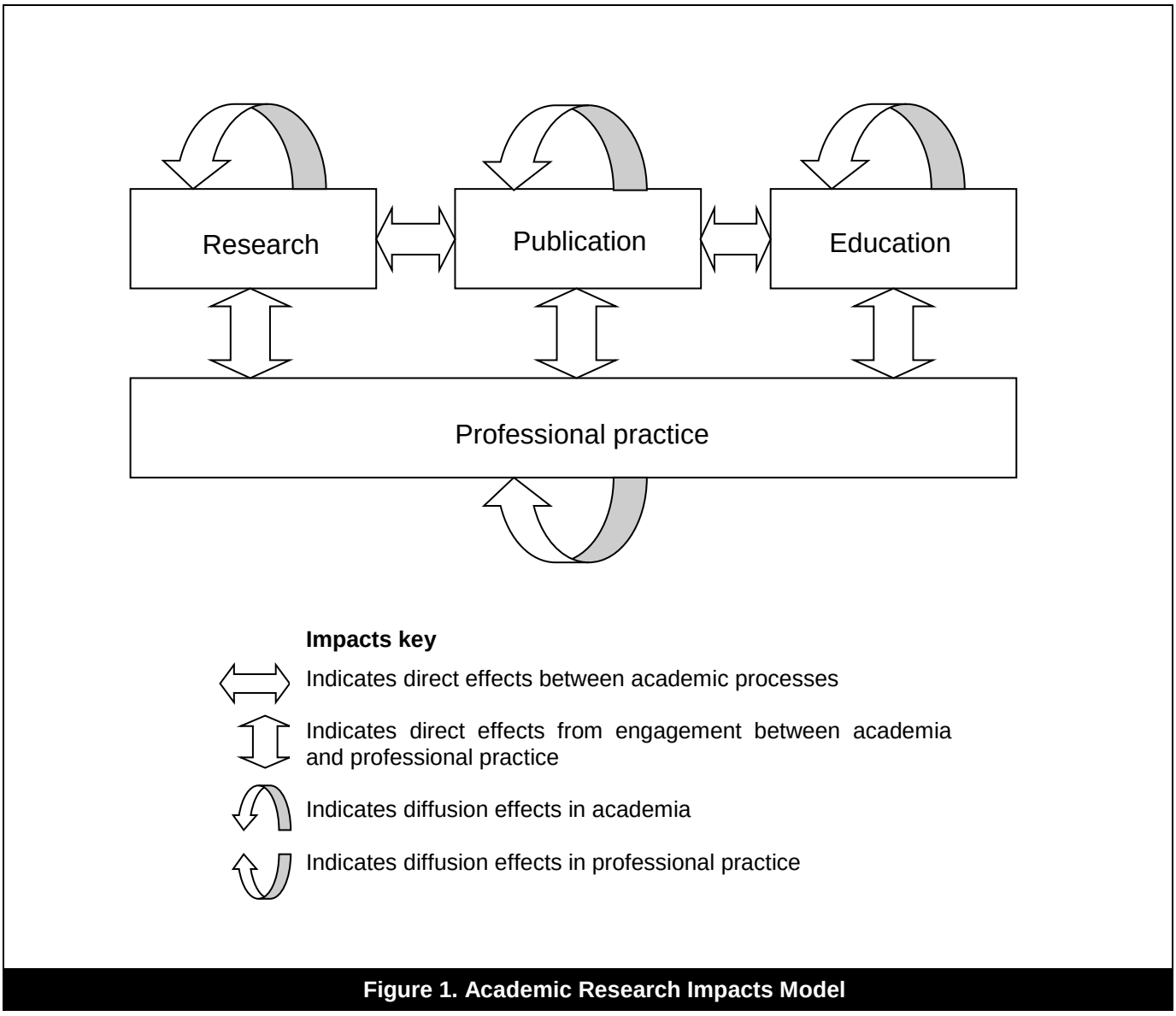

Figure 1. Academic Research Impacts Model

Publication Engagement

Direct engagement of academic publication with professional practice can similarly take various forms. For example, IS researchers may publish their work in a journal targeted toward practitioners, such as *MISQ Executive* or *Sloan Management Review*. They may also present it at a practitioner conference or meeting, such as those held by SIM. Or they may be interviewed by local or national news organizations about the work.

Even where IS researchers publish principally to communicate with other researchers, there may be some engagement with professional practice. For instance, while researchers might maintain their personal webpage with

other researchers uppermost in mind, they might also include content directed toward professional practice. Researchers' academic institutions might produce videos in which they explain their research to a professional audience (for instance, on her webpage). Their work might also come to the attention of a major trade publication, such as *ComputerWorld*, which might then mention it, for instance, in its "Think Tank" column.

The more prestigious research publications such as *MIS Quarterly* (*MISQ*) and *Information Systems Research* (*ISR*) are typically aimed more at researchers than practitioners. Such publications may require that papers speak to their "implications for practice" to a certain degree. However, in the review process, peer researchers, not practitioners, confirm that this requirement is met. (As a note in passing, in *MISQ*'s early years, when it was co-published by SIM, it attempted to involve practitioners as reviewers. It has since given up such engagement and now focuses more exclusively on its academic audience.)

Education Engagement

Academic education and its instructional programs can also engage professional practice with resulting impacts. Here, students in these programs are understood to be future or practicing professionals. IS instruction can incorporate research findings directly through assigned paper readings or lecture slides and notes, or through textbooks in which the research is referenced. IS research can also be communicated through executive and other continuing education programs that are offered either by academic institutions, professional associations, or private firms that specialize in practitioner education. Again, the engagement may obtain its impetus from either academic or professional practice.

Because the academic educational process is of substantial interest to professional practice (regardless of whether academic research is or not), certain engagement initiatives reflect this. A prime example in the IS field is SAP's University Alliance Program, whereby participating schools obtain licensed access to SAP enterprise software and resources for use in their instructional programs. Members of this program also meet regularly and share their experiences and teaching approaches. The program provides an excellent example of academic and professional practice collaboration, although it does not primarily target support for academic research[5].

A different form of education engagement deserves special mention because it joins the education process to the research process itself. In this form of education engagement, which occurs primarily in Europe, schools offer an industrial PhD degree to already employed students, who pursue research of direct interest to their employers and who continue their professional careers on graduation. Funding for these programs can come in part from the government. For instance, the Copenhagen Business School, supported by Denmark's Ministry of Science, offers such a program. Needless to say, such programs can deliver direct research impacts and serve to build important bridges between academia and industry[6].

Diffusion of Practices

Diffusion of academic and professional practices constitutes the second basic form by which research impacts result. In Figure 1, semi-circular feedback arrows indicate the multiple points where diffusion takes place. Academic research, publication, and education each has its own diffusion process, and all are differentiated from that of professional practice. The effects are of a second-order, where direct engagement effects are now passed on to others in the institutional fields, who, one by one, however slowly or quickly, leverage the learning in their own work. Thus, it is through these diffusion processes that research acquires its longer-term cumulative impact.

In the case of professional practices' diffusion, the second-order research impact accumulates with each successive adoption of an improved practice that results from the earlier engagement of one or more practitioner members of the field. So, for example, the use of "critical success factors" (CSFs) by IS executives spread from firm to firm in the late 1970s after its original introduction by Jack Rockhart and the Center for Information Systems Research (CISR), with its direct links to practice, at the Sloan School (Rockhart, 1979). The impacts of the original CSF research were thus substantially extended. In the case of research's diffusion in the academic field, in contrast, there may be little impact on practice, unless further direct engagement takes place as already described. Still, the greater the academic diffusion, the more opportunities there will be for such engagement. Thus, a certain potential for eventual impact on practice is accumulated through diffusion purely in the academic field.

Next, I elaborate on the diffusion processes in the fields of both professional and academic practice.

[5] For an overview of SAP's University Alliance Program, see http://scn.sap.com/docs/DOC-7876.
[6] See http://www.cbs.dk/en/research/phd-programmes/different-routes-to-a-phd.

Communications of the Association for Information Systems

Professional Practice Diffusion

We know much about the diffusion of professional practice from relatively recent IS research. Studies of "organizing visions" and their career paths, for instance, have explored the origins and spread of innovations such as enterprise resource planning (ERP), customer relationship management (CRM), and Web 2.0, and yielded insights into the underlying institutional mechanisms (Swanson & Ramiller, 1997; Swanson, 2012). Important role players include vendors, consultancies, technology analysts such as Gartner, trade and popular press writers, advertisers, bloggers, academics, and conference organizers.

All of these role players serve a kind of publication process for professional practices that parallels the more formal one familiar to academia, but is much more open, free-wheeling, dynamic, and obviously driven by market forces. Thus, when a firm happens to innovate with IT such that it has a success story to tell that might impress and attract others to follow in its footsteps, those who might gain from subsequent diffusion come together as institutional entrepreneuers to learn about the story, write it, and put it too into play such that it captures management attention (Wang & Swanson, 2007).

While IS academics may be involved directly or indirectly in the diffusion of IS professional practices, they are not usually major players. Rather, practitioners look to each other, with the considerable help of consultancies and technology analysts, to monitor new developments and determine which new practices (and associated products and services) to seriously pursue. These consultancies and analysts are themselves heavily invested in being recognized as "thought leaders" and, therefore, brand their own ideas accordingly more than they refer their clients to the published contributions of IS academic researchers (Swanson, 2010).

Academic Practice Diffusion

In the case of academic practices, the diffusion process is quite different and may explained in terms of its research, publication, and educational components to best be understood. First, those who undertake research often do so as part of a larger program, such that the results of one study inform and motivate the next. Similarly, as junior scholars such as doctoral students gain study-specific experience and move on to other academic institutions, they carry these research pursuits to new venues. Thus, for example, the research on group decision support systems (GDSS) and electronic meeting rooms begun at the University of Arizona in the 1980s and spread through its disciples to other schools across the US (Nunamaker, Dennis, Valacich, Vogel, & George, 1991).

Second, under prevailing publication practices, published research diffuses in the classical way when other researchers absorb its findings and lessons and leverage it in their own work (via citations). Again, research impacts may accumulate comparatively quickly when a study's importance is immediately recognized by research peers, slowly when its importance emerges gradually, or not at all if it fails to make any impact. Certain research may become widely popular and diffuse so thoroughly through its publication that it becomes almost overrepresented and members of the field eventually argue for moving on from it as happened with the technology acceptance model (TAM) (Benbasat & Barki, 2007). Among the important role players in the diffusion process are the journals and their editors, boards, and reviewers, and academic associations such as AIS, INFORMS, Academy of Management, and the ACM, who sponsor and promote journals, appoint editors, and manage the distribution process.

Third, in the case of educational practices, diffusion takes place most obviously through the adoption of textbooks, cases, and readings across programs and courses, and more informally through borrowed and adapted syllabi and lecture notes by faculty. This diffusion is reinforced and perhaps accelerated through the standardization of curriculum (see, e.g., Topi et al., 2010). Research findings that work their way into IS curriculum can accordingly engage all the students exposed to them.

III. DISCUSSION

Having worked through the simple model, here I briefly discuss some of its ramifications. In doing so, I offer three broad conjectures on research impacts to motivate further consideration. My conjecture speak to each of the three academic practice components: research, publication, and education. Because it has already received much attention and generated substantial controversy, I begin with academic publication.

IS Academic Publication

As already mentioned, IS is not the only field in which the practical impact of its published research has been called into question. In management more broadly, there has been notable self-examination, anguish, and calls for reform. One recent study examines the research published in two premier journals, *Administrative Science Quarterly* (*ASQ*) and *Academy of Management Journal* (*AMJ*), since their inception. The authors note that, over time, it has become increasingly less "actionable" (i.e., usable either conceptually or instrumentally by a practitioner) (Pearce & Huang, 2012). Among the speculated reasons for this decline is the push by business school deans to have their junior

faculty publish in the most prestigious journals, those which will help increase a school's ranking, regardless of whether the published research is actionable or not. This has led to a large increase in submissions to leading journals, a decreasing proportion of which seems to report actionable findings.

In the IS field, the identification of leading journals has itself become something of an obsession, which reflects these same pressures. As one indicator, the AIS Senior Scholars recently enlarged their recommended "basket of six" top journals to a "basket of eight", arguably in an attempt to relieve institutional pressure. At the same time, the journals themselves are increasingly subjected to citation-based studies that generate their own rankings, as in one that attempts to validate the "basket of eight" (Lowry et al., 2013). And so, where research publication is concerned, the IS academic community is presently much turned in on itself[7]. As but one example of this, one reader of a previous version of this paper argued that it lacked relevance in a research environment in which the promotion and tenure rewards are fundamentally misaligned with achieving practical research impacts[8].

In these circumstances, should IS academics really be surprised or disappointed if IS practitioners spend little or no time reading what is written in leading IS journals that do not directly engage practitioners in the publication process? Perhaps such expectations are unrealistic. Perhaps the leading research journals are not the place to look for IS research that achieves impact through direct practitioner engagement.

As I mention above, journals are just one means of research publication. Researchers can also present their findings to professional meetings and forums aimed specifically at practitioners. They can directly engage practitioners even if their important journal paper goes unread. Of course, if they do not thus engage practitioners, one way or another, their published research may go unnoticed and indeed have little impact on the profession. And so, as a first conjecture, I suggest that: (1) IS academic research publication should not be expected in the absence of direct engagement with practitioners to substantially impact IS professional practice.

Fortunately, opportunities for direct engagement are many, and, as the model indicates, are not limited to engagement in the publication process alone.

IS Academic Research

Perhaps the most obvious way for IS academics to directly engage practitioners is in the research itself, prior to its publication. Where this engagement is with a single research sponsor or collaborator, the impact may be limited in part by design. However, when the engagement is with a broader professional group such as SIM, the research undertaken might gain a more substantial foothold among those with a potential interest in it, which can then carry over to its publication.

Such a foothold is important in both research and its publication because its initial impacts on practice, in the form of new professional practices it informs, can subsequently be driven by the diffusion of the practices themselves, where the IS professionals look to each other, not to the IS research, to guide their adoption decisions. With such diffusion, the impacts can accumulate on their own, so to speak, with or without the researcher's further involvement. Of course, to the extent the researcher gains acclaim among practitioners for the work that underpins the new practice, they may be able to ride the innovation wave as its guru or consultant, increasing the prospects for future research engagement.

The basic insight leads to a second conjecture: (2) IS academic research can impact IS professional practice as much through its diffusion among practitioners as it can through practitioners engaging directly with it. While the latter is necessary to initiating impacts, research's value can be multiplied many times over when the diffusion process extends these impacts to others.

One means by which IS academics can both engage practitioners and seed the diffusion of their research is by establishing their own research centers with practitioner membership. The Sloan School's CISR is perhaps the

[7] The problem is exacerbated when government funding of research relies on citation metrics, as in the UK since 2010. Powell and Woerndl (2008) suggest that this may also have the effect of pulling research to the "dull middle ground" rather than to more important but risky subjects in need of study. The problem of assessing the value of IS research more broadly, beyond citation metrics and publication in top journals, is addressed by Hassan (2014). How much value accrues or not and to whom lies beyond the scope of the simple research impacts model presented here. See also Ramiller, Swanson, and Wang (2008), who offer insights into the institutional forces that shape IS research directions.

[8] Indeed, it is easy to agree that researchers seeking to advance their careers are commonly placed in severe binds by the demands placed on them in the present global academic system. My own sense is that the nature of these binds varies substantially across institutions, however. They can be very different in Europe than in the US, for instance. In this broad context, the concern of many regarding practical research impacts is not likely to go away.

leading program of this kind[9]. Beyond providing funding, the center's membership model provides a forum for the initiating, publishing, sharing research, such that its subsequent diffusion is substantially enabled. There are many alternative models for such centers. Note that, for many years now, directors of IS research centers around the world have met informally at ICIS to share their ideas and best practices for engagement.

IS Academic Education

Finally, we note again that the IS academic education process provides an important vehicle for incorporating research that impacts IS professional practice, primarily in degree programs that prepare future professionals, but also in continuing education programs that reach current practitioners. Most significantly, IS curricula in degree programs can incorporate research findings that are tuned not just to the fashionable technologies of the moment, but to the longer-term perspectives and understandings needed to become a responsible professional.

Consider a study that takes a socially critical perspective of a current business practice, for instance, and questions whether it should be permitted to continue largely unrestricted. One might think here of research that examines systems that gather information from children online to market to them, and that finds the associated practice exploitive and harmful[10]. While such a study might not be well received by those currently engaged in this practice, who might be oriented toward extending it, its findings might be usefully incorporated in educational materials aimed at educating the larger IS practitioner community with respect to their work's broader social impact.

Traditional coursework is also where future professionals encounter concepts and theories that are the natural products of research. It is in such coursework that students may first learn of, for instance, "communities of practice" (Brown & Duguid, 1991; Lave & Wenger, 1991), which may profoundly shape the way they subsequently think about how the systems they develop are ultimately used. When such concepts are also taken up and diffused in the broader practitioner community, their impacts may then multiply. Just to illustrate, I recently spoke with an IS professional who made reference to "building a community of practice" when introducing a new enterprise system. When asked, she was a little vague about how she happened to be familiar with the concept.

Of course, not all IS theoretical concepts are well suited to be taken up and used by practitioners because some are aimed more at researchers. The notion of a "communication genre" (Yates & Orlikowski, 1992) might first be thought to be a likely candidate for this, given its level of abstraction. However, when I did a quick search, I found that the concept was featured as if it was well understood, without any explanation, in a magazine article aimed at computer professionals (Harper, 2005). Thus, perhaps our more theoretical work finds its way into practice more than we might think. Too, even those concepts that don't become widely adopted may be helpful to the educational process and ultimately influential to informed practice.

So, while a prevailing, but perhaps misplaced, concern is whether current IS practitioners are reading what is written in IS research journals, a corresponding, and perhaps more serious, concern is whether IS research findings are significantly and adequately incorporated in IS textbooks and educational materials aimed at educating future practitioners. In a growing profession such as IS, these future practitioners are of course many.

Hence, my third conjecture, which serves as a reminder: (3) IS academic research can impact IS professional practice as much through the education of future professionals as it can through the dissemination of its findings to current professionals.

IV. CONCLUSION

A simple research impacts model applied to the IS field reveals that the impacts are diverse and accumulate over time in ways not easy to assess and measure. Simplified notions of impacts, for instance—those based on the idea that practitioners will read published research papers to be guided in their actions—may largely miss the important impacts themselves. Any suggestion that the IS field stands condemned when practitioners "do not, in general, read what we write" is misguided. Rather than focusing on this one issue, IS academics should seek a more sophisticated understanding of the impacts of their research, by all concerned parties.

Such an understanding might begin by retaining the distinction between immediate impacts from direct engagements with practitioners in research, publication, and education, and second-order impacts that accumulate through the diffusion of practices. In the case of direct engagements, it should not be too difficult to identify and

[9] See cisr.mit.edu. My own school has had an IS research program, supported by an IS Associates Program for more than thirty years. See http://isassociates.org. This footnote seems a good place to extend my gratitude for this long-standing support.

[10] I have no particular study in mind here. See Singer (2012) for a recent report on the practice. See Livingstone (2003) for a perspective on the research needed.

catalog those types characteristic of the IS field for subsequent reference. Several of these easily came to mind in preparing this paper, for instance, but they are hardly definitive. A collective effort to develop a comprehensive catalog might be a worthwhile effort. With such a catalog at hand, IS academic programs should find it relatively easy to characterize their own direct engagement and compare their own profile to that of others.

Less easy, of course, is assessing the actual impacts of direct engagement, although here too certain immediate impacts may make themselves known through the engagement itself. Separating out research impacts from other impacts, for instance, by tying the research content of an executive education program to its reception by professional participants and assessing its influence on subsequent actions is still more daunting. Does anyone really want to undertake this? Might it not be more worthwhile to focus on direct engagement profiles and how they are successful or not, and then step up our efforts to engage more effectively, so as to actually increase impacts?

With regard to research impacts that accumulate through the diffusion of academic and professional practices, it may be possible to conduct studies that monitor the spread of the field's important concepts in the academic and practitioner literatures to shed more light on how this diffusion takes place. This might also give us a better sense of what the IS field actually amounts to in terms of its evolving theory (see, in particular, Davis, 2000). Whether this would be helpful to finding new ways to facilitate the diffusion processes is an open question, however.

Finally, I suggest that more attention be given to the incorporation of IS research findings in the field's textbooks and instructional programs. To my knowledge, there have been no empirical studies that have assessed the actual extent to which our research has been leveraged in our educational endeavors (though I have not searched systematically for such studies, so they may well exist). It would be helpful to know more about where we actually stand with this.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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