Ausgewählte Ansätze zur Unterstützung des Business Process Management

Analyse der Erfolgsfaktoren und Einsatzmöglichkeiten von Process Performance Management und Enterprise Social Media

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Dipl. Wirtsch.-Inf. Christian Ritter

Berichterstatter:

Prof. Dr. Susanne Leist

Prof. Dr. Dieter Bartmann

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Abkürzungsverzeichnis

BPM	Business Process Management
bzw.	beziehungsweise
CPM	Corporate Performance Management
d. h.	das heißt
ESM	Enterprise Social Media
ESN	Enterprise Social Network
KPI	Key Performance Indicator
KMU	Kleine und mittlere Unternehmen
PPM	Process Performance Management
S.	Seite
u. a.	unter anderem; und andere
vgl.	vergleiche
VoC	Voice of the Customer
z. B.	zum Beispiel

1 Problemstellung und Notwendigkeit der wissenschaftlichen Untersuchung

Dieses Kapitel steckt den Rahmen und die Grundlagen der vorliegenden Dissertationsschrift ab. Zunächst motiviert Abschnitt 1.1 das Thema und führt die zugrundeliegende Problemstellung dieser Arbeit ein. Im Anschluss daran wird die konkrete Zielsetzung und Einordnung dieser Dissertationsschrift herausgearbeitet. Aufbauend auf dieser Zielsetzung erläutert Abschnitt 1.2 die sechs daraus abgeleiteten Forschungsfragen, die die vorliegende Arbeit im weiteren Verlauf adressiert. Der Aufbau und die Gliederung dieser Arbeit werden in Abschnitt 1.3 beschrieben und schließen das Einleitungskapitel ab.

1.1 Motivation, Problemstellung und Zielsetzung

Durch steigenden Wettbewerbsdruck einerseits [Müller 2011, S. 15] und die Entwicklung immer neuer, oftmals für das eigene Geschäftsmodell disruptiver Technologien andererseits [Manyika et al. 2013, S. 23] stehen Unternehmen mehr denn jemals zuvor vor großen Herausforderungen. Die Wertschöpfung in Unternehmen wird durch die im Unternehmen verankerten Geschäftsprozesse erreicht, die folglich die Wettbewerbsfähigkeit eines Unternehmens maßgeblich bestimmen [Allweyer 2005, S. 7]. Eine Steigerung der Wettbewerbsfähigkeit ist daher auch mit einer Verbesserung der internen Prozesse verbunden [Dumas et al. 2013, S. 26].

Als Haupttreiber für die interne Prozessveränderung sehen Unternehmen die Themen Kosteneinsparung bzw. Produktivitätssteigerung einerseits, sowie die Optimierung bestehender bzw. die Entwicklung neuer Geschäftsprozesse andererseits [Harmon/Wolf 2014, S. 12/13]. Mit der fortschreitenden Verschiebung der Wertschöpfung in Richtung des Dienstleistungssektors in Verbindung mit der weiter zunehmenden Digitalisierung des Alltagslebens können bestehende, auf immateriellen Gütern aufbauende Geschäftsmodelle leichter kopiert und attackiert werden. Unternehmen, die nicht die Möglichkeiten besitzen, Kunden über einen Lock-In-Effekt[1] an ihr Ökosystem zu binden (z. B. Apple, Microsoft) oder eine monopolartige Stellung aufweisen, müssen zwangsläufig ihren Wettbewerbsvorteil über die Prozesseffizienz suchen.

Mit dem Geschäftsprozessmanagement (engl. *„Business Process Management"* (BPM)) hat sich eine Managementdisziplin etabliert, die den Herausforderungen der Organisationen in strukturierter Weise begegnet [Rosemann/vom Brocke 2015, S. 105]. Der Ansatz des BPM basiert auf einer Ende-zu-Ende-Betrachtung der Geschäftsprozesse und legt einen starken Fokus auf den Kunden sowie auf die tatsächliche Wertschöpfung für den Kunden [Hammer 2015, S. 6]. Das Ziel des BPM ist eine Überwachung der Unternehmensprozesse zur Sicherstellung konsistenter Prozessergebnisse einerseits und die Verbesserung der Geschäftsprozesse andererseits [Dumas et al. 2013, S. 1]. Das BPM orientiert sich hierbei an den einzelnen Phasen des Prozesslebenszyklus. Für das methodische Vorgehen des BPM finden sich in der Literatur zahlreiche verschiedene Varianten (vgl. [Aalst 2011, S. 8], [Dumas et al. 2013, S. 21], [Weske 2012, S. 12], [zur Muehlen 2004, S. 273]). Die grundlegenden Elemente des Vorgehens im BPM sind

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[1] Ein Lock-In entsteht, wenn die Wechselkosten zu einem anderen System größer sind als der entstehende Nutzen durch den Wechsel zum neuen System (vgl. [Walgenbach 2007, S. 61]).

bei allen Autoren identisch und nur unterschiedlich stark gewichtet oder anderen Phasen zuge-ordnet. Als generisches Vorgehen über alle Autoren kann für das BPM ein Lebenszyklus mit den Phasen „Design/Modellierung", "Implementierung", "Ausführung", "Monitoring" und „Controlling/Evaluation" identifiziert werden.

Zusammenfassend kann das BPM als eine Sammlung von Methoden und Werkzeugen zum Design, der Analyse, der Ausführung und der Überwachung (engl. „*Monitoring*") von Ge-schäftsprozessen betrachtet werden [Dumas et al. 2013, S. 26]. Das BPM unterstützt Unterneh-men dabei auch bei der Ausrichtung von konkreten kurzfristigen Prozessverbesserungsvorha-ben an den strategischen Unternehmenszielen. Die tatsächliche Verbesserung der Prozessleis-tung kann über Kennzahlen, z. B. bezogen auf die Flexibilität, die Schnelligkeit, die Qualität oder die Kosten der Prozessverarbeitung, gemessen werden. [Kaplan/Norton 2008, S. 7] Pro-zessmodelle und Kennzahlen stellen somit die Grundlage für das Prozessmanagement dar [Dumas et al. 2013, S. 26]. Die Messung und Überwachung der Prozessleistung mittels Pro-zesskennzahlen (engl. „*Key Performance Indicator*" (KPI)) und die Nutzung dieser KPIs für die Prozesssteuerung wird unter dem Begriff des *„Process Performance Management"* (PPM) beschrieben [Melchert et al. 2004, S. 4054]. Das PPM wird daher im BPM-Zyklus primär in die Phase des Monitoring eingeordnet, es umfasst jedoch noch zusätzliche Aufgaben, die sich in die weiteren Phasen des BPM erstrecken [Blasini 2013, S. 3]. Durch seinen Überwachungs- und Steuerungscharakter trägt das PPM zur inkrementellen Verbesserung der Prozesseffizienz bei. Schwachstellen und Ineffizienzen in der Prozessverarbeitung werden durch vom Soll-Wert abweichende Kennzahlenausprägungen sichtbar gemacht [Heckl/Moormann 2010, S. 119]. Da-mit ermöglichen sie es, konkrete Gegenmaßnahmen zu identifizieren und anzustoßen (z. B. Ka-pazitätsanpassungen, Änderungen am Prozessdesign). Das PPM zielt somit auf eine inkremen-telle, kontinuierliche Prozessverbesserung im Rahmen des BPM ab.

Neben der Bereitstellung von Methoden für eine inkrementelle Verbesserung der Prozesse kann das BPM auch als einer der Haupttreiber für die Einführung von Innovation im Unternehmen betrachtet werden. Als Beispiel sei die Anwendung der Prozessmodellierung im Rahmen des BPM genannt. Die grafische Darstellung der Prozesse ermöglicht es den am Prozess beteiligten Mitarbeitern, die eigenen Prozesse besser zu verstehen, sie in den Gesamtkontext des Unter-nehmens einzuordnen und daraus Ideen für Verbesserungen und Innovationspotentiale zu iden-tifizieren [Becker/Kahn 2005, S. 11]. Auf diesem Weg können neue Technologien (z. B. Mo-bile Business, Social Media, Big Data), die durch die immer weiter fortschreitende Digitalisie-rung der Gesellschaft im Privatleben Einzug erhalten, mithilfe des BPM in den Unternehmens-kontext und folglich auch direkt in die Unternehmensprozesse übertragen werden. Damit un-terstütze das BPM Unternehmen dabei, neue Potentiale durch den Einsatz innovativer Techno-logien zu realisieren. Das BPM ist jedoch nicht nur Innovationstreiber, sondern es wird auch selbst von Innovation getrieben. Neue Technologien können die Methoden und Konzepte des BPM unmittelbar beeinflussen und verändern, sofern sie zielführend in den BPM-Ansatz inte-griert werden. [Schmiedel/vom Brocke 2015, S. 3/4] Beispielsweise kann Social Media im Rah-men des BPM als Kommunikationskanal genutzt werden, um bei der Prozessmodellierung in-terne Mitarbeiter in die Erstellung der Prozessmodelle einzubinden oder um direktes Feedback von externen Stakeholdern zu den erstellten Prozessmodellen einzuholen [Trkman/Klun 2015,

S. 65]. Durch den direkten Feedbackkanal wird zudem auch die Einbindung des einzelnen Mitarbeiters in die Gestaltung und Verbesserung der Unternehmensprozesse verstärkt. Die neuen Technologien erleichtern dadurch die Erhebung von Prozessmodellen. Zudem ermöglichen sie beispielsweise die kollaborative Prozessmodellierung durch Fachexperten über das Internet [zur Mühlen 2000, S. 319]. Zusammenfassend kann festgehalten werden, dass neue Technologien das BPM sowohl unternehmensintern als auch –extern unterstützen.

Betrachtet man die interne Sicht sind für Unternehmen v.a. Effizienzsteigerungen durch den Einsatz neuer Technologien von Bedeutung. Die Adaption der neuen Technologien in die internen Abläufe stellt eine große Herausforderung für Unternehmen dar. Mitarbeiter der sogenannten „Generation Y", also der ab 1980 geborenen, sind mit den neuen Technologien wie Mobile Business und Social Media aufgewachsen. Sie werden daher auch als „digital natives" bezeichnet. [Aksoy et al. 2013, S. 245] Durch ihren alltäglichen und gewohnten Umgang mit den neuen Technologien im privaten Umfeld (z. B. Soziale Netzwerke oder Microblogging), erwarten sie deren Nutzung auch im Unternehmensalltag [Meck 2015, S. 30]. Die Anwendung von Social Media im betrieblichen Umfeld wird mit dem Begriff *Enterprise Social Media* (ESM) bezeichnet [Leonardi et al. 2013, S. 2]. Der Einsatz von ESM, beispielsweise durch die Nutzung von *Enterprise Social Networks* (ESN), befriedigt die Bedürfnisse der jüngeren Mitarbeiter. Gleichzeitig befähigen ESN die Unternehmen, die Kollaboration und Kommunikation zwischen ihren Mitarbeitern über Landesgrenzen und verschiedene Kulturen hinweg sicherzustellen [Kane 2014, S. 1]. ESN erfüllen jedoch häufig nicht die hohen Erwartungen, die bei der Einführung der Plattformen gestellt werden und scheitern dadurch häufig [Gartner 2013]. In der Forschung finden sich bisher noch keine Untersuchungen, die die Erfolgsfaktoren bei der Einführung von ESN ganz allgemein betrachten.

Neben den Herausforderungen der internen Nutzung sehen sich Unternehmen auch mehr denn je mit der Frage konfrontiert, wie sie die Vielzahl neuer Technologien sinnvoll für die Integration ihrer Kunden oder Geschäftspartner in ihre Wertschöpfungskette nutzen können. Dies gilt insbesondere für stark IT-getriebene Branchen aus dem Dienstleistungssektor wie beispielsweise der Bankenbranche. Die Bankenbranche wird aus Sicht der Generation Y in den nächsten Jahren einer radikalen Veränderung ausgesetzt sein (vgl. [Scratch 2013]). *„Banking is necessary, Banks are not"* – dieses Zitat von Microsoft-Gründer Bill Gates aus dem Jahre 1994 beschreibt in diesem Zusammenhang ein hochaktuelles Dilemma der Bankenbranche. Sie verschloss lange Zeit die Augen vor neuen Technologien an der Kundenschnittstelle im Internet (vgl. [Baxter/Vater 2014, S. 10]) und ermöglichte es dadurch neuen Konkurrenten, sich als zentrale Schnittstelle zwischen Kunde und Bank bzw. sonstigen Zahlungsdienstleistern zu etablieren. Beispiele hierfür sind Fintechs[2] wie PayPal oder Anbieter von Smartphone-Betriebssystemen (z. B. Apple, Google), die die Hoheit über das Endgerät und damit exklusiv den direkten Kontaktpunkt zum Kunden besitzen. Dies ermöglicht ihnen die Einführung von eigenen Zahlungsverfahren (z. B. Apple Pay, Google Wallet), die sofort eine kritische Masse an Nutzern aufweisen. Die Konsequenzen dieses Versäumnisses sind fatal: Zum einen müssen Banken sich

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[2] Ein Fintech bezeichnet einen Finanzdienstleister, der *„mittels digitaler Infrastruktur neuartige Angebotsformen und Abwicklungsprozesse in klassischen Bereichen des Bankgeschäfts wie Kreditgeschäft, Anlagestrategien und Zahlungsverkehr"* etabliert [Statista 2015a]. Fintechs sind i.d.R. Start-Ups oder Non-banks.

den Zugang zu „ihren" Kunden bei der Zahlungsabwicklung durch Gebühren an diese neuen „*Gatekeeper*" erkaufen und somit auf einen Teil ihrer Marge verzichten [Creative Construction 2014, S. 9]. Zum anderen verlieren sie durch den Verlust der direkten Kundenbeziehung auch ihre Marktmacht sowie sämtliche Möglichkeiten des Cross- oder Up-Selling. Folglich werden sie in die Rolle des reinen Zahlungsabwicklers und damit aus ihrem eigentlichen (und ertragreichen) Kerngeschäft gedrängt [Bradley et al. 2015, S. 14]. Sie werden dadurch vom Kunden nicht mehr als direkter Geschäftspartner wahrgenommen und sind folglich beliebig austauschbar. Dieses Beispiel veranschaulicht die große Bedeutung, die die Integration neuer Technologien an der Kundenschnittstelle besitzt. Neben den rein technologischen Überlegungen müssen bei der Einbindung externer Stakeholder (z. B. Kunden, Lieferanten) in die Unternehmensprozesse in Zeiten zunehmender Globalisierung aber auch kulturelle Aspekte berücksichtigt werden. In Rahmen des BPM treten kulturelle Unterschiede beispielsweise in der Gestaltung der Geschäftsprozesse in unterschiedlichen Ländern und Kulturen zutage. Der Einfluss der nationalen Kultur auf Prozesse ist bisher jedoch kaum erforscht.

Sowohl bei der internen Verwendung als auch bei der Fokussierung auf externe Stakeholder zieht der Einsatz neuer Technologien eine starke, teils radikale Veränderung der bestehenden Prozesse nach sich. Aus diesem Grund unterscheidet er sich deutlich vom inkrementellen Vorgehen zur Verbesserung der Prozessleistung durch das PPM. Im Hinblick auf die Unterstützung des BPM sehen sich Unternehmen folglich mit der Frage nach den Erfolgsfaktoren für das PPM einerseits und die Verwendung von neuen Technologien andererseits konfrontiert. Die Zielsetzung dieser Arbeit liegt daher in der Untersuchung der Erfolgsfaktoren dieser beiden Unterstützungsmöglichkeiten für das BPM. Bei der Betrachtung der externen Perspektive soll zudem der kulturelle Aspekt mit in die Überlegungen einfließen.

Abschließend soll dem Grundgedanken der Wirtschaftsinformatik, die Erklärung und die Gestaltung von Anwendungssystemen (vgl. [Mertens et al. 2012, S. 4]) durch die Implementierung einer prototypischen Anwendung Rechnung getragen werden. Ziel ist es, Möglichkeiten der Unterstützung des BPM durch neue Technologien aufzuzeigen. Prozessmodelle stellen die fundamentale Grundlage eines effektiven BPM dar. Aus diesem Grund soll die prototypische Implementierung das BPM bei der Prozessmodellierung unterstützen.

Zusammenfassend können die drei Zielsetzungen dieser Arbeit wie folgt definiert werden:

> **Zielsetzung 1 (Z1):**
> *Untersuchung der Erfolgsfaktoren für die Unterstützung des BPM durch eine kontinuierliche Prozessverbesserung mittels PPM*

> **Zielsetzung 2 (Z2):**
> *Untersuchung der Möglichkeiten für die Unterstützung des BPM durch den Einsatz von Enterprise Social Media unter Berücksichtigung interner sowie externer Stakeholder*

> **Zielsetzung 3 (Z3):**
> *Beispielhafte Anwendung neuer Technologien zur Verbesserung der Prozessmodellierung*

1.2   Forschungsfragen

Ausgehend von der in Abschnitt 1.1 beschriebenen Problemstellung und der definierten Zielsetzung dieser Arbeit werden im Folgenden sechs Forschungsfragen erarbeitet, die diese Dissertationsschrift behandelt. Die einzelnen Forschungsfragen orientieren sich dabei an den drei beschriebenen Zielsetzungen und können jeweils einer direkt zugeordnet werden.

Z1: Die ersten beiden Forschungsfragen befassen sich mit den Erfolgsfaktoren für den Einsatz von kontinuierlichen Ansätzen zur Unterstützung des BPM (*Zielsetzung 1*). Hierzu wird exemplarisch das Process Performance Management untersucht. Zunächst sollen allgemeine erfolgskritische Faktoren für den Einsatz des PPM herausgearbeitet werden (*Forschungsfrage 1*). Im Anschluss daran wird die Frage gestellt, welche funktionalen Kriterien für die Bewertung von PPM-Softwarelösungen herangezogen werden können (*Forschungsfrage 2*).

> **Forschungsfrage 1:**
>
> *Welche sind die erfolgskritischen Faktoren für den Einsatz von PPM?*

Hintergrund: Es existieren eine Reihe verschiedener Ansätze zur Prozessverbesserung, z. B. das Process Performance Management oder das Qualitätsmanagement, die jeweils unterschiedliche Zielsetzungen verfolgen. Da der Fokus der ersten Zielsetzung dieser Arbeit auf der kontinuierlichen Verbesserung der Prozessleistung und nicht auf einem qualitativen Aspekt liegt, soll folglich das PPM als Ansatz zur Unterstützung des BPM näher untersucht werden. Zudem ist das PPM im Vergleich zum BPM oder zum Qualitätsmanagement ein relativ junges und noch vergleichsweise wenig erforschtes Themengebiet. Der tatsächliche monetäre Nutzen des PPM ist für Unternehmen nur schwer zu quantifizieren, zudem auch viele Unternehmen auf eigenentwickelte PPM-Methoden und Softwarelösungen setzen. Eine einheitliche Erfolgsmessung und -bewertung ist folglich nicht möglich. Aus diesem Grund sollen in der ersten Forschungsfrage die erfolgskritischen Faktoren für den Einsatz von PPM anhand der Rahmenbedingungen und Entscheidungen von Unternehmen, die PPM erfolgreich einsetzen, abgeleitet werden.

> **Forschungsfrage 2***:*
>
> *Welche funktionalen Kriterien können zur Bewertung von Softwarelösungen für das PPM herangezogen werden?*

Hintergrund: Die operative Umsetzung eines effektiven Process Performance Management erfordert aufgrund der notwendigen Prozessüberwachung zwingend die Unterstützung durch spezialisierte Softwarelösungen, welche die verschiedenen Phasen des PPM adressieren. Der tatsächliche Unterstützungsbedarf durch PPM-Software unterscheidet sich von Unternehmen zu Unternehmen sehr stark und hängt von den bereits vorhandenen Anwendungssystemen für die Business Intelligence und das BPM ab. Daher ist die Ausgangssituation für die Einführung von PPM-Software maßgeblich von den individuellen Rahmenbedingungen des Unternehmens abhängig [Heckl/Moormann 2010, S. 125]. Vor diesem Hintergrund soll untersucht werden, wie

die Bedürfnisse und die konkreten Anforderungen eines Unternehmens möglichst umfassend durch den Einsatz von PPM-Software erfüllt werden können. Zur Operationalisierung dieser Anforderungen sind Bewertungskriterien erforderlich, die bei der Beantwortung der zweiten Forschungsfrage erarbeitet werden. Die Grundlage hierzu stellen die Ergebnisse der Forschungsfrage 1 dar.

Z2: Nach der Betrachtung des PPM als Beispiel für die inkrementelle Prozessverbesserung durch die Überwachung und Steuerung der Prozessleistung sollen gemäß *Zielsetzung 2* Möglichkeiten für die Unterstützung des BPM durch den Einsatz von Enterprise Social Media untersucht werden. Die Untersuchung soll sowohl interne als auch externe Stakeholder berücksichtigen. Für die Verbesserung der internen Kollaboration werden Enterprise Social Networks als eine Form von ESM untersucht (*Forschungsfrage 3*). Die Einbeziehung externer Stakeholder wird beispielhaft durch die Betrachtung einer Nutzungsmöglichkeit für die Auswertung der Kundenkommunikation in Online Social Networks (OSN) untersucht (*Forschungsfrage 4*). Abschließend zur zweiten Zielsetzung erfolgt eine Betrachtung von Möglichkeiten, die nationale Kultur aus Prozessmodellen abzuleiten (*Forschungsfrage 5*).

Forschungsfrage 3:

Wie ist der Begriff ESN definiert, was ist der aktuelle Stand der Forschung und welche zukünftigen Forschungsthemen zu ESN werden in der Literatur adressiert?

Hintergrund: Die Verbreitung von Enterprise Social Networks (z. B. Yammer oder Jive) in Unternehmen nimmt stetig zu, was sich auch in den immer weiter steigenden Umsätzen der Anbieter widerspiegelt (vgl. [Thompson 2015]). Unternehmen erwarten sich vom Einsatz eines ESN u.a. eine verbesserte Kollaboration und Kommunikation zwischen den Mitarbeitern, eine Verbesserung der sozialen Beziehungen, sowie die Förderung des Knowledge Managements [Holtzblatt et al. 2013, S. 16]. Die hohe Erwartungshaltung kann jedoch häufig nicht erfüllt werden. Konkrete, allgemeingültige Erfolgsfaktoren für den Einsatz von ESN existieren bisher nicht, da die Forschung zum Thema ESN noch am Anfang steht und bisher nur wenige Unternehmen, die ESN einsetzen, untersucht wurden. Zudem finden sich je nach Autor unterschiedliche Begrifflichkeiten, die das Phänomen ESN beschreiben, z. B. Corporate Social Network (vgl. [Vaezi 2011]), Enterprise Social Networking Sites (vgl. [Malsbender et al. 2013]), Corporate Social Software (vgl. [Steinhueser et al. 2011]) oder Enterprise Social Software (vgl. [Kügler et al. 2012]). Die unterschiedlichen Begrifflichkeiten hängen zum einen mit dem Zeitpunkt der Veröffentlichung der Beiträge und der zu diesem Zeitpunkt verfügbaren Technologie zusammen (z. B. bildeten die ersten kommerziell verfügbaren ESN Anfang der 2000er Jahre nur Microblogging-Funktionalitäten ab und weisen erst seit ein paar Jahren die von Sozialen Netzen bekannten umfangreichen Funktionalitäten auf). Zum anderen hängt die Begriffsvielfalt mit den verschiedenen Forschungsgruppen zusammen, die jeweils einzelne Begriffe vertreten. Die Vielfalt der Begrifflichkeiten erfordert daher zunächst eine Untersuchung um die in der wissenschaftlichen Community etablierten und akzeptierten Begriffe zu identifizieren. Daneben soll der aktuelle Stand der Forschung erhoben und analysiert werden, um einen Einblick in

die Möglichkeiten, Rahmenbedingungen und Erfahrungen des Einsatzes von ESN zu erhalten. Abschließend behandelt diese Forschungsfrage künftige Fragestellungen im Themenbereich ESN, da sich daraus aktuelle Trends und mögliche Hinweise auf Best Practices ergeben.

Forschungsfrage 4:

Wie kann die Kundenstimme aus sozialen Netzwerken extrahiert werden und wie hoch ist die Güte einer automatisierten Analyse dieser Kundenposts?

Hintergrund: Die weltweite Zahl der Nutzer von OSN wie Facebook oder Google+ steigt kontinuierlich an und wird in diesem Jahr erstmals die 2 Milliarden-Grenze durchbrechen [Statista 2015b]. Neben der Aufrechterhaltung von Freundschaften und der täglichen Kommunikation mit Gleichgesinnten nutzen die Mitglieder OSN auch vermehrt, um mit Firmen in direkten Kontakt zu treten. Positives Kundenfeedback umfasst beispielsweise Produkt- oder Verbesserungswünsche, Lob zu neu vorgestellten oder etablierten Produkten sowie das bereitwillige Teilen von Informationen mit anderen Hilfesuchenden zu aktuellen Problemen mit einem Produkt oder einer Dienstleistung. Auch Kritik, Beschwerden und Servicefälle finden sich verstärkt auf offiziellen Firmenseiten in OSN. Die Analyse, Bearbeitung und Beantwortung dieser Kundennachrichten bindet mit steigender Social Media Präsenz immer mehr Personal. Gerade für KMUs, die aufgrund ihrer i. d. R. überschaubaren Mitarbeiterzahl kein eigenes Social Media Team besitzen, kann die so anfallende Arbeitslast andere wertschöpfende Tätigkeiten behindern. Dennoch ist das direkte Kundenfeedback über Social Media Kanäle jedoch für KMUs mittlerweile ein wichtiger Indikator für die Kundenzufriedenheit. Eine automatisierte Analyse und Interpretation der Kundenmeinungen (engl. *„Voice of the Customer"* (VoC)) könnte daher die Arbeitslast für KMUs deutlich reduzieren. Es existieren bereits einige kommerzielle Softwarelösungen, die Social Media Posts über eine Sentimentanalyse einem positiven, negativen oder neutralen Grundton zuordnen können. Sie zielen jedoch auf die Analyse sehr großer Datenbestände vor dem Hintergrund der Trenderkennung ab und messen beispielsweise, wie häufig ein Produkt in einem Sozialen Medium genannt wird. Damit eignen sie sich für den Einsatz bei KMUs nur bedingt. Da KMUs zudem mit ihren Produkten eher Nischenmärkte bedienen, ist die dort genutzte „Fachsprache" für auf korrektes Deutsch angelernte Algorithmen kaum verständlich. Vor diesem Hintergrund soll die vierte Forschungsfrage untersuchen, wie hoch die Güte eines speziell angelernten Algorithmus zur Sentimentanalyse bei KMUs ist.

Forschungsfrage 5:

Wie können aus Prozessmodellen Hinweise auf die nationale Kultur identifiziert werden?

Hintergrund: Sowohl bei der Nutzung von ESN als unternehmensweite Kollaborationsplattform über verschiedene internationale Niederlassungen, als auch bei der Nutzung von OSN als Kommunikationsmedium zu Kunden aus aller Welt, müssen Unternehmen sich früher oder später mit kulturellen Unterschieden der einzelnen Prozessbeteiligten auseinandersetzen. Die Kollaboration über Unternehmens- und Landesgrenzen hinweg nimmt in Zeiten der Globalisierung mehr und mehr zu und bedingt dadurch eine kulturelle Diversität der Mitarbeiter [vom

Brocke/Sinnl 2011, S. 365]. Untersuchungen zeigen, dass Geschäftsprozesse dem Einfluss der nationalen Kultur unterliegen [Jayaganesh/Shanks 2009, S. 10]. Unternehmen, die Kooperationspartner oder eigene Niederlassungen im Ausland besitzen, werden daher Unterschiede in den Geschäftsprozessen bzw. den zugehörigen Prozessmodellen feststellen können. Die Identifikation der nationalen Kultur kann dabei unterstützen, bereits beim Prozessdesign auf kulturelle Besonderheiten einzugehen. Auch in der Analysephase kann die Identifikation der nationalen Kultur helfen, Ursachen für Probleme in der Prozessausführung zu erkennen und zu beheben. Die fünfte Forschungsfrage soll daher untersuchen, wie die nationale Kultur aus Prozessmodellen abgeleitet werden kann. Diese Fragestellung wurde bisher noch nicht in der Forschung adressiert.

Z3: Die letzte Zielsetzung dieser Arbeit (*Zielsetzung 3*) soll abschließend aufzeigen, wie die praktische Umsetzung eines Werkzeugs zur Unterstützung der Prozessmodellierung im BPM durch die Nutzung neuer Technologien gestaltet werden kann (*Forschungsfrage 6*).

Forschungsfrage 6:

Können neue Technologien das BPM bei der Prozessmodellierung unterstützen?

Hintergrund: Prozessmodelle stellen die Grundlage jeder Prozessverbesserung im Rahmen des BPM dar. Die kontinuierliche Aktualisierung der erhobenen Prozessmodelle ist jedoch eine der großen Herausforderungen des BPM [Rosemann 2006, S. 383]. Die Erhebung der Prozessmodelle erfolgt durch speziell geschulte Modellierungsexperten, die sowohl das notwendige Software- als auch Methodenwissen besitzen. Die Fachabteilung als die prozessausführende Organisationseinheit stellt über Interviews und Dokumente den Input für die Erstellung des Prozessmodells bereit, den der Modellierungsexperte interpretiert und in ein Prozessmodell überführt. Eine Aktualisierung der so erhobenen Prozessmodelle erfolgt meist nur noch bei akutem Bedarf, z. B. bei bevorstehenden Audits. Die Verantwortlichkeit für die Pflege der Prozessmodelle liegt beim Modellierungsexperten. Bei der Sicherstellung der Aktualität von IST-Prozessen wäre daher eine ständige Überwachung der Fachabteilung notwendig, was aber nicht praktikabel ist. Die sechste Forschungsfrage zielt daher darauf ab, neue Technologien zu nutzen, um die Fachabteilung einerseits zu befähigen und andererseits auch zu motivieren, aktiv und autark an der Prozesserhebung teilzunehmen. Hierzu bedarf es einerseits einer Reduktion der Komplexität der Modellierungskonstrukte, damit auch Prozessmodellierungs-Novizen bei der Erhebung der Prozesse nicht überfordert werden. Zudem sollen die Mitarbeiter in den Fachabteilungen durch das Erlebnis der Nutzung neuer Technologien („Spaßfaktor") dazu gebracht werden, die Prozesse aus eigenem Antrieb zu modellieren und zu aktualisieren.

1.3   Aufbau der Arbeit

Der Aufbau dieser Arbeit ist in Abbildung 1 dargestellt. Er orientiert sich an der zuvor präsentierten Zielsetzung der Arbeit und deckt die sechs beschriebenen Forschungsfragen ab. Nach der Einleitung in Kapitel 1 folgt in Kapitel 2 die Präsentation der sechs wissenschaftlichen Beiträge in logischer Reihenfolge in sechs Unterkapiteln. Die einzelnen Beiträge werden zu Beginn der Unterkapitel jeweils kurz eingeführt und einer Forschungsfrage zugeordnet. Sie sind danach in der Originalform ihrer Veröffentlichung in diese Dissertationsschrift eingebunden. Den Abschluss der Arbeit stellt Kapitel 3 dar. Auf eine Zusammenfassung der Arbeit folgt die kritische Würdigung der Forschungsergebnisse. Das abschließende Unterkapitel präsentiert einen Ausblick auf den in dieser Dissertationsschrift behandelten Themenbereich.

Abbildung 1: Aufbau der Arbeit

2 Wissenschaftliche Beiträge

Dieses Kapitel umfasst die sechs wissenschaftlichen Beiträge, welche jeweils eine der in Abschnitt 1.2 definierten Forschungsfragen adressieren. Die Reihenfolge der Beiträge orientiert sich an der zugrundeliegenden Themenstellung dieser Arbeit und untergliedert sich in die drei in Abschnitt 1.1 definierten Zielsetzungen dieser Arbeit (siehe Abbildung 2).

Abbildung 2: Zuordnung der wissenschaftlichen Beiträge zu den Themenbereichen dieser Arbeit

Die ersten beiden Beiträge beleuchten die erste Zielsetzung und untersuchen daher *Erfolgsfaktoren für die Unterstützung des BPM durch kontinuierlichen Prozessverbesserung mittels PPM*. Das PPM steht als ein Ansatz zur laufenden Prozessüberwachung und -steuerung im Zentrum der Betrachtung. Zunächst werden die Erfolgsfaktoren für die erfolgreiche Anwendung von PPM identifiziert (*Beitrag 1*). Im Anschluss werden funktionale Anforderungen zur Bewertung von Softwarelösungen für das PPM erarbeitet (*Beitrag 2*).

Die zweite Zielsetzung untersucht *Möglichkeiten für die Unterstützung des BPM durch den Einsatz von Enterprise Social Media unter Berücksichtigung interner sowie externer Stakeholder*. In diesem Zusammenhang wird untersucht, inwiefern Social Media Einfluss auf das BPM im Unternehmen nehmen kann. Zunächst wird der Stand der Forschung zum Thema ESN als eine in den letzten Jahren immer häufiger genutzte Form der internen Kollaboration herausgearbeitet (*Beitrag 3*). Im Anschluss daran wird untersucht, wie Soziale Netzwerke von KMUs genutzt werden können, um externes Kundenfeedback automatisiert zu erheben, zu verarbeiten und zu interpretieren (*Beitrag 4*). Den Abschluss der zweiten Zielsetzung bildet die Identifikation von Hinweisen zur nationaler Kultur aus Prozessmodellen (*Beitrag 5*).

Die abschließende Zielsetzung (*Beispielhafte Anwendung neuer Technologien zur Verbesserung der Prozessmodellierung*) wird durch die Vorstellung einer prototypischen Implementierung bearbeitet. *Beitrag 6* stellt eine mobile Applikation vor, die Novizen die kollaborative Prozessmodellierung ermöglicht und somit das BPM mithilfe neuer Technologien unterstützt.

Alle sechs wissenschaftlichen Beiträge wurden bei anerkannten wissenschaftlichen Konferenzen bzw. Journals eingereicht und sind entweder derzeit in Begutachtung oder bereits veröffentlicht. Eine Übersicht über die relevanten Details der einzelnen Beiträge stellt Tabelle 1 auf der nächsten Seite dar. Das dort genannte Ranking der Zeitschriften und Konferenzen entstammt dem anerkannten VHB-Jourqual 3 Ranking für die Wirtschaftsinformatik[3]. Die Bewertungen der für diese Arbeit relevanten Konferenzen und Journals ist in Abbildung 3 dargestellt.

Zeitschrift	JQ3	JQ2	Anzahl Voten	Anteil Rating o. besser	Verteilung der Voten					Nicht Wiss.	Nicht BWL
					A+	A	B	C	D		
Proceedings of the European Conference on Information Systems (ECIS)	B	B	157	68,2%	2,5%	15,3%	50,3%	25,5%	6,4%	7,1%	0,0%
Proceedings of the International Conference on Design Science Research in Information Systems and Technology (DESRIST)	C	n.e.	70	72,9%	0,0%	5,7%	31,4%	35,7%	27,1%	10,3%	1,4%
Computer Networks	k.R.	n.e.	19	n.a.	0,0%	10,5%	36,8%	31,6%	21,1%	0,0%	13,6%

Abbildung 3: Ranking der für diese Arbeit relevanten Konferenzen und Journals

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[3] http://vhbonline.org/service/jourqual/vhb-jourqual-3/teilrating-wi/

	Titel	Autoren	Eingereicht bei	Typ[6]	Status[5]	Ranking[4]	Anteil
1	**Successful application of PPM - an analysis of the German-speaking banking industry**	*Josef Blasini* *Susanne Leist* ***Christian Ritter***	19th European Conference on Information Systems (ECIS 2011), Helsinki, 09.-11.06.2011.	**K**	**V**	**B**	33%
2	**Using Functional Requirements to Evaluate Process Performance Management Tools**	***Christian Ritter*** *Susanne Leist* *Josef Blasini*	17th IEEE Conference on Business Informatics (CBI 2015), Lissabon, 13-16.07.2015.	**K**	**V**	**n. v.**	80%
3	**Enterprise Social Networks: A Literature Review and Research Agenda**	*Benjamin Wehner* ***Christian Ritter*** *Susanne Leist*	Computer Networks - Special Issue on Social Media Networks in Business	**J**	**V**	**n. v.** (Impact Factor: 1.446)	45%
4	**Assessing the Accuracy of Sentiment Analysis of Social Media Posts at Small and Medium-sized Enterprises in Southern Germany**	*Josef Schwaiger* *Markus Lang* ***Christian Ritter*** *Florian Johannsen*	24th European Conference on Information Systems (ECIS 2016), Istanbul, 12.-15.06.2016.	**K**	**V**	**B**	15%
5	**A new Approach for Measuring National Culture: Analyzing Business Processes in Germany and India**	*Benjamin Wehner* *Thomas Falk* ***Christian Ritter*** *Susanne Leist*	24th European Conference on Information Systems (ECIS 2016), Istanbul, 12.-15.06.2016.	**K**	**A**	**B**	20%
6	**A Prototype for Supporting Novices in Collaboration Business Process Modeling Using a Tablet Device**	***Christian Ritter*** *Josef-Michael Schwaiger* *Florian Johannsen*	10th International Conference on Design Science Research in Information Systems and Technology (DESRIST 2015), Dublin, 21.-22.05.2015.	**K**	**V**	**C**	45%
							238%

Tabelle 1: Übersicht über die wissenschaftlichen Beiträge der Dissertation

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[4] Ranking nach VHB-Jourqual 3 (http://vhbonline.org/service/jourqual/vhb-jourqual-3/teilrating-wi/)

[5] **V**: In Konferenzproceedings bzw. Journal veröffentlicht, **A**: Eingereicht und abgelehnt

[6] **K**: Konferenz, **J**: Journal

2.1 Beitrag 1: Successful application of PPM - an analysis of the German-speaking banking industry

Der erste Beitrag befasst sich mit der ersten Zielsetzung dieser Arbeit, der Untersuchung von Möglichkeiten zur Unterstützung des BPM durch die kontinuierliche Prozessverbesserung mittels PPM. Banken bietet sich aufgrund der Immaterialität der Bankdienstleistungen und der damit verbundenen starken Prozess- und IT-Fokussierung des Bankensektors ideal für die Umsetzung eines PPM an. Daher werden anhand einer Expertenumfrage zunächst der Status quo des PPM im Bankensektor erhoben und anschließend die Erfolgsfaktoren für das PPM bei Banken identifiziert. Damit adressiert der Artikel die erste Forschungsfrage:

Forschungsfrage 1:

Welche sind die erfolgskritischen Faktoren für den Einsatz von PPM?

Titel	Successful application of PPM - an analysis of the German-speaking banking industry
Autoren (Anteile)	*Josef Blasini, Susanne Leist, **Christian Ritter*** (33% - 33% - **33%**)
Veröffentlicht in	Proceedings of the 19th European Conference on Information Systems (ECIS 2011), Helsinki.
Ranking	B
Status	Veröffentlicht
Link zum Beitrag	http://aisel.aisnet.org/ecis2011/1/

Tabelle 2: Details zu Beitrag 1

Association for Information Systems
AIS Electronic Library (AISeL)

ECIS 2011 Proceedings

European Conference on Information Systems (ECIS)

10-6-2011

SUCCESSFUL APPLICATION OF PPM – AN ANALYSIS OF THE GERMAN-SPEAKING BANKING INDUSTRY

Josef Blasini

Susanne Leist

Christian Ritter

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SUCCESSFUL APPLICATION OF PPM – AN ANALYSIS OF THE GERMAN-SPEAKING BANKING INDUSTRY

Blasini, Josef, University of Regensburg, Universitätsstraße 31, 93040 Regensburg, Germany, josef.blasini@wiwi.uni-regensburg.de

Leist, Susanne, University of Regensburg, Universitätsstraße 31, 93040 Regensburg, Germany, susanne.leist@wiwi.uni-regensburg.de

Ritter, Christian, University of Regensburg, Universitätsstraße 31, 93040 Regensburg, Germany, christian.ritter@wiwi.uni-regensburg.de

Abstract

Process Performance Management (PPM), whose importance has increased as a result of the recent financial and economic crisis, is one of the major management concepts regarding business processes. Especially its ability to continuously supervise process efficiency and to discover potential for process optimization strengthens its importance. Although PPM application in the banking industry is widespread, there is still a lot of room for improvement. Only a few PPM applications are based on a consistent methodology and many different individual concepts are being used. The purpose of this paper is to identify factors for PPM success. Therefore, we distinguish between factors that are implemented by banks whose PPM application can be identified as successful vs. those banks whose PPM application is less successful. The analysis is conducted using different research methods – exploratory and confirmatory ones. Confirmatory analysis is used to prove that three indicator variables ('net benefits', 'user satisfaction', and 'acceptance') define 'successful application of PPM'. Exploratory analysis is applied to identify linear correlations between given variables (e.g. 'integration of PPM in corporate strategy', or 'complete and reasonable selection of key performance indicators') and 'successful application of PPM'.

Keywords: Process Performance Management, Process Performance Measurement, Process Controlling, Banking Industry

1 Introduction

Since the emergence of the global financial and economic crisis in the last years banks have been facing tougher competition for financially strong customers and, consequently, an increasing pressure to cut and control costs. As banking services are immaterial and require intensive use of Information Technology (IT), an effective and efficient business process management is crucial to a bank's competitiveness. Monetary performance indicators like cash flow or cost reports delay the observation of impacts triggered by optimization efforts. Thus, validating their success is a challenge as well as implementing corrective measures to counteract less promising optimization attempts (Hoffmann, 1999). As a result, many banks implement Process Performance Management (PPM) by adding measurement and control mechanisms directly to their core business processes. These systems enable banks to permanently monitor process performance in or near real-time, to identify optimization potential, and to predict potential bottlenecks in process execution. As a result, banks can increase their responsiveness and strengthen their competitiveness. Additionally, medium-term optimization potential for process design can be discovered (Leist et al., 2010).

By intensively using IT, banks possess almost ideal prerequisites to implement indicator driven process capability and performance monitoring. However, banks apply PPM to very different extents. Especially well established PPM methods are hardly used. Instead, banks tend to apply their own concepts derived from internal requirements without having a sound theoretical background, or they concentrate solely on the technical realization of PPM systems and their functions (Leist et al., 2010).

Based on this knowledge, we conducted a study to determine the application of PPM in the German-speaking banking industry (see Leist et al., 2010). As German banks traditionally show high cost-income ratios (CIR) in global or European comparison, the German market can be seen as highly competitive. Therefore banks have a high need to increase their productivity and monitor their costs. These demands are the perfect starting point for applying PPM. The goal of the survey was to identify the status quo of PPM application, to gather current trends, and to generate hints to best practice applications. The survey was conducted in the first quarter of 2010 and it contains answers from experts covering all relevant banking types in the German-speaking area.

Accordingly, this paper shows a different perspective on the results of the study. To be more specific, the following questions will be addressed:
- How can successful application of PPM be measured?
- Which attributes show a direct link to successful application of PPM in the banking industry and to what extent can they be found at successfully acting banks?

To put it in a nutshell, this paper's goal is to identify characteristic attributes that can be used to distinguish between banks successfully applying PPM and banks that are less successful in utilizing PPM, and further on serve as success factors.

Empirical research methods are being used to support this analysis (see Wilde and Hess, 2007). For hypothesis testing exploratory (structure discovery) as well as confirmatory (structure testing) data analysis techniques are used (see Backhaus et al., 2003) to find characteristic attributes of banks that apply PPM in a successful way.

This paper's structure is as follows: After this introduction section 2 presents foundations of PPM in the banking industry and gives an insight into related work in this area of research. Section 3 creates the theoretical basis for the subsequent analysis and formulates the hypothesis. Section 4 presents a short summary of the survey results followed by the results of our data analysis that address the research questions. Additionally, this section covers the validation of the hypothesis. In section 5 we discuss and interpret our results. The closing section sums up the main points and notes the implications for future research.

2 Process Performance Management in the Banking Industry

2.1 Terminology

When searching for a definition for PPM many different, mostly overlapping definitions from various authors can be found. To clarify our definition of PPM, our understanding of performance as well as the underlying concepts will be explained in the following.

The term 'performance' contains a future-oriented approach (Krause, 2005; Lebas, 1995). In general, performance can be understood as a contribution of a company-internal or company-external individual or group to achieve a company's goals (Chamoni et al., 2006). Machines (Gleich, 2002) or information systems can be used as support. Krause (2005) defines the term in the business realm as the degree of achieving company goals or the potential output of all stakeholder-relevant attributes of an organization (Krause, 2005). Pleier differentiates between three views (capability, process, result) which focus on different aspects of performance creation (Pleier, 2008).

Business Performance Management is an extensive approach for process-oriented and strategy-conform planning, measurement, and controlling of contributions to multidimensional organizational goals (Chamoni et al., 2006). These contributions can be derived from different corporate perspectives, e.g. employees, teams, offices, or processes. This is the reason why some authors suggest a focus of Performance Management on stakeholder utility (Krause, 2005; Otley, 1999). Performance Management is defined as a cycle ('plan', 'improve', 'control', 'communicate'), each of whose steps affect performance and the underlying mental models of involved protagonists (Krause, 2005). Performance planning serves two goals: First, it aligns requirements of stakeholders with those of competition. Secondly, it defines requirements and a target range for performance. This is achieved by defining and concretizing Key Performance Indicators (KPIs) (Krause, 2005). Performance improvement can be supported by a vast number of methods, e.g. Total Quality Management (Stamatis, 1997), Continuous Quality Improvement (CQI) (Kostka and Kostka, 2008), Lean Thinking (Womack, 1996), and Business Process Reengineering (BPR) (Hammer and Champy, 2003). Performance controlling contains measurement, monitoring, and evaluation of performance based on predefined KPIs (Krause, 2005). The task of Performance communication is to process, prepare and release collected information to its target audience using IT-systems. A feedback loop should be established to identify deficits in report design or to replace non-beneficial KPIs (Krause, 2005).

PPM narrows the view of Performance Management and can be seen as the active management of business processes through planning, monitoring and controlling (Leist et al., 2010). The main goal is to identify optimization potential in business processes (Chamoni et al., 2006). A business process comprises a sequence of activities, focuses on fulfilling an organizational task and cuts across functional boundaries (Davenport and Short, 1990; Harrington, 1991). As a business process is performed by human beings and machines, it represents a socio-technical system (Shaw et al., 2007). Even though modeling of these processes with a semi-formal modeling technique is not a mandatory requirement for PPM, it is strongly suggested for transparency (Oehler, 2006) and consistency (Thomas and Fellmann, 2007) reasons.

2.2 Object of Research

By definition, banks seem to be perfect candidates for implementing PPM. The banks' role as financial intermediary and, consequently, their transaction and transformation functions are based on the fact that financial services are immaterial (Thomas, 2008). The transformation function, consisting of risk, time, and batch transformation (Krotsch, 2006; Riese, 2006), further constitutes the importance of information flows. Given these characteristics, banking processes are especially suitable to be processed by IT systems. The used IT systems are the source for digital process information and simplify the collection of process data (Leist et al., 2010).

Along with the immateriality of banking services the integration of the external factor (customer) is another characteristic of value chains in the financial industry (Thomas, 2008). Although banking services for retail clients are more or less standardized, the individual requirements of corporate clients or of clients in wealth management generate an individual banking product for each customer. In addition and as a subsequence, a large number of different banking products require different processes for their development, sales and transaction. Thus, planning and controlling banking processes is especially important (Leist et al., 2010).

Keeping the mentioned points in mind, banks can be considered as fitting objects to research the application of PPM. On the one hand, they fulfill important requirements to monitor the product life cycle on a technical and organizational level using KPIs, while, on the other hand, the heterogeneity of banking itself forces them to efficiently and effectively control their processes (Leist et al., 2010).

2.3   Related Work

The successful application of PPM is not an intensely discussed topic in literature – despite its importance for the banking industry, especially after the global financial and economic crisis. In particular, investigations aiming to identify factors for a successful application of PPM can hardly be found. Nevertheless, there are several research studies which concentrate on similar topics containing valuable hints for our investigation.

A major topic of research is the impact of IS on business process effectiveness and organizational performance, not only since IT investments have grown rapidly over the years (Chang and King, 2005; Melville et al., 2004; Bharadwaj, 2000). Most prominently, the DeLone and McLean IS success model (DeLone and McLean, 1992) synthesized previous research (Ives et al., 1983; Mason, 1978) involving IS success into a more coherent body of knowledge and was a starting point of several following investigations (Molla and Licker, 2001; Seddon and Kiew, 1994). The theoretical foundation of this research is the resource-based view which argues that companies possess resources; these can be divided into two subsets, one that enables them to gain competitive advantages, and another one that leads to superior long-term performance (Wade and Hulland, 2004). While the contribution of IS to banks has been debated from several viewpoints in literature (e.g. Davamanirajan et al., 2006; Tallon, 2010), only little discussion has been dedicated to the contribution of Performance Management Systems, not to mention PPM. Examples for these contributions are the investigation of the influence of Performance Management on the overall performance of a company and the identification of success factors (Gleich, 2001; Gleich, 2002), or the relation between marketing communication and performance by identifying success factors (Janz, 2008). Other authors focus on development, implementation (Schreyer, 2007), and introduction (Krause, 2005) of Performance Measurement/Management Systems and examine their influence on a company's performance. All these investigations provide a promising basis for potential success factors in our research.

A second research area consists of studies which have a narrower focus. They constitute user acceptance as the main factor for applying IT (e.g. TAM (Davis, 1989)). In consequence, user acceptance is an essential precondition for IT to be successfully applied and to gain an impact on a company's performance (see Beaudry and Pinsonneault, 2010; Karahanna et al., 2006; Davis, 1989). However, none of the found studies place an emphasis on PPM. This is not a surprising result since PPM cannot be reduced to the underlying IT system. In addition, most of the studies assume the use of the investigated IT as optional for the user. In contrast, PPM requires the tool to be used in order to generate the next report or to conduct the predefined analyses. Nevertheless, the result of these investigations to regard user acceptance as a prerequisite for successful application of IT is considered in our research.

A third research area concentrates on characteristics of PPM. Based on empirical research publications these authors analyze the underlying factors of PPM. However, they do not close the link to the successful application of PPM. One of the most promising approaches in this area is the work of Bucher and Winter (2007) who identify four factors defining Business Process Management that are

mainly related to PPM. Their exploratory analysis shows that, in addition to the extent to which performance measurement is conducted, the use of established methods and standards is to be seen as a distinguishing feature of successful PPM users (Bucher and Winter, 2007). Cleven et al. (2010) analyze four stereotype problem situations of PPM and highlight optimization potential. For example, KPI enthusiasts define and implement a large amount of performance indicators, but only monitor and control a small number of processes using these KPIs (Cleven et al., 2010).

To sum it up, we found different research areas which provide a basis for potential success factors and give hints for the definition of a successful application. However, empirical research focusing on the successful application of PPM was not discovered.

3   Successful Application of PPM

3.1   Operationalization of PPM Success

Because of the multiple causes of corporate success and the resulting allocation problem (Fritz, 1995) it is not expected that the design of PPM can explain corporate success or its conclusion. Instead, the scope has to be limited on the area of PPM and especially on its application. Thus, in this paper success is defined as the successful application of PPM. Accordingly, the term 'PPM success' is used in the sense of the successful application of PPM.

PPM success cannot be represented by any directly observable or measurable variable in an empirical research study. Instead, success has to be defined as a latent variable representing the hypothetical construct of success (see Backhaus et al., 2003). This latent variable needs to be operationalized by several indicator variables which represent components of PPM success and not its cause (see Seen et al., 2007). This is due to the fact that PPM success can only be represented by its causes when these causes are known to their full extent and also their interdependencies are clearly identified. In contrast, components of PPM success represent their underlying factor by definition to its full extent. Taking these requirements into account, three indicator variables were derived from literature as indicators for PPM success: 'net benefits', 'user satisfaction', and 'acceptance'. They are characterized as follows:

Net benefits: In economic research, an objective approach is widely used to define success as the degree of achievement of objectives (Fritz, 1995). These objectives can reach from a project level to an overall organizational level. In this paper, we focus on the overall approach. Since PPM by definition is not a self-purpose but an instrument to achieve certain goals (Amshoff, 1993), the degree of achievement of goals can be used as an indicator for its success. This indicator is equivalent to 'net benefits' in the D&M-ISS model (see DeLone and McLean, 2003).

User satisfaction: The second indicator for PPM success is the satisfaction of the individual user with the application of PPM. Gelderman (1998) points out a significant correlation between user satisfaction and success . Additionally, user satisfaction is the starting point for individual and consequently also for organizational productivity (DeLone and McLean, 2003).

Acceptance: The Technology Acceptance Model (TAM) by Davis (1989) describes why users of Information Systems use and accept new technologies. Acceptance of IS is the base for a high degree of success (DeLone and McLean, 2003). Igbaria and Tan (1997) found a significant correlation between acceptance and individual performance. Considering organizational performance (see Igbaria and Tan, 1997), this relationship allows to use the variable acceptance for PPM success. In contrast to user satisfaction this variable enhances the personal view of the individual user to the perceived acceptance of all organizational units.

To fully represent PPM success as many indicator variables as possible should be used, because multi-dimensional measurement ensures that the latent variable success is measured with high reliability. However, to focus on the most dominant indicators for PPM success, we limited our analysis to the 3 aforementioned indicator variables, which can be considered to be in conformance with literature as shown above.

3.2 Formulation of Hypothesis and Research Design

One major goal of this paper is to measure the successful application of PPM. For this purpose, we created a model that, on the one hand, contains the latent variable 'success' and, on the other hand, the three indicator variables 'net benefits', 'user satisfaction', and 'acceptance' that operationalize PPM success. Our research includes the following steps:

(1) Testing of hypothesis H: The successful application of PPM is represented by 'net benefits', 'user satisfaction', and 'acceptance'. Based on a reflective measurement model, hypothesis H can be tested by conducting a confirmatory factor analysis (Backhaus et al., 2003; Edwards and Bagozzi, 2000).

(2) Correlation of potential success factors: In addition to H, we want to analyze which attributes show a direct link to successful application of PPM in the banking industry. A necessary, but not necessarily sufficient condition for the impact of a success factor is a linear correlation between these variables and the successful application of PPM. We conduct an exploratory research to prove the assumed correlations between variables and PPM success by calculating linear correlation values.

4 Survey and Results of the Empirical Research

4.1 Survey Design and Data Collection

The foundation for our study was an online questionnaire that was conducted in the first quarter of 2010 and its participation was restricted to banking experts in the German-speaking area. The questionnaire contained a total of 50 questions split into four categories. First, the participants were asked to provide general information about themselves (position, department, relevant expertise in Process Management and PPM) as well as about their institutions (type of bank, total assets, number of employees). Then the experts answered six questions about current and planned projects concerning PPM in their banks. Afterwards, we asked four questions that contained a general evaluation of PPM (e.g. importance, strategy, impact of financial crises…). These questions were followed by four questions regarding the knowledge and application of various PPM methods as well as the plans to implement those methods in the participants' banks and their net benefits. The main section of the questionnaire consisted of 27 questions that were aligned to the phases of Krause's PPM-cycle (Krause, 2005). The last section was composed of three questions about the acceptance of PPM in the participants' institutes. We used a five-level Likert scale for most of the questions.

To acquire as many participants as possible, we sent out an e-mail invitation to join our survey to every banking expert we found through various sources (in total, we invited over 1,000 individuals within 705 different banks). Multiple experts per bank occurred as a result of addressing different departments of the bigger institutes. The position of the participants ranged from CEOs to PPM Managers/Users. When we closed the survey, 109 experts (from 89 different banks) had participated in the survey. To ensure a very high quality and to ensure that the results were comparable, we filtered this data set by applying strict criteria:
- All questions had to be answered
- Control questions were answered correctly
- Timing restrictions were met

After applying these restrictions we remained with a data set of 40 participants (34 different banks). This number may look small; it is, however, of very high quality due to our strict filtering. Also, a rather small sample size can be justified when results are statistically valid (Straub, 2009). It is obvious that a larger sample size would improve result quality; however, since our hypothesis is statistically significant (see section 4.2), our sample size has to be considered as sufficient. Additionally, our sample size also fulfills multiple statistical requirements as presented in the next section (e.g. Kaiser-Meyer-Olkin Measure, Cronbach's α, factor structure).

4.2 Results of the Empirical Research

As an introduction to the used data set we will present some descriptive analyses before we start the hypothesis testing. Table 1 shows the absolute and relative frequencies for each of the three indicator variables which were formulated to operationalize the latent variable 'PPM success'.

		Very High	High	Average	Poor	Very poor
Net benefits	Frequency	6	12	14	6	2
	Percent	15.0	30.0	35.0	15.0	5.0
User satisfaction	Frequency	1	10	14	14	1
	Percent	2.5	25.0	35.0	35.0	2.5
Acceptance	Frequency	4	12	18	5	1
	Percent	10.0	30.0	45.0	12.5	2.5

Table 1:   Frequency table for indicator variables

Net benefits: The scale ranged from 'very high' (=1) to 'very poor' (=5). Looking at the frequency table shows a concentration on the two levels 'high' and 'average'. The overall mean is 2.65.
User satisfaction: It shows a slightly negative tendency across all participants. The overall mean is 3.1.
Acceptance: It is seen rather negative by the participants of the study. The overall mean is 2.68.

Testing of Hypothesis H

Backhaus (2003) requires a correlation analysis as a first step to discover interdependencies among variables (Backhaus et al., 2003). Table 2 presents the Spearman correlation coefficients for the three indicator variables. The correlation between 'user satisfaction' and 'acceptance' is not significant on a .05 level. However, the correlation between 'net benefits' and 'acceptance' is highly significant on a .01 level (0.415). The highest correlation exists between 'net benefits' and 'user satisfaction' (0.693). High correlation values hint at a strong dependency of the three variables which is a requirement for the confirmation of hypothesis H.

Correlation		Net benefits	User Satisfaction	Acceptance
Net benefits	Correlation Coefficient	1.000	.693[**]	.415[**]
	Sig. (2-tailed)	.	.000	.005
User Satisfaction	Correlation Coefficient	.693[**]	1.000	.279
	Sig. (2-tailed)	.000	.	.081
Acceptance	Correlation Coefficient	.415[**]	.279	1.000
	Sig. (2-tailed)	.005	.081	.

[**]. Correlation is significant at the .01 level (2-tailed).
[*]. Correlation is significant at the .05 level (2-tailed).

Table 2:   Correlation Matrix

Reliability testing of the model shows that the variables 'net benefits', 'user satisfaction', and 'acceptance' can be used to operationalize the latent variable 'PPM success'. The Principal Component Analysis (PCA) shows high communalities for the three variables (see table 3). All of them are above the required value of 0.4 by Osborne and Costello (Osborne and Costello, 2005).

Communalities	Initial	Extraction
Net benefits	1.000	.790
User satisfaction	1.000	.716
Acceptance	1.000	.492

Components	Component 1
Net benefits	.889
User satisfaction	.846
Acceptance	.702

Extraction Method: Principal Component Analysis

Table 3:   Communalities   *Table 4:   Component Matrix*

Additionally, the factor loadings are above the defined minimum requirement of 0.7 (see table 4) (Bortz and Weber, 2005). The total variance explained is 66.613%. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy which shows the extent of the connection between the initial variables and thus indicates if the factor analysis is reasonable (Backhaus et al., 2003) has a value of 0.619. This value is considered as 'mediocre' by Kaiser and Rice (Kaiser and Rice, 1974). Furthermore, it is above the minimum requirement of 0.6 (Schendera, 2010). Cronbach's α (Cronbach, 1951) shows a value of 0.746 which is above 0.7 as demanded by Nunnally (Nunnally, 1978).

According to Bortz and Weber (2005) another indicator for the correctness of an underlying model is the stability of a factor structure (FS). In our case, given a sample size of N = 40 and a minimum factor loading of 0.7, the factor structure is calculated as FS = 0.8441 which is above the minimum requirement of 0.8. This means we have an acceptable conformity between true and sampled factor structure which justifies further interpretation (Bortz and Weber, 2005).

As a result, Hypothesis H can be confirmed. The successful application of PPM can be represented by the three indicator variables 'net benefits', 'user satisfaction', and 'acceptance' The validity of the underlying model can be stated as confirmed based on its reliability and stability.

Correlation of potential Success Factors

After testing hypothesis H we also checked on correlations between further variables gathered from the initial questionnaire and the operationalized variable 'successful application of PPM'. In this exploratory analysis, we calculated Spearman's correlation coefficient for every variable. We found significant correlations at the .05 level for eleven variables. These are presented in table 5.

Correlations to successful application of PPM (N = 40)	Correlation Coefficient	Sig. (2-tailed)
Importance of PPM	.317*	.046
Integration of PPM into corporate strategy.	.567**	.000
Connection of PPM to employee compensation	.409**	.009
Need for a more useful selection of performance indicators	-.456**	.003
Need for proof of completeness of performance indicators	-.456**	.003
Degree of processes controlled using PPM (deposit transactions)	.398*	.011
Degree of processes controlled using PPM (payment transactions)	.375*	.017
Sources for PPM data – Process Management Tool	.332*	.036
Problems due to low automation in data collection	-.404**	.010
Visualization of process models with KPIs in PPM system	.315*	.048
Usage of methods for performance improvement - BPR	.387*	.014

**. Correlation is significant at the .01 level (2-tailed).
*. Correlation is significant at the .05 level (2-tailed).

Table 5:   *Correlations to successful application of PPM*

The list of significant variables can be separated into two groups: Variables reflecting opinions on PPM and variables reflecting characteristics of PPM. The first group contains only one significant variable ('importance of PPM'). The other ten variables fall into the second group. Seven of them show a positive linear correlation to successful application of PPM: 'integration of PPM into corporate strategy', 'connection of PPM to employee compensation', 'degree of processes controlled using PPM' (deposit transactions and payment transactions), and 'visualization of process models with KPIs in PPM system'. The use of a Process Management Tool as a source for PPM data and the use of BPR as a method for performance improvement also show a positive linear correlation to PPM success.

We identified three variables showing a negative linear correlation to the successful application of PPM: 'need for a more useful selection of performance indicators', 'need for proof of completeness of performance indicators', and 'problems due to low automation in data collection'.

The described correlations of the single variables to PPM success can be analyzed in further detail. We analyzed the strength of the correlation between the given variables and the three operationalizing

indicator variables 'net benefits', 'user satisfaction', and 'acceptance'. The results are presented in the following figures. They show a tendency towards the linear correlation for all three indicator variables.
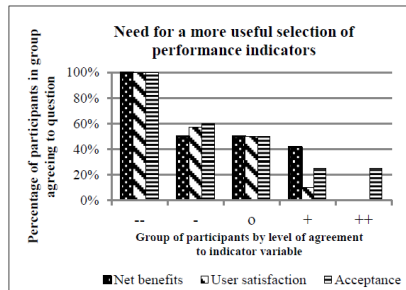

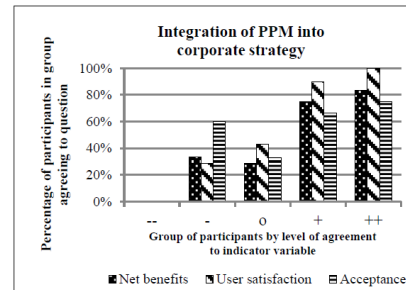| Figure 1:	Need for a more useful selection of performance indicators
Figure 2:	Integration of PPM into corporate strategy

Figure 1 shows the relationship between each of the three indicator variables and the variable 'need for a more useful selection of performance indicators' which is highly correlated to PPM success (-.456). Looking at user satisfaction in figure 1, the entire group of users who are very unsatisfied (--) with the current PPM sees the need for a more useful selection of performance indicators (100%). On the other hand, users who are satisfied (+) or very satisfied (++) with the current PPM in their organization see no or hardly any need for a more useful selection of performance indicators (10% and 0% respectively). As a result it can be stated that 'user satisfaction' is the higher the more the tendency for the need of a more useful selection of performance indicators decreases. This explains the negative correlation described earlier on (-.456). The same behavior can be observed with the other indicator variables 'net benefits' and 'acceptance'. The higher the net benefits or the acceptance of the current PPM are, the lower the need for a more useful selection of performance indicators.

Another very interesting relationship can be found regarding the variable 'integration of PPM into corporate strategy', which pinpoints the highest positive correlation of all variables. Figure 2 shows that the high correlation of this variable to PPM success (.567) can be observed for the three underlying indicator variables as well. Except for a small outlier in the group of low acceptance (-), a positive correlation between the 'integration of PPM into corporate strategy' and the operationalizing variables for PPM success was found. Experts rating 'net benefits', 'user satisfaction', and 'acceptance' on a high or very high level (+/++) mentioned that their institutions had incorporated PPM in their strategy with a much higher probability than the remaining participants.

5 Interpretation of the Empirical Research

The results of our empirical research prove that Hypothesis H is valid. The indicator variables are correlated with each other and can be used to represent the factor 'PPM success'. Furthermore, eleven variables from the study were identified that showed a linear correlation to PPM success – eight of them showed a positive correlation and three of them a negative one.

The highest value of a correlation coefficient was found with the variable 'integration of PPM into corporate strategy'. We assume that an incorporation of PPM into a bank's strategy will have a positive impact on successful application of PPM since it will require and motivate (top) management to apply PPM. As a result, all organizational units will be motivated to apply PPM in a useful way and increase its acceptance, user satisfaction and net benefits. This is the reason why the integration of PPM into corporate strategy is recommended to improve its successful application.

The two variables 'need for a more useful selection of performance indicators' and 'need for proof of completeness of performance indicators' also show high but negative values in linear correlations. Banks that see the need for a more useful selection of performance indicators tend to be less successful when applying PPM than their competitors that are satisfied with the performance indicators they have gathered. Banks that are unsure if they have collected all the necessary performance indicators are also less successful than their counterparts. As a result, it seems necessary to collect all important performance indicators without monitoring random, potentially useless, ones.

Additionally, we discovered a positive linear correlation between PPM success and the variable 'connection of PPM to employee compensation'. As a result, we can assume that if a bank connects its employee compensation directly to PPM (e.g. by monitoring the achievement of individual's goals), its application of PPM will most likely be more successful.

Data quality is another issue as regards PPM success that we discovered in our research. Low automation in data collection leads to a less successful application of PPM. This means, banks that successfully apply PPM already use a highly automated system for data collection hence minimizing the occurrence of data quality problems caused by manual tasks. Automation is a key to the successful application of PPM and should therefore be already considered when starting to design PPM.

There were certain variables that did not have any correlation with PPM success. For example, the variable 'problems due to missing data sources' did not show any linear correlation with PPM success. However, Figure 3 shows non-linear correlations between the mentioned variable and the three indicator variables.
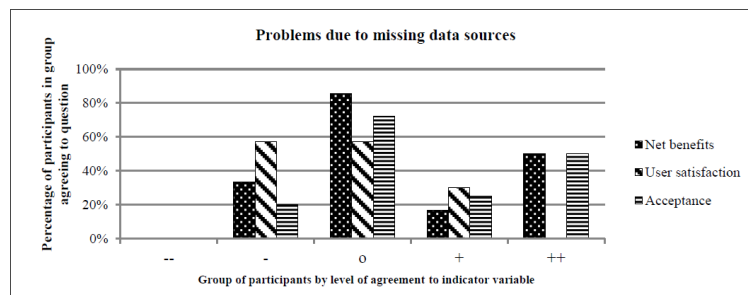
Figure 3:   *Problems due to missing data sources*

It shows as well that banks with either (very) low or (very) high PPM success do not or hardly face any problems due to missing data sources. However, banks with medium PPM success claim to struggle with the unavailability of the adequate data sources more often. While we would have expected more problems at the less successful banks, we assume that banks having little PPM success face deeper problems than only collecting more data. They will more likely be struggling with incorrect, missing, or an overload of data. Regarding the application of PPM, successful banks have no need to collect more data, since they will most likely possess all the necessary data they need for operating their PPM.

6   Conclusion

Achieving strategic goals while strictly adhering to the calculated budgets is one of the major challenges banks nowadays face as a result of the recent financial and economic crisis. Process Performance Management is a major solution to tackle this challenge. It combines data analysis and reporting based on historic or real-time data with forecasts and simulations for forecasting and controlling. The study we conducted in Q1/2010 showed a broad distribution of PPM among banks in the German-speaking area, but it also identified a big need for improvement.

In this paper, we showed how PPM success can be described as a factor of three indicator variables, and pinpointed the attributes that support a successful application of PPM. We could confirm that the three variables we selected to represent a successful application of PPM – 'net benefits', 'user satisfaction', and 'acceptance' – can actually be used to describe PPM success based on statistical evidence. Additionally, we found strong correlations between PPM success and several attribute variables, e.g. 'integration of PPM into corporate strategy', 'connection of PPM to employee compensation', 'need for a more useful selection of performance indicators', and 'need for proof of completeness of performance indicators', which could serve as PPM success factors. Interestingly, none of them are exclusively relevant for banks. Especially the problem to select the appropriate KPIs is known as a general challenge of PPM. We had expected that characteristic attributes like 'regulatory compliance' or 'financial impact of violation of regulations' would be of a higher interest for banks due to the consequences of the financial and economic crisis. According to our survey, banks do not express this need. Our conclusion is that the application of PPM is still in an early development state focusing on basic performance measurement.

The practical relevance of our research shows up in the problem statement and the importance of PPM in the banking industry. The definition of the indicator variables is – not only caused by the recent financial and economic crisis – of great interest in the banking world, since they can support a successful application of PPM and therefore help to support monitoring, controlling and managing banking processes. From a research perspective, we found dependencies between indicator variables and PPM success by applying our model. These variables can further on be used to define PPM success.

The following limitations have to be considered:
- The data set is rather small (N = 40). This is due to our very strict selection of useful data as explained earlier on in this paper. However, we showed that our sample size is sufficient and statistically relevant (see section 4.2).
- We analyzed a total of 99 variables of which eleven showed a linear correlation to PPM success. We have not yet entirely finalized our search for non-linear correlations, which means that correlations of the remaining variables with PPM success cannot be excluded.
- Moreover, since correlations only show dependencies, but not the direction of these dependencies, it cannot be stated free of doubt whether an attribute (e.g. 'integration of PPM into corporate strategy') is the cause for PPM success (and thus a success factor) or the effect of PPM success.
- We are aware that the definition of PPM success is biased by asking practitioners questions about acceptance, satisfaction and net benefits of their very own PPM. Thus the conclusion cannot be drawn whether banks that claim to successfully apply PPM actually achieve an objective and verifiable PPM success, e.g. a higher degree of process optimization.

Based on these limitations further research possibilities are suggested below:
- The purpose of our investigation could be extended and further analysis of the collected data could be done. It could be analyzed if the answers significantly differ depending on the banking type the interviewee belongs to, or on the interviewee's position in the bank.
- From a practitioner's perspective, PPM success can be seen as the achievement of predefined objectives which could be seen as an equivalent to 'net benefits'. As a result 'user satisfaction' and 'acceptance' would only be considered as being success factors. Since this viewpoint contradicts literature, further research will have to be conducted.
- As the focus of our study we chose banks due to their perfect fit to the requirements of PPM. However, a broader focus on other industries would be beneficial for future research, especially because none of the identified success factors are banking specific.
- To further enhance the practical relevance of our research, we are planning on conducting case studies with PPM practitioners across various industries. This will complement our investigation with insights on how practitioners can manage PPM to be successful based on their individual experiences.

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2.2 Beitrag 2: Using Functional Requirements to Evaluate Process Performance Management Tools

Das Ergebnis der Forschungsfrage 1, die Identifikation der Erfolgsfaktoren für den Einsatz von PPM, stellt den Ausgangspunkt der weiteren Untersuchung dar. Auf Grundlage der dort identifizierten Erfolgsfaktoren wird der Branchenfokus im zweiten Beitrag aufgegeben. Es werden folglich allgemeine funktionale Kriterien abgeleitet, die ganz allgemein an eine Softwarelösung zur Unterstützung des PPM gestellt werden können. Ein daraus operationalisierter Kriterienkatalog soll Unternehmen in die Lage versetzen, eine Evaluation verschiedener Softwarelösungen durchzuführen. Der Beitrag untersucht danach, wie ein Unternehmen eine Softwarelösung aus allen am Markt verfügbaren Angeboten mit Hilfe dieses Kriterienkataloges identifizieren kann, welche die eigenen Bedürfnisse und konkreten Anforderungen des Unternehmens möglichst umfassend abdeckt. Damit beantwortet dieser Beitrag die zweite Forschungsfrage:

> **Forschungsfrage 2**:
>
> *Welche funktionalen Kriterien können zur Bewertung von Softwarelösungen für das PPM herangezogen werden?*

Titel	Using Functional Requirements to Evaluate Process Performance Management Tools
Autoren (Anteile)	*Christian Ritter, Susanne Leist, Josef Blasini* (**80% -** 10% - 10%)
Veröffentlicht in	Proceedings of the 17th IEEE Conference on Business Informatics, Lissabon.
Ranking	n.v.
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Link zum Beitrag	http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7264727

Tabelle 3: Details zu Beitrag 2

Using Functional Requirements to Evaluate Process Performance Management Tools

Christian Ritter	Susanne Leist	Josef Blasini
Chair of Business Engineering	Chair of Business Engineering	Chair of Business Engineering
University of Regensburg	University of Regensburg	University of Regensburg
Regensburg, Germany	Regensburg, Germany	Regensburg, Germany

Abstract—Process Performance Management (PPM) supports companies in planning, monitoring, and improving process performance. Many PPM tools are available, but often companies choose not to utilize these tools. Instead they implement and use proprietary in-house PPM solutions. A possible explanation for not using a standard tool can either be seen in the tools' incomplete support of the functional requirements of the individual company's business context and needs, or in the missing knowledge of decision makers concerning a proper tool evaluation and selection. These two questions are addressed by this paper. We identified the most relevant functional requirements of a PPM-tool by conducting multiple literature reviews. The functional requirements were operationalized by evaluation criteria from literature. We performed an evaluation of ten selected PPM-tools to validate the applicability of the evaluation criteria. This evaluation let us describe the average criteria coverage for each of the functional requirements and for each tool to elaborate the main differences. Additionally, we analyze tool support of the functional requirements and deduct evaluation recommendations for certain business contexts.

Keywords—Process Performance Management, Functional Requirements, Evaluation Criteria, Tool

I. INTRODUCTION

Especially in competitive markets a company's success not only depends on the quality of its products and services, but also on its efficient production. Thus, managing the efficiency of production processes is of increasing importance. Therefore, numerous tools have been developed to support practitioners by managing efficient and effective processes [1]. These tools support users in planning, monitoring, and improving the performance of a company's processes in different ways. They stem from different fields (process modeling, business process management (BPM), workflow management (WfM), business intelligence (BI)), but provide a similar set of functions to support the user. We classify them under the name Process Performance Management (PPM) tools.

Companies can choose from several PPM tools available on the market to support their PPM efforts and implement a PPM solution targeting their individual requirements. However, the challenge of selecting the appropriate tool for the given circumstances arises. Since the adequacy of a tool in large part depends on the context of its application, it is difficult to predict which tool fits best to a company's needs. Recent research reveals that a majority of practitioners does not use standardized software tools for supporting their PPM efforts, but often apply their very own PPM methods or use proprietary in-house PPM solutions (cf. [2]). We see similar developments in adjacent fields like BI tools (cf. [3]). As functionality is the number one reason for choosing a specific tool (cf. [3]), a possible explanation for not using a standard tool can either be seen in the tool's incomplete support of the functional requirements of the individual company's business context, or in the missing knowledge of decision makers concerning a proper tool evaluation and selection process. While standard evaluation criteria for software quality (e.g. ISO 9126) exist, we do not know of any published PPM-related requirements.

To address the two described issues with selecting PPM tools, we first gather the functional requirements a PPM tool can possibly possess to support all 5 phases of the PPM-cycle (see Fig. 1). Therefore, we analyze literature concerning PPM in general and PPM in application to identify a set of functional requirements a PPM tool should provide. Secondly, we define evaluation criteria to operationalize these requirements. We prove the applicability of the evaluation criteria by conducting a tool evaluation with ten PPM tools. As a result, we summarize the functional requirements that each of the evaluated tools support to help decision makers finding the appropriate tool for their individual needs. Also, we describe recommendations for certain typical business contexts. The aforementioned goals lead to two research questions:

- *RQ1: What are the most relevant functional requirements of a PPM tool?*
- *RQ2: How can these functional requirements be operationalized into evaluation criteria and applied?*

The first goal of this paper is to derive the most relevant functional requirements for PPM tools from literature (*RQ1*). Second, we identify criteria that can be used to evaluate PPM tools with regards to their functional design. To validate this operationalization, we conduct a tool evaluation (*RQ2*). Hence, the paper is structured as follows: In *section II* we introduce PPM, present related work and our research methodology. In *section III* functional requirements are derived and operationalized by evaluation criteria. *Section IV* comprises the evaluation of the PPM tools. It includes the explanation of the tools and the evaluation procedure as well as the presentation and discussion of the evaluation results. The paper is concluded with a brief summary, a set of limitations and an outlook of further research.

II. CONCEPTUAL BACKGROUND

A. Process Performance Management

While the term PPM is still not very widely-used in research nor in practice, the concept behind it is being developed [4]. PPM narrows the view of performance management to the process level (cf. [5-8]). The core part of PPM is the measurement of process performance by means of key performance indicators (KPIs). However, PPM does not only consist of a measurement phase, but can rather be seen as the active management of business processes through planning, monitoring and controlling based on process KPIs. To provide a detailed understanding of how a process can be (re)designed and how to improve its performance, PPM focuses on identifying performance outcome measures [9]. The main goal is to identify optimization potentials in business processes [10].

The different tasks in PPM can be derived from the double loop of Business Performance Management (cf. [10, 11]), a well-established and widely accepted process model in PPM literature. It links two procedure cycles on different abstraction levels with each other. The first cycle includes – on a strategic level – the definition of business goals, strategic KPIs, and the initiation of process redesign. The second cycle concentrates on PPM-related aspects on the operational level which can be summarized into a PPM-cycle (see Fig. 1). This PPM-cycle consists of five core phases: 'design', 'plan', 'implement', 'monitor', 'control and optimize'. The first phase of the PPM-cycle includes the analysis of existing processes, (re)designing activities, and modeling the process to be monitored. After identifying useful, goal-oriented process KPIs and planning the targeted process performance in phase two, the third phase represents the (technical) implementation. It contains necessary procedures like the identification of data sources, the creation of the performance data base, and the procedures for data analysis, data communication, and data use [12]. This phase is rather extensive once when the PPM system is set up. After the PPM system is operational it only concerns technical aspects (database support, import/ export file formats, system interfaces). During or after the process enactment, the actual process performance is measured and monitored in phase 4, followed by controlling actions (phase 5) [12].

Fig. 1. Five phases of the PPM-cycle

Process performance measurement systems are used to determine the performance of business processes [6]. These information systems support PPM on a technical level by automatically collecting or importing relevant data, calculating process KPIs, and visualizing them according to the corresponding process steps. These PPM tools support all five of the presented PPM-phases by providing technical support for performing the necessary tasks.

B. Related work

There are several publications that help practitioners to evaluate the current situation of available tools for BPM and to find the right tool for their specific needs. All publications focus directly on BPM or adjacent fields. We found the following tool evaluations in the different fields of BPM that gave us useful hints to our research concerning vendors, evaluation criteria and methodology:

- *Process modeling and analysis*: Recent academic studies evaluated business process modeling tools in general [2] or with a special focus on collaborative process modeling [13]. Several industry reports focusing on business process management tools and business process modeling tools are published on a regular basis (cf. [14-18]).

- *Simulation:* Tools for Business Process Simulation were evaluated by [19], by [20] (analysis of six tools in detail regarding their modeling and simulation capabilities), and by [21] (evaluation of the simulation options of 106 BPM tools; eight were picked for a detailed analysis).

- *Workflow Management and Process Execution*: The core information systems in BPM are WfM systems and BPM suites (BPMS), providing model-driven process execution. Industry Reports are regularly published by Forrester Research [22, 23] and Gartner Research, which analyzes the market of BPMS supporting workflow execution [24]. Lately, Gartner expanded BPMS to intelligent BPMS by adding new functionality like real-time activity monitoring or deep complex-event processing [25, 26]. [27] evaluated BPMS according to their powerfulness and comfort based on their ability to implement a realistic testing scenario.

- *Business Intelligence (BI)*: Several industry reports are also available in the BI field published regularly, e.g. by BARC [3, 28] and Gartner Research [29, 30].

Apart from one single tool evaluation in the field of PPM (cf. [31]), studies about defining and presenting the most relevant functional requirements for PPM tools are missing in literature. However, we found PPM-related studies evaluating the current need for PPM support at companies as well as the actual level of PPM support (cf. [31]). A case study of a large telecommunication company in Switzerland revealed that despite a sophisticated PPM tool was used, the workforce showed a strong resistance to the measurement initiatives fearing complete transparency of the individual's performance [4]. This case study clearly showed that a PPM tool is not only supposed to support in the monitoring phase, but also in the planning phase while selecting appropriate process KPIs or in the improvement phase by anonymizing personal data. As a result, we see the need for a tool evaluation focusing on all five phases of the PPM-cycle and analyzing how current software solutions support every functional requirement.

III. DEDUCTION OF FUNCTIONAL REQUIREMENTS

A. Research Approach

Based on the definition of the PPM-cycle presented in *II.A*, we derived functional requirements for each of the five PPM phases. Proceeding top-down starting with literature rather than analyzing functionality of available tools enabled us to identify only valid and successfully applied functional requirements and applicable evaluation criteria. As we included case studies as a main source in our literature analysis, our extensive research approach considers researchers' as well as practitioners' points of view (see Fig. 2):

(1) We started our research with extracting the basic requirements of each of the *five PPM-phases* (as described in *section II.A*) by analyzing the relevant publications. The identified research papers covered the topics of BPM [32-35], PPM [4, 6, 11, 36], and business process improvement [9]. This step was important to understand the different needs in every PPM-phase to define the functional requirements that contribute to those needs afterwards. Having this as a starting point, we collected possible functional requirements for each phase by conducting two literature reviews regarding PPM. For both we applied a well-established approach by [37].

(2a) The first literature review analyzed *research papers in the PPM context*. We searched Google Scholar, SpringerLink, Emerald Insight, EBSCOhost, and Science Direct. Starting out with 'Process Performance Management' as our primary search string we added and combined additional keywords ('business performance management', 'business process management', 'corporate performance management', 'business process modeling', 'criteria', 'design', 'evaluation', 'performance indicator', 'key performance indicator', 'KPI', 'measurement', 'phase', 'survey', 'tool', 'software', 'process performance') in the search process. After thoroughly screening the 955 results we identified 73 publications that delivered direct hints towards the identification of functional requirements of PPM software.

(2b) Next, we tried to identify functional requirements from a practitioner's perspective. Therefore, we chose to conduct a literature review on *case studies in the PPM context*. To ensure the validity of the results, we based our research on case studies published in conference proceedings and academic journals which have a high reputation for their review process. For the literature search we used the databases Emerald Insight, SpringerLink, EBSCOhost, WISO, and the search engine Google Scholar. We applied backward and forward search as proposed in [38]. We used combinations of the following keywords for the literature search: 'process', 'performance', 'management', 'requirements' 'PPM', 'methodology', 'case study', 'performance pyramid', 'performance prism', 'balanced scorecard', 'value-based performance management', 'EFQM'. After analyzing the results we identified nine case studies helping to identify functional requirements of PPM tools.

(3) With the extensive knowledge about the five phases of the PPM-cycle and the consolidated results of the two literature reviews in the PPM context, we identified a total number of the 14 most relevant *functional requirements* spread across the five PPM-phases for tools supporting PPM based on their number of mentions in the identified literature.

(4) As a direct measurement of the identified functional requirements is not possible, we had to research on how to operationalize them. We deducted evaluation criteria for each of the functional requirements from the aforementioned research and an additional literature review on *software evaluations in PPM or closely related fields (BPM, BI)*. We already described the most relevant literature on software evaluations in *section II.B*. We are aware that completeness concerning the criteria selection based on a literature review in these broad topics is a challenging task and can hardly be achieved. However, we are confident that we covered all major contributions in the given topics, which defines our literature review as being representative according to [37, 39, 40].

(5) Based on the gained knowledge about the criteria used in tool evaluations and our results from the earlier literature reviews, we operationalized the 14 *functional requirements by formulating appropriate evaluation criteria*. The evaluation criteria for process modeling tools were extracted from [2, 13, 17, 22-24]. Since the PPM-cycle covers more topics than just process modeling, we also acquired additional evaluation criteria by studying tool evaluations for business process analysis and optimization (cf. [15, 18, 26, 41]). From the BI perspective we used [3, 28] to enhance our list of evaluation criteria operationalizing the functional requirements.

(6) This operationalization was then *validated by conducting a tool evaluation* covering ten PPM tools to successfully prove the applicability of the evaluation criteria.
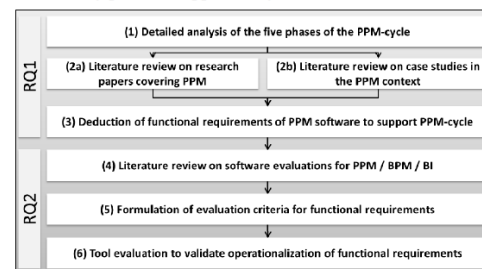

Fig. 2. Research Approach

B. Results

The basic requirements for each of the five phases of the PPM-cycle were our starting point for solving our research questions. Analyzing and combining the results of the three literature reviews mentioned above then led to the list of the most relevant functional requirements for PPM tools. This list of functional requirements was assigned to the different phases of the PPM-cycle presented earlier in Fig. 1 by matching the general requirements of each PPM-phase. However, our analysis of the case studies revealed that while process analysis and (re)design are parts of the *design phase* in the PPM-cycle, they are highly specialized but often neglected tasks depending on a company's specific processes and its situation (cf. [42, 43]). In contrast, process modeling – as the actual modeling task or by importing existing process models – requires strong tool support. Thus, the benefits of a PPM tool in the design phase mainly depend on its process modeling capabilities. For this reason we narrowed our view down to *modeling* activities only within the first PPM-phase, which lead us to five phases for structuring the functional requirements. A summary of the identified functional requirements for PPM tools for each of the five PPM-phases is presented in *Table I* alongside with the sources they were derived from.

Processes play a central role in PPM. Managing process performance requires modeling the processes as a first step in the PPM-cycle. We could confirm in our literature reviews that process modeling capabilities are a necessary functional requirement of the *modeling phase*. We also discovered the need for a PPM tool to support standardized process modeling notations. This need is transferred into a second functional

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requirement in this phase: the number of supported process modeling notations supported by the PPM tool. (cf. [13, 41]).

TABLE I. FUNCTIONAL REQUIREMENTS AND EVALUATION CRITERIA

PPM-phase	Functional requirement	Source(s)
MODEL	process modeling capabilities	[4, 9, 15, 18, 41]
	supported process modeling notations	[2, 13, 33, 41]
PLAN	availability of a KPI repository	[44-46]
	availability of differentKPI dimensions	[4, 6, 9, 47-50]
	definition of measurement parameters	[6, 11, 42, 48]
	definition of target values	[44, 45, 48]
IMPLEMENT	database systems support	[12]
	supported import formats	[13, 33, 41]
	supported export formats	[13, 33, 41]
	standard software interfaces	[41, 42, 51]
MONITOR	data preparation	[15, 36, 44]
	visualizing/ reporting	[9, 36, 41, 43]
C. & O.	general controlling capabilities	[9, 44, 52]
	process improvement identification	[9, 15, 35, 53]

The *planning phase* is mainly based on the allocation and use of KPIs and planning target performance. This is reflected in four closely related functional requirements we identified in this phase. The first requirement describes the availability of a KPI repository within the PPM tool to provide the ability to find and identify default KPIs. The second requirement reflects the availability of different KPI dimensions to enable the user to manage process performance in many contexts. To allow the user to measure what, when, where, and how he needs to, the third requirement contains possibilities to define measurement parameters. This phase's last requirement is the definition of target values for KPIs as planning target performance is one necessary step in the planning phase. (cf. [4, 44]).

The *implementation phase* represents the technical aspects of the PPM-cycle. According to our research it consists of four functional requirements. As data collection and data analysis are necessary in this phase we transferred the need for supporting various database systems, and import as well as export formats into three different functional requirements [13, 41]. Interfaces to standard software were another functional requirement we identified to provide flexibility in different enterprise architecture contexts [41].

Monitoring is one of the major reasons for implementing PPM software in companies as it visualizes the actual process performance to a broader audience. It also allows to compare performance over processes, organizational units, and time. We derived two sets of functional requirements in this phase: Data preparation and visualizing/reporting. The first one covers the question on how to gather and prepare the relevant data [15], while the latter one reflects the possibilities to present selected KPIs in the right form to the right audience [9, 41].

The last phase of the PPM-cycle is called *controlling and optimization* (C. & O.). Its main goal is to improve process performance by rolling out appropriate courses of action. Besides general controlling capabilities to help with decision support we found the actual identification of process improvements as the other main functional requirement in this phase [9, 15, 35, 53].

The next step was to operationalize the mentioned functional requirements to evaluate PPM tools with regard to their support of the five PPM-phases. Therefore, we developed a set of measureable evaluation criteria representing each of the functional requirements. These criteria were derived from the two literature reviews used to identify the functional requirements and a third literature review on tool evaluations. Thus, they represent a combination of well-established criteria used in other tool evaluations and extracted information from either research papers or case studies. Criteria found in the literature reviews concerning adjacent fields of PPM were evaluated, adjusted if necessary, and consolidated accordingly. The final list of 74 resulting criteria for operationalizing each of the functional requirements is presented in *Table II*. It was used for the PPM tool evaluation described in *section IV*.

To provide an insight into the reasoning behind our criteria list we will shortly discuss the suggested evaluation criteria for one of the functional requirements for each PPM-phase:

The evaluation criteria for the functional requirement *process modeling capabilities* in the modeling phase are mainly based on criteria used by existing evaluations for process modeling tools. We identified the criteria *ability to create a process map, ability to model interfaces to other processes, definition of process inputs, definition of process outputs, definition of relevant organizational units* as the main criteria for operationalizing this functional requirement.

To operationalize the functional requirement *availability of different KPI dimensions* in the planning phase we used generally accepted performance dimensions, mostly adopted from the Balanced Scorecard or other methods. The consolidated list of our suggested KPI dimensions consists of *process quality, process time, process costs, customer satisfaction,* and *service level agreements*.

In the implementation phase we operationalized the functional requirement *supported export formats* by widely accepted and standardized file formats mentioned in tool evaluations we reviewed. We found *XML, BPEL, XPDL, PDF, HTML, graphics, MS Office formats* as the most relevant ones.

The list of criteria for the functional requirement *visualizing/ reporting* in the monitor phase generally consists of evaluation criteria found in industry reports for BI tools. We selected the following ones: *visualize actual/target processes, show status of KPIs, display thresholds, automatic distribution of information, generate reports/cockpits, export reports*.

The functional requirement *process improvement identification* in the control and optimize phase was mainly operationalized by criteria derived from case studies. We identified the following criteria to be helpful for the evaluation: *identify processes with impact on core competences, process*

benchmarking, measurement of effort and chance of success, identification of process capacity, simulation.

We are aware that the criteria derived cannot be complete in every aspect and business situation. However, we think that the criteria list represents a valuable and reasonable basket to support practitioners with their tool selection process.

TABLE II. EVALUATION CRITERIA FOR OPERATIONALIZING THE FUNCTIONAL REQUIREMENTS

Functional requirement	Evaluation criteria
process modeling capabilities	create process map, interfaces to other processes, definition of inputs, definition of outputs, definition of relevant organizational units
supported process modeling notations	BPMN 1.1/1.2, BPMN 2.0, UML, (e)EPC
availability of a KPI repository	KPI database available, guided wizard for predefined KPIs, KPI filtering
availability of different KPI dimensions	customer satisfaction, process quality, process time, service level agreements, process costs
definition of measurement parameters	measurement points, measurement time, measurement cycles, measurement methods, measurement data base
definition of target values	best-practice KPI thresholds, automatic control of thresholds, statistical methods to determine thresholds, automatic calculation of thresholds
database systems support	Oracle Database, MSSQL-Server, IBM DB2, MySQL, PostgreSQL
supported import formats	XML, XPDL, BPMN, MS Office
supported export formats	XML, BPEL, XPDL, HTML, PDF, graphics, MS Office
standard software interfaces	SAP, MS Visio, ARIS, ADONIS
data preparation	aggregation of data at different levels, monitoring in real-time, "early-alert"-system for critical development, drill-through data to different levels, data historization
visualizing/ reporting	visualize actual/target processes, show status of KPI, display thresholds, automatic distribution of information, generate reports/cockpits, export reports
general controlling capabilities	identify process weaknesses, display cause and effect relations, display influencing factors, simulation, display sequences and frequencies, display variants and branches, identify workflows, benchmarking, time comparisons, display conflicting objectives, forecasting, documentation
process improvement identification	identify processes with impact on core competences, process benchmarking, measurement of effort and chance of success, identification of process capacity, simulation

IV. VALIDATION OF THE CRITERIA LIST AND TOOL EVALUATION

A. Market analysis, tool selection, and data gathering

In a first step we conducted a *market analysis* to identify potential tools in the PPM field. Since we were unaware of any research evaluating PPM tools, we started off by analyzing research studies from adjacent fields. We did not focus on any geographical area and considered all major tool evaluation studies available (cf. [15, 16, 18, 26]; see *section III.A*). The examined areas of interest initially included BPMS, business process modeling tools, PPM tools, WfM systems, business process simulation tools, and BI tools. Since all of these six

categories either fully or partially covered our requirements presented earlier (see *Table I*), the market analysis identified these categories of tools as potentially supporting PPM.

TABLE III. SELECTED TOOLS FOR THE EVALUATION (BY PRODUCT NAME)

Product name (version)	Vendor name	Vendor Website
ADONIS (4.0)	BOC AG	*www.boc-group.com*
ADOscore (3.0)		
analystView/ managerView/ processView (3.0)	Global 360 Inc.	*www.global360.com*
ARIS PPM (5.1)	Software AG	*www.softwareag.com*
BONAPART (6.0.1)	BTC AG	*www.btc-ag.com*
hyScore (4.8.5.3)	hyperspace GmbH	*www.hyperspace.de*
Income NG	SYNLOGIC AG	*www.synlogic.ch*
Living Systems Process Suite	Whitestein Technologies	*www.whitestein.com*
OfficeTalk (4.73)	JOOPS Informationstechn ik GmbH	*www.joops.com*
Process Editor/ Process Analytics (5.0)	Signavio GmbH	*www.signavio.com*

We then started the *tool selection*. First, we dismissed all tools from the BI category because they did not provide a clear process view. This restriction narrowed the number of tools down to 42. We contacted the corresponding vendors and offered them to participate in our evaluation. We received feedback from 15 vendors. Six stated that they perceived that their tool did not fit into the PPM category and therefore chose not to participate. We contacted the remaining nine vendors again and provided them with the evaluation checklist. Three vendors chose to evaluate more than one tool: BOC AG individually evaluated two tools, while Global Inc. 360 and Signavio GmbH evaluated their set of tools in one evaluation checklist. This led to a total number of ten participating tools in the evaluation. We will use the following synonyms in this paper: Global 360 for *analystView/managerView/processView*, LSPS for *Living Systems Process Suite*, Signavio for *Process Editor/ Process Analytics*. An overview of the vendors and their corresponding products is presented in *Table III*.

For the *data gathering* we implemented a checklist based on the criteria presented in *Table II* using MS Excel. Besides the functional criteria we added general (e.g. product/vendor name) as well as technical (e.g. system requirements, system architecture) criteria to the checklist. Each of the 74 criteria was named and enriched with hints for clarification. We only allowed a binary answer for each criterion (yes/no), but offered the possibility to provide additional comments. We also offered a text field for general comments on the tool at the end of the checklist. We provided the checklist to all vendors and contacted them personally by phone or e-mail to explain the self-evaluation process and the criteria in detail to prevent any misinterpretation. After receiving all ten criteria checklists, we analyzed the comments and adjusted the checklists if required.

For the *evaluation of the PPM tools* we analyzed the adjusted criteria lists for each tool. For the data analysis, we did not use any weights on the criteria or PPM-phases since the importance of each criterion differs with the circumstances a company is facing when it plans to implement a PPM tool. Thus, a practitioner has to define individual weights for each criteria based on his or her main goals during the tool selection.

B. Results and discussion of the tool evaluation

As mentioned earlier, we want to provide practitioners with a set of criteria to evaluate tools to support their PPM initiatives. As a direct consequence, one goal of our research is to validate the suggested criteria list. Therefore, we use it to determine to which extent the functional requirements of the five PPM-phases are fulfilled by the tools selected in *section IV.A.* Additionally, we are interested in the different positioning of the tools in the market. We therefore analyze the functional requirements of the tools based on our criteria checklist by focusing on criteria that fragmented our sample. Consequently, we then suggest tool types that fit well for certain business situations. Based on the vendors' responses to our evaluation checklist, we analyzed how the individual tools covered every single one of the five phases of PPM.

The ten evaluated tools represent a variety of tools developed and marketed for PPM and adjacent fields. Thus, a closer look at the tool categories seems to be helpful. Process modeling tools like ADONIS, LSPS, and Signavio outperform in the modeling and implementation phase. Marketed as a BPMS, the Global 360 toolset is expectedly strong in modeling and implementing, but ranks lower on controlling and optimizing. IncomeNG has its benefits in monitoring, implementing, and controlling & optimizing. Software marketed as PPM tools include ADOScore, ARIS PPM, and hyScore. ADOscore is one of the stronger planning tools but shows a relatively low coverage in the control & optimize phase in the competition. ARIS PPM is strong in the monitor phase and the control & optimize phase while having a relatively low criteria coverage in the other phases. The rather low average coverage of the two PPM tools may be surprising at first. However, considering that both of these tools are stand-alone extensions for the respective modeling tools ADONIS and ARIS explains their lack in modeling capabilities. Hyscore has a strong focus on performance measurement and performs well in the monitoring phase, too. OfficeTalk is strong in the monitoring phase being a WfM system that is able to monitor its own workflows. BONAPART is focused on modeling and controlling & optimizing which is not surprising since it has a process modeling history.

When looking at the criteria coverage by PPM-phase for all tools in our evaluation, we see an average range from 72% (*Plan*) to 82% (*Monitor*) with a total average of 75% of covered criteria over all PPM-phases. This demonstrates that the 'average' tool on the market covers approximately three out of four criteria of the most relevant functional requirements. This concludes that the available tools support PPM in a reasonable manner but there is still room for improvement.

As we did not perform a weighting of the criteria or the PPM-phases, looking at the average criteria coverage only can be misleading. Thus, analyzing the tool support within the five PPM-phases and their support of the individual functional requirements is required, especially when trying to find the best fitting tool types for specific business situations.

We first looked at the *modeling* phase. Its criteria coverage over all the tools averages at 75%. As functional requirements this phase covers process modeling capabilities and supported process modeling notations. The criteria for process modeling capabilities are fulfilled entirely by all but two of the tools. One is ADOscore, which does not need to provide the functionality of the sister product ADONIS, and the other one is hyscore, a web based tool primarily designed for Balanced Scorecards that does not offer extensive process modeling capabilities at all. When looking at the supported process modeling notations we see more variance in our evaluation. Three tools (ADONIS, ADOscore, Signavio) provide support for all the four evaluated notations. A broad support for a wide range of process modeling notations seems to be missing for the remaining tools as they specialize on either the BPMN notations or the other two notations (UML, (e)EPC), or even use their very own notation (hyScore, Synlogic). Interestingly, BPMN 2.0, by many seen as an international industry standard for business process modeling, is only supported by five of the evaluated tools (ADONIS, ADOscore, OfficeTalk, Signavio, LSPS). As a result, practitioners evaluating PPM tools need to check if there is a specified process modeling notation used in their company first. If only a few notations are supported, a PPM tool could also be used as a means to define a standard process modeling notation within a company. Afterwards, they can determine if the PPM tool is needed to model business processes or if a process modeling tool already exists and all that is needed is to import and export process models to and from the PPM tool.

The *planning* phase mainly concerns KPIs and is less fragmented than the modeling phase. Its average coverage is the lowest of the five phases with 72%. All three criteria concerning the functional requirement availability of a KPI repository are fulfilled by ADOscore and LSPS only. While KPI filtering is offered by nine of the ten tools, a KPI database as well as predefined KPIs are only provided by four of the tools. Predefined KPIs are solely offered by tools that positioned themselves as PPM-tools (ADOscore, ARIS PPM) or BPM suites (Global 360, LSPS). The functional requirement regarding the availability of different KPI dimensions is completely fulfilled by all but three tools (ARIS PPM, BONAPART, Signavio) which lack customer satisfaction as a measurement. The third functional requirement, the definition of measurement parameters, is covered by all but two tools. These tools are either marketed as modeling (BONAPART) or WfM (OfficeTalk) tools and therefore serve a different purpose. The functional requirement regarding the definition of target values is more fragmented, especially when it comes to best-practice thresholds (only supported by ADOscore, Global360 and OfficeTalk), or statistical methods to determine these thresholds (four tools). It seems that generating best-practices based on actual or historic values or by applying statistical procedures is a functional requirement that is not very common in regards of tool support as its criteria coverage only averages at 48% among the evaluated tools. To summarize the analysis of this phase we can state that selecting tools specifically marketed as PPM tools is a good starting point for a tool evaluation when KPIs play a central role in the practitioner's company. Selecting a tool that provides a KPI repository helps preventing errors in KPI definition and enables PPM novices to start out with a validated set of KPIs to choose from. If a broad variety of KPIs are not the focus of the PPM initiative, choosing any of the tools is appropriate since they all offer similar functionalities in this phase.

The *implementation* phase is based on criteria relevant to database systems support, supported import and export formats, and standard software interfaces. Its coverage averages at 76%. Fragmentation of the criteria coverage among this phase is the lowest of all five PPM-phases. While differences in supported import and export formats are hard to find except for BPEL and XPDL, we see a higher variance in supported databases and standard software interfaces. All tools support commercial database systems rather than open source ones; Microsoft SQL Server is the only database supported by all tools followed by Oracle and DB2 with eight supporting tools. By definition this phase is the one most dependent on the individual business context when evaluating PPM tools. If certain import or export formats are required to integrate the PPM tool into the company's IT landscape, then those criteria are decisive. The number of supported databases ensures the flexibility in accessing and handling multiple data sources.

Functional requirements in the *monitoring* phase concern data preparation, and visualizing and reporting. Both are covered to a large extent by all tools but BONAPART. The average criteria coverage is 82%, which is the highest average of all five phases. Seven of the ten evaluated tools cover more than 80% of the defined criteria in this phase. Most of the differences between the tools in this PPM-phase can be spotted in the area of data preparation. A closer look reveals the ability to monitor and use data in real-time as the main distinguishing criterion within the tools. Only four of the ten tools (GLOBAL360, OfficeTalk, Signavio, LSPS) support the respective criteria, because most of the tools in our evaluation stem from the process modeling field. As real-time monitoring is a complex task and requires direct access to operational systems, tools either need to handle their own workflows or offer powerful integration capabilities. The evaluation criteria for the functional requirement visualizing and reporting is fully covered by all but three tools (ADONIS, BONAPART, Signavio). The missing criteria are KPI related or concern the automatic distribution of information. From a practitioner's point of view the monitoring phase seems to be quite important in the PPM cycle. However, basically all of the evaluated tools provide sufficient functionality regarding the visualization and reporting of KPIs. The main differentiation point between the tools can be found in the functional requirement of data preparation, especially concerning real-time analysis. If this functionality is required in the business scenario, e.g. when monitoring high-volume transactions in certain industries like banking, and none of the already existing tools is covering this task, taking a closer look at these criteria might be appropriate.

The criteria coverage of the *controlling and optimization* phase averages at 74% and shows a fragmentation into two clusters, containing seven and three tools respectively. The segmentation between the two clusters can be identified in the evaluation criteria regarding both functional requirements general controlling capabilities and the identification of process improvement. In the first functional requirement the main distinguishing criteria are display cause and effect relations, conflicting objectives, and forecasting. However, these criteria cannot explain the segmentation of the tools for the most part. The criteria operationalizing the functional requirement concerning the identification of process improvement can serve as a discriminant though (e.g. identifying process capacity).

The three lowest performing tools (ADOscore, hyScore, Signavio) in this functional requirement also possess the lowest coverage in the controlling & optimization phase in total.

By looking at the numbers of the individual PPM-phases we see that the *monitoring* phase is the one with the highest criteria coverage of all tools followed by the *implementation* phase. The *modeling* phase seems to be the most diverse one, as some tools have a process modeling background while others do not (want to) focus on this topic. The *controlling and optimization* phase accounts for the second lowest average criteria coverage. The lowest overall coverage in the *planning* phase can be explained by the weakness of most of the tools regarding KPIs and target value definition.

V. CONCLUSION AND FURTHER RESEARCH

Planning, monitoring, and improving process performance are some of the main challenges companies are confronted with in today's competitive markets [26]. While on the one hand practitioners require strong tool support to solve the arising objectives, there is no profound practical or theoretical knowledge as to which functions these tools need to implement and on how to pick the right tool for the company's individual circumstances. With this paper we addressed these two issues.

We first extracted functional requirements of an idealized PPM tool from literature by combining the results of three literature reviews into a detailed list of the most relevant functional requirements that tools should provide in each of the five phases of the PPM-cycle. We operationalized these functional requirements by deriving a list of evaluation criteria from literature to enable practitioners to evaluate PPM tools.

In addition, we used this criteria list to evaluate available tools marketed towards PPM or adjacent fields. The self-evaluation of the tool vendors revealed a heterogeneous tool market as the criteria coverage was diverse in each of the five PPM-phases for our sample of ten tools. While some of these results were to be expected due to the fact that the evaluated tools have different historical and thematic backgrounds, it still shows the need for practitioners to identify their requirements before picking a tool for implementation. Our results can serve as a starting point for practitioners in a tool selection process as well as for tool vendors in their future tool development.

Selecting the appropriate tool for a certain business context can be a tough challenge. Our criteria list provides a blueprint for a (weighted) criteria list and a guidance in the tool selection process. Even though a tool evaluation is highly dependent on the conditions of the company introducing PPM, we identified a set of generalized selection criteria for practitioners. When business process modeling is not actively performed in the company, focusing more on the functional requirements of the model phase seems to be appropriate as modeled processes are the basics for a successful application of PPM. If the focus of the PPM initiative is to provide KPIs to a broader audience, the functional requirements of the monitoring and planning phases should get more attention in the evaluation process. If the PPM tool needs to be integrated into a determined IT infrastructure, the functional requirements of the implementation phase need to be considered especially. When focusing more on process improvement initiatives, then the functional requirements of the controlling an optimization phase should be emphasized.

We are aware that the self-evaluation by the tool vendors may lead to overvaluation of their own tools. For further research, we could define a use case that vendors would have to implement with their tools to reduce uncertainty arising from the self-evaluation based on the criteria list. While this process would improve the validity of the evaluation, it would require a heavy workload and commitment from both the vendors and the researchers. The lessons learned from looking at the vendors' perspective on solving a given showcase problem could be worth the effort since it could be used for creating case studies which would thus serve research again. A last restriction of our research is the limited validity of our presented results in view of the ongoing development of the evaluated tools as new versions of some of these tools are released regularly. A re-evaluation of the newer versions could identify current developments in PPM software, especially when compared to the results of this evaluation. However, the actual evaluation of the tool market was not the primary goal of this paper, but was used to validate the functional requirements and their operationalization though the criteria list.

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2.3 Beitrag 3: Enterprise Social Networks: A Literature Review and Research Agenda

Der dritte Beitrag fokussiert die internen Stakeholder im Rahmen der zweiten Zielsetzung dieser Arbeit. Der Einsatz eines ESN zur Verbesserung der Kollaboration im Unternehmen kann das BPM unterstützen (siehe Abschnitt 1.1). Da der Begriff ESN und die dahinterliegende Technologie noch nicht sehr lange existiert, entwickelt sich die Forschung zu diesem Themengebiet erst seit wenigen Jahren. Dies hat zur Folge, dass sich größtenteils Fallstudien unter den wissenschaftlichen Publikationen finden. Auch der Begriff des Phänomens ESN in der Literatur ist noch nicht eindeutig besetzt. Daher beschreibt dieser Beitrag ein umfassendes Literature Review. Neben der Identifikation und Einordnung der verschiedenen Begriffe gibt dieser Beitrag auch einen Überblick über alle in den Top-30 Journals und den Top-10 Konferenzen veröffentlichten Publikationen zum Themengebiet ESN in den Jahren 2004-2015. Zur Einordnung der einzelnen Beiträge wird ein Framework mit den beiden Dimensionen „Untersuchungsobjekt" und „Status der ESN-Implementierung" entwickelt. Aus den identifizierten Beiträgen wird eine Forschungsagenda entwickelt, die sowohl den aktuellen Stand der Forschung als auch den zukünftigen Forschungsbedarf zum Thema ESN ableitet. Damit befasst sich dieser Beitrag mit der dritten Forschungsfrage:

Forschungsfrage 3:

Wie ist der Begriff ESN definiert, was ist der aktuelle Stand der Forschung und welche zukünftigen Forschungsthemen zu ESN werden in der Literatur adressiert?

Titel	Enterprise Social Networks: A Literature Review and Research Agenda
Autoren (Anteile)	*Benjamin Wehner,* **Christian Ritter***; Susanne Leist* (45% - **45% -** 10%)
Veröffent- licht in	Computer Networks - Special Issue on Social Media Networks in Business
Ranking	Impact Factor (2015): 1.446 / 5-Year Impact Factor (2015): 1.903
Status	Angenommen
Link zum Journal	http://www.sciencedirect.com/science/journal/13891286/

Tabelle 4: Details zu Beitrag 3

Enterprise Social Networks: A Literature Review and Research Agenda

Benjamin Wehner, Christian Ritter, Susanne Leist
benjamin.wehner | christian.ritter | susanne.leist@wiwi.uni-regensburg.de
University of Regensburg, Universitätsstraße 31, 93049 Regensburg, Germany

Abstract

Enterprise Social Networks (ESNs) have been receiving increasingly more attention in academia and practice over the past years. ESNs are implemented to improve collaboration among employees and to foster knowledge management by capturing tacit knowledge, among other reasons. However, ESNs do not always fulfill the companies' expectations and consequently companies question their investment. Due to the growing popularity of ESNs in practice and the still unanswered questions of how to ultimately achieve ESN success, a growing number of researchers have started to analyze the ESN phenomenon, leading to a steadily growing number of publications in a variety of outlets. However, research groups are not in accordance yet on what terminology to use for the given phenomenon. This shows that the young research field of ESNs is still in development. To support future research and practice, we perform a literature review to answer three research questions: first, we analyze which terms for the phenomenon of ESNs were used and which term tends to be accepted by the community recently. Second, we analyze ESN publications regarding the addressed topics to provide a state-of-the-art in regard to ESN research. We elaborate a framework using the dimensions ESN implementation status and focus of investigation to structure the publications and to provide a comprehensive overview of the research topics. Third, we identify areas of future research on the basis of the current publications and trending topics.

Keywords: Enterprise Social Network, ESN, framework, topic analysis

1 Introduction

With affordable and reliable internet service for everyone and information technology evolving quickly, the first digital natives, also referred to as 'Generation Y', have been exposed to technology and the internet from early childhood. As a result, they are technologically savvy and are used to applying technology, especially for communication [1]. The resulting communication needs were fostered by the emergence of Social Media at the turn of the millennium [2]. By entering the workforce, Generation Y started to transfer their communication habits and their demand for Social Media into the workplace [3] and are expecting their employers to provide technology to fit their 'social needs'. As a result, large corporations have started to implement Enterprise Social Media in their portfolio of IT applications, e.g., Henkel, one of Germany's largest companies in the chemical industry, introduced the Enterprise Social Network 'Yammer' at the end of 2015. According to Henkel's CEO Kasper Rorsted, Yammer's introduction at Henkel was a result of the rising expectations of Generation Y employees. They are socially connected via Snapchat, Facebook, or Instagram in private life and also expect this in their professional life [4]. As Generation Y is now slowly taking over the responsibility of making strategic business decisions as newly promoted managers [5], they will define the future use of Social Media in the business world in the upcoming decades.

Enterprises introduce Social Media for various reasons, e.g., to improve innovation management [6] or to provide social collaboration [7]. Examples of well-known Social Media platforms are Online Social Networks (OSN) like Facebook or Google+, Microblogging platforms like Twitter, or video sharing platforms like YouTube. However, companies also use Social Media platforms specifically designed and implemented for their internal use. An example for a class of internal applications are Enterprise Social Networks (ESNs), which

represent the in-business counterpart to OSN. ESNs support companies with providing new use cases for their workforce as they expect benefits from ESNs by supporting collaboration, strengthening social connection, fostering situation awareness, and facilitating knowledge management [8]. Additionally, ESNs also pave the way for companies to extend their efforts regarding *"crowdsourcing, open innovation, or the inclusion of external experts in internal processes"* ([9], p. 151).

ESN adoption in enterprises has accelerated over the past years as customer-driven social technologies like OSN cannot provide necessary enterprise collaboration capabilities (e.g., document storage, knowledge search, integration with existing communication systems) [7]. Market research has been showing a significant rise in ESN investment recently. For example, IDC's February 2013 Social Business Survey mentions an ESN adoption rate of 79% among all respondents. Between 2014 and 2019, the worldwide revenue of ESN software is expected to more than double [10]. However, ESNs do not always fulfill the companies' expectations as usage often dwindles after an initial spike and companies question their investment [11].

Due to the growing popularity of ESNs in practice and the still unanswered questions of how to ultimately achieve ESN success, a growing number of researchers have started to analyze the ESN phenomenon. Multiple research groups have evolved over the last years contributing to this topic. These groups have mostly been focusing on their own ideas and definitions. Thus, to get the state-of-the-art about literature on ESNs, a literature review including a detailed topic analysis is necessary. Further, to structure articles in regard to ESNs, we develop a general framework to classify all literature dealing with ESNs containing the two dimensions *focus of investigation* and *ESN implementation status*. Both the detailed topic analysis and the framework are the basis to identify gaps and redundancies in current research, which enable us to define a profound research agenda. As a result of the problem statement, our paper addresses the following three research questions:

RQ1: Which terms and definitions referring to ESNs does the IS community apply?

RQ2: What topics are currently addressed in IS research on ESNs? How can these topics be classified in a framework?

RQ3: What are the main topics for future research on ESNs and what would a research agenda look like?

We address these three research questions by conducting a systematic literature review applying the well-established method of Webster and Watson [12]. It is followed by a qualitative analysis of all identified literature according to Mayring [13]. This leads us to a universal framework for ESN research, ultimately resulting in a proposed research agenda for the field of ESNs.

The paper is structured as follows: Section 2 introduces definitions, our research methodology, related work and a new framework for structuring ESN research. Section 3 presents the results of our literature review and highlights the most interesting findings concerning current research topics. In section 4, we analyze and discuss further research questions raised by literature. The paper closes with a conclusion in section 5.

2 Research Method and Application

2.1 Terms and Definitions

Social Media can be classified as „ *...a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content*" ([14], p. 61). These internet-based applications incorporate blogs,

social networking sites, collaborative projects, content communities, virtual social worlds as well as virtual game worlds [14]. The term Social Media is strongly associated with platforms for private use. However, Social Media has also gained increasing attention in the business world recently. Social Media applied by an enterprise is referred to as Enterprise Social Media (ESM) (cf. [15]). ESNs platforms typically combine multiple social technologies with the goal to support collaboration among business users and can thus be defined as *"web-based platforms that allow workers to (1) communicate messages with specific coworkers or broadcast messages to everyone in the organization; (2) explicitly indicate or implicitly reveal particular coworkers as communication partners; (3) post, edit, and sort text and files linked to themselves or others; and (4) view the messages, connections, text, and files communicated, posted, edited and sorted by anyone else in the organization at any time of their choosing"* ([16], p. 2).

According to Turban et al. [17], there are five general approaches of how companies can apply ESM: (1) using publicly available Online Social Networks (OSN), (2) introducing internal Enterprise Social Networks (ESNs), (3) creating enterprise-owned, publicly accessible social networks, (4) enhancing existing communication technologies (e.g., e-mail) with social functionalities, or (5) developing tools that include capabilities to support social networking applications. Consequently, the term ESM is twofold: On the one hand, ESM entails the use of any of the publicly available Social Media platforms for the purpose of marketing, recruiting, and the like (cf. [15, 18]). However, while customer-facing Social Media platforms (e.g., Facebook, Twitter, LinkedIn, Pinterest, Snapchat) aim at keeping users engaged to gather more and more of their personal data, the goal of a company when applying ESM is to increase efficiency and effectivity in accomplishing its business objectives [15]. On the other hand, ESM platforms for internal company use (e.g., ESN) typically combine multiple social technologies, e.g. microblogging and social networking, with the goal to support collaboration among business users. From a technical perspective, ESNs can be defined as *"a web-based technology that supports users' contributions of persistent objects to a shared pool and that enables company-wide responses to these objects"* ([19], p. 3). For clarification, Figure 1Figure 1 depicts the definition of ESM in the context of Social Media (highlighted horizontally by a dotted line).
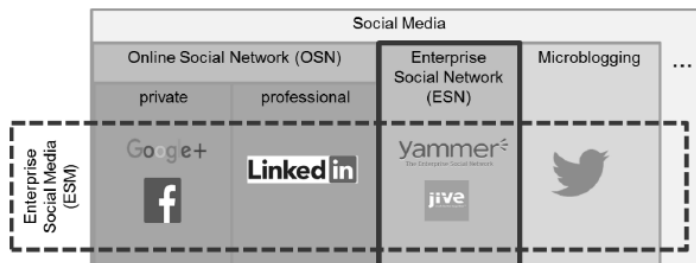
Figure 1: ESNs in the context of Enterprise Social Media

Topics regarding research on ESNs include its impact on employees' collaboration and communication, its contribution to flatter hierarchies, or its success factors [20]. As research in the area of ESNs has only started recently and is still evolving, many different terms and definitions have been developed and used interchangeably to describe the same phenomenon. This is mainly caused by different terms introduced by different research groups and the ongoing evolution of the underlying technology of ESNs and corresponding tools. We will address this issue with Research Question 1. Examples of terms used in literature include but are not limited to: Enterprise Social Software [19, 21]; Corporate Social Software [22]; Corporate Social Network [23]; Enterprise Social Networking Sites [24, 25]; Enterprise 2.0

[26]. While these terms are not real substitutes of each other, their general understanding refers to the same phenomenon and differs mainly by either the time the terms were introduced or by their initial scope. As we strive towards clarification of terms (see RQ1), we will use the expression ESN in this paper if not stated otherwise.

2.2 Related Work

Despite the fact that demand for ESN implementation has been steadily increasing over the past years [27], research regarding Social Media Networks has mainly focused on OSNs so far (cf. [20]). However, many IS researchers have been focusing on OSNs without considering the organizational context of Social Media [16]. Nevertheless, research on the use of Social Media in organizations has been continually evolving and expanding over the last five to ten years and has gained some popularity in IS research. Thus, we needed to check whether any of our research questions have already been answered by other publications recently. We therefore searched for publications that provided – in the context of Social Media – one of the following three goals: an overview of the state-of-the-art, a research agenda, or a framework to classify literature.

We first searched for publications addressing similar research questions in the context of Social Media [20, 28, 29] and Enterprise 2.0, i.e., elaborating the evolution of enterprises using Web 2.0 technologies (e.g., [26, 30, 31]). We identified the following publications:

- A literature review by Berger et al. [20] provides an overview of the state-of-the-art of OSN research. The authors describe the manifold research areas in this context, e.g., general characteristics of OSNs, or OSNs in an organizational context.
- Schlagwein et al. [28] elaborate on the unique features of social information systems and provide an overview of research topics in this particular field, e.g., crowdsourcing and viral marketing.
- Hanafizadeh et al. [29] focus on the business impacts of social networking sites used both internally and externally by organizations, e.g., to support E-Commerce and advertising.
- Williams et al. [30] describe the various key topics in Enterprise 2.0 research, e.g., strategies for Enterprise 2.0 use and barriers to adoption.

Further publications describe the application of Web 2.0 in one particular field, e.g., how to analyze the usage of Social Media tools in the different product lifecycle phases (cf. Roch and Mosconi [32]), or how to achieve one particular goal, e.g., to foster collaboration (cf. Dürr et al. [33]).

Even though these publications seemed promising at a first glance, all of them analyze literature in related fields which have a broader or different focus than ESNs. Thus, the literature analyzed in these articles can, if at all, only be reused in a very limited way to solve our research goals. This is especially true as none of it focuses on ESNs in particular. As a result, the topics in these articles are also not aligned to fit research on ESNs.

We found only one literature review conducted by Viol and Hess [34] that focuses on ESNs and classifies the articles based on a high-level topic analysis. Although the focus of this article is narrowed down to ESNs, the results of its analysis are very abstract. Their paper only describes six meta-topics, which have been defined by deductive topic identification (see [31]). In contrast to their paper, we conducted an in-depth analysis on a broader article base and induced category development (cf. [13]; see 2.3), as this is an adequate approach to obtain a clear and detailed picture of the state-of-the-art and to derive a research agenda (cf. [12]). Thus, we differ strongly from their work in terms of the method of analysis used. However, when

comparing our results (see section 3) with theirs, we see no contradiction, but instead a more detailed reappraisal of ESN research.

As mentioned earlier, we also define a framework to classify ESN related articles. Before developing our own framework, we searched for existing frameworks that we could potentially use for our research. We therefore identified four frameworks in the context of Social Media that provide similar goals to ours:

- van Osch and Coursaris [35] developed a framework for classifying organizational Social Media research providing six interrelated dimensions (artifacts, actors, activities, management, employees, external stakeholders) to deduct a research agenda. The "artifact" dimension discriminates between the various types of Social Media, e.g., virtual social worlds, blogs, or social networking sites. As our research strictly focuses on ESNs and thus on only one single Social Media artifact, this dimension cannot be applied to our research and the framework cannot be applied to answer our research questions.
- A more focused classification framework was published by Kane et al. [36]. Their 2x2-framework structures research in Social (Media) Networks using the two dimensions "explanatory mechanisms" (structure vs. content) and "explanatory goals" (user behavior vs. platform induced). Their publication strictly focuses on a framework and a research agenda for Social Network Analysis in Social Media contexts.
- Aral et al. [37] defined a framework for Social Media research containing different levels of analysis.
- Herzog et al. [19] define a conceptual framework for the evaluation design of Enterprise Social Software to support different stakeholders.

While all of these publications provide some sort of framework in the Social Media context, we could not identify any publication regarding a framework particularly developed for classifying ESN related articles. The deduction of the framework and its details will be explained in section 2.4.

The in-depth topic analysis of the current literature in combination with the defined framework enabled us to identify a well-grounded research agenda. The in-depth analysis supported our work by ensuring the originality of the identified research questions (see RQ3).

2.3 Research Method

To address the three research questions described in section 1, we conducted a systematic literature review. As such, our research is structured in accordance to Bandara et al. [38] and follows the proposed procedure of Webster and Watson [12]. To provide full transparency of our research and to make our literature review reproducible, all relevant steps (see Figure 2) are explained in detail in the following.
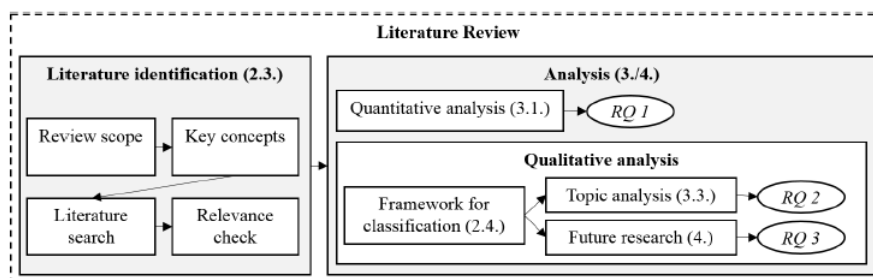

Figure 2: Research Method

First, the *review scope* is defined in accordance with the research questions (cf. [39], see section 1). Afterwards, seminal works that deal with ESNs (e.g. [15-17]) were drawn on to define key terms and to extract *key concepts* that were later on used to define the search terms and the time period for the literature search. Based on these results and the knowledge about the variety of different terms used to describe the phenomenon of ESNs (see section 2.1), we identified the most promising search terms for our literature review as presented in Table 1, e.g., 'Enterprise Social Networking'. A reasonable time period for our literature search seemed to be the advent of the first ESN related literature in 2004, which also marked the point in time where the first 'mainstream' Social Networks started to emerge (cf. [40]). Table 1 provides an overview of the search parameters of our literature review.

Search Terms (all combinations)	Enterprise	*AND*	Social	*AND*	Network(s/ing)
					Software
	Corporate				Media
	Social Intranet				
Time Period	2004 - 2015				
Search fields	Title, Abstract, Keywords (where possible)				

Table 1: Overview of search parameters

The *literature search* was conducted in two sequential steps. In the first step, we searched for relevant publications using the defined search terms and filtered the results for the relevant literature. Afterwards, we performed a backward (screening the references used in these papers) and forward search (publications that have cited these papers; cf. [41]).

To conduct a successful literature search, appropriate journals and conferences which provide high quality articles and major contributions in IS research have to be chosen [12]. To select the relevant ones, a well-known approach is referring to rankings [42]. Widely accepted rankings for the IS community are the MIS journal ranking[1] and the VHB-Jourqual 3 ranking[2]. For our selection process, we picked the 30 top journals of the MIS journal ranking and enriched this list with journals that focus on similar or adjacent topics as our research from the VHB-Jourqual 3 ranking, e.g., Journal of Computer-Mediated Communication, AIS Transactions on Human-Computer Interaction.

Further, conference proceedings are a valuable means to exchange new ideas especially in a young field (cf. [42]), which ESN indeed is. To select appropriate conferences, we referred to the VHB-Jourqual 3 ranking that lists the proceedings of the most relevant conferences in IS research. In addition to these ranked conferences, we extended our search to specialized conferences that are explicitly covering our research topic, as suggested by Koch et al. [9]. We therefore added European Conference on Social Media (ECSM) to our list, as ESN is mentioned as one of the main research topics of this conference. The complete list of the selected journals and conferences for our literature review is presented in Appendix 1.

After defining the search parameters (see Table 1), the literature search was conducted and resulted in a total of 3,825 publications initially. Then, we checked them for their relevance to our research questions (cf. [38]) based on their title, the provided keywords and their abstract. To reduce the subjectivity of the selection process, two researchers evaluated the relevance of each paper individually. The main reasons for discarding articles for the upcoming classification and topic analysis were a different focus of the article (e.g., Online Social Networks (cf. [2]), inter-firm network analysis (cf. [43])) or the application of general social media concepts in entrepreneurial settings (e.g., public microblogging used by a company (cf.

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[1] http://aisnet.org/general/custom.asp?page=journalRankings
[2] http://vhbonline.org/service/jourqual/vhb-jourqual-3/teilrating-wi/

[38]), analyzing video sharing platforms used by a company (cf. [44])). Afterwards, the results of both researchers were compared by calculating Krippendorff's alpha, which is a well-known measure to verify the reliability of agreement [45]. The two researchers disagreed on a total of 60 publications, which led to $\alpha = \left(\frac{2*(3,825-60)}{2*3,825}\right) = 0.984$. This value shows a high agreement among the two researchers, as social scientists consider $\alpha > 0.8$ as being a high value [45]. The remaining 60 disagreements were discussed with a third researcher and, in all cases, a consensus was found eventually, e.g., we eventually discarded a paper in which IT, and not an ESN as defined in section 2.1, was used as a driver for building social capital in supply chains (cf. [46]).

After evaluating all publications, we identified 99 articles as being relevant to our research questions. We extended our literature search by analyzing these 99 publications in regards to their references (backward search) and in which outlets they were cited in (forward search; cf. [41]). Hereby, we identified seven additional articles that had not been included in our collection as they were not published in the top ranked IS journals and conferences. However, all of them were either published in other peer-reviewed journals (e.g., Journal of Database Management) or conference proceedings (e.g., Mediterranean Conference on Information Systems) and contained promising content for our research questions. For this reason, we decided to add them to our literature review, which ultimately led to a final number of 106 relevant articles for a further in-depth topic analysis.

Before we could start with this analysis, we had to specify its topics. It is important to note that topics include subjects of an ESN (e.g., network structure, technologies) and/or the different perspectives of an ESN (e.g., benefits, success factors, impact), but they do not include research methods. The subsequent topic analysis in this paper is based on the concept-centric approach presented by Webster and Watson [12] and the qualitative content analysis according to Mayring [13], entailing deductive category application and inductive category development. As a starting point for the analysis, we searched through existing literature to identify potential categories. This search entailed, for example, literature on Enterprise 2.0 meta-topics [31], on categories of ESN applications [17], on advantages and disadvantages of ESN application [16], on challenges and opportunities [47], or on ESN use in companies [48]. Based on these findings, we deducted generalized categories for the qualitative analysis of our literature review, e.g., *knowledge management*, *collaboration*, and *communication* [17]. We used these categories to classify the 106 articles (deductive category application). However, not all categories addressed by the 106 publications fit into one of these initial categories as it turned out in some cases that they were too broad to comply with our approach. Therefore, we further divided them into more specialized categories (inductive category development) to which the identified topics were allocated. Then, we aligned the categories to the ESN context to clearly show the particular connection to ESNs, which ultimately led to the topics to be used for the in-depth analysis (e.g., *ESN impact on knowledge management*). We classified the identified literature and analyzed the topics addressed in these publications using the framework proposed in the next section. This classification in the framework helps to better structure and review the articles found.

2.4 Framework for classification

To structure current and future research topics derived from the 106 identified articles, we developed a framework to initially classify the articles. As a starting point for our framework, we first analyzed existing frameworks in a similar context to determine their applicability to our research question (see 2.2). We then built our framework adopting the best fitting dimensions and ideas from these frameworks to create one that supported our goals.

The first dimension, focus of investigation, rooted from various frameworks we analyzed. For example, van Osch and Coursaris [35] use management, employees, and external stakeholders and three dimensions of their framework to represent the different focus views on organizational Social media research. A similar approach can be identified in the framework published by Kane et al. [36] as they differentiate between explanatory mechanisms and goals. Aral et al. [37] use the dimension "Level of Analysis" to distinguish general layers that are important over time and do not focus on particular technologies or concepts in the rapidly changing field of Social Media. As we wanted to classify and structure the literature by the main perspective of investigation, we particularly chose their dimension, enriched it with ideas from the other frameworks and adapted it to the specific field of ESN research. As a result, our dimension consists of three distinct, but synthesizing layers, ranging from an individual user's perspective through a platform perspective to a higher-level company's perspective.

- **Individual focus**: Research focusing on employees and their direct environment. Exemplary questions are: *What are the benefits of ESNs for employees? How can we measure employee surplus generated by ESNs? How do ESNs affect user behavior? What motivates an employee to use an ESN?*

- **Technical focus**: Research focusing on software, technical aspects and functionalities. Exemplary questions are: *How should an ESN be designed to ideally meet user expectations and demands? Which functionalities increase employee acceptance? What should the introduction process of an ESN look like?*

- **Organizational focus**: Research focusing on the company level (network and effects). Exemplary questions are: *How can short- and long-term effects of ESNs on an enterprise level be measured? How is the organizational culture affected by an ESN? How should an ESN be governed?*

The second dimension of our framework, *ESN implementation status*, is adapted from the dimension *"time"* as presented by Herzog et al. [19]. While other existing frameworks use activities (e.g., Aral et al. [37], van Osch and Coursaris [35]) or content/structure (e.g., Kane et al. [36]) to classify research, we identified the implementation status of the ESN at the time of the research addressing it as the major discriminant for classifying papers, especially when trying to provide guidance to practitioners. Additionally, topics of the research will strongly be influenced by the state of implementation and will therefore allow us to distinctly classify the articles. Research will either cover specific ESN topics before (*ex-ante*), during (*ongoing*), or after implementation (*ex-post*). While the ex-ante perspective focuses on expectations of all ESN stakeholders, the ex-post perspective provides experiences and best practices.

- **Ex-ante**: All topics before the implementation of ESNs. For example: *Platform design, assessment of user requirements, alignment of business strategy.*

- **Ongoing**: All topics during or right after the implementation of ESNs (short-term perspective). For example: *Barriers during the implementation, early adopters and their influence on propagation in the company, description of implementation phases.*

- **Ex-post**: All topics after the implementation of ESNs (long-term perspective). For example: *Effects on the network structure, success measurement, organizational change.*

We combined the two presented dimensions focus of investigation and ESN implementation status into a 3x3 framework (see Table 2 and Table 3) to provide us with a structured overview of the general research focus of the extracted literature. Using the framework, we were able to classify all of the 106 publications within the two dimensions. This classification supports both

researchers and practitioners. Researchers can identify existing literature fitting their specific research, e.g., a researcher who studies the general effects of ESNs on employees will use the framework dimension focus of investigation and select literature from the three areas dealing with user focus as a starting point. For practitioners, our framework offers a substantial collection of topics related to the introduction, execution, and effects of ESNs. Thus, the framework provides a company with articles fitting the company's specific situation, e.g., a company that intends to newly introduce an ESN will foremost search for articles in the ex-ante category of the dimension ESN implementation status.

3 Results

3.1 Quantitative Results

To address RQ1, we needed to analyze terms and definitions used by the IS community in the ESN context. Thus, we first analyzed the number of articles regarding the year of publication, the publication outlet, and the publication type to gain a status quo insight in the importance of ESN research in the IS community. Next, we analyzed the terms used to describe the phenomenon of ESNs in total and over time to analyze the current terminology used in the IS community and to describe recent developments in terminology over time.

Looking at the *year of publication* (see Figure 3), ESNs can generally be classified as a young research field. With a total of only 9 publications in the years 2004 to 2009, the publication rate was expectedly rather low at the time of the first emergence of early ESN applications. From 2010 on, IS research leaned more towards ESNs as companies became more aware of ESNs and first larger scale implementations were put in place. Afterwards, the publication rate increased steadily until 2015, with one slight dent in 2013. The highest number of publications so far was achieved in 2015 with 24 articles, confirming the continuously rising interest of IS research in ESNs.
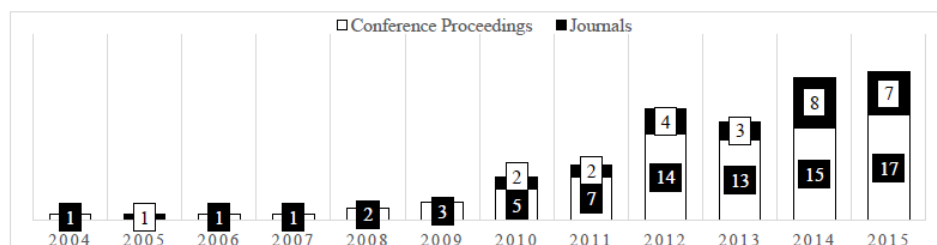

Figure 3: Year of publication

As it is to be expected in a young research field like ESNs, more articles were published in conference proceedings (75%) than in academic journals (25%) in total. In this regard, looking at the *publication outlet* in detail, we see that the top five publication outlets are solely conference proceedings (see Figure 4). However, with research advancing, the proportion of journal publications has been steadily increasing, reaching 34% in 2014 and 29% in 2015 respectively (see Figure 3). The journal with the most publications relevant to ESNs so far is BISE (4 articles), followed by I&M and ISR (3 articles each). BISE is the the journal with most articles due to the publication of a special issue with ESNs as one of the main topics. The fact that a special issue regarding ESNs has already been published shows the particular and trending interest on the topic ESN in the IS community. Given the growing publication rates in the well-established journals and conferences analyzed, we can state that the topic ESN has been established in the IS community and is considered to be an interesting and innovative

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research area. However, the share of ESN articles in relation to all publications of a conference or a journal is still low. This becomes obvious when looking at the past five years as only about 0.5% of the articles at HICSS, 1.1% at ECIS, and 0.8% at AMCIS deal with ESNs. Further, there are many journals and conferences with less than three publications only (see Figure 4). These include the International Conference on Complex, Intelligent and Software Intensive Systems (CISIS), the International Conference on E-Commerce (ICEC), and the Computer Networks Journal. This shows that the topic of ESNs is not only addressed by IS research, but also by many adjacent research disciplines due to its manifold nature, e.g., in the fields of knowledge management, collaboration, and communication [17].
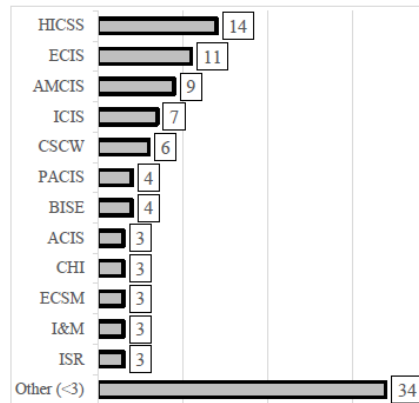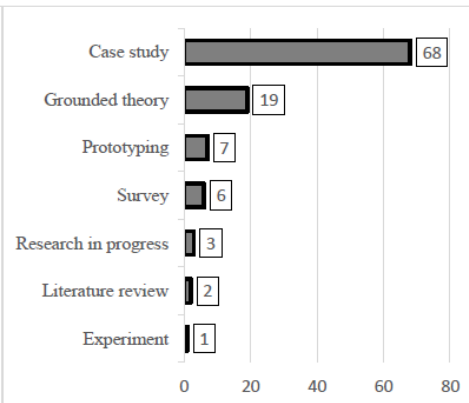

Figure 4: Publication outlets   Figure 5: Type of Articles

Looking at Figure 5, we allocated each article to one of the following types: case study, survey, experiment, literature review (cf. [49]), grounded theory (cf. [50]), prototyping information systems (short. prototyping) (cf. [51]), and research in progress. By far the biggest share of articles in our analysis are case studies (68, see Figure 5). These case studies describe how ESNs are observed in actual corporate implementations in regard to specific topics, e.g., how organizational knowledge is shared using an ESN [52] or how task performance is affected by using an ESN [53]. The category of grounded theory comprises 19 articles and analyzes ESNs from both a theoretical and practical perspective, e.g., by describing a model to assess the individual benefits of ESNs for employees [54] or by developing a measurement instrument to empirically assess influencing factors of ESN usage [55]. Most articles found are practice-driven research publications. Consequently, we only found a small number of theoretical works. According to these findings, we see a large share of articles based on single cases only that therefore lack in generalizability in their specific topics. To sum it up, we can define ESN as a research field that has large practical influence on research with a smaller share of the theoretical foundation.

In regard to the *authors of ESN publications*, we summarized the number of articles of each author and analyzed co-authorships. The 106 articles were published by 223 different authors, which amounts to an average of 2.1 authors per article. Interestingly, the seven most publishing authors account for 31 of the 106 articles (29.2%). One explanation is a high number of co-authorships that also shows that there are several distinct research groups in regard to ESNs. However, the research groups currently start to collaborate and co-publish.

In our analysis, we discovered that a lot of different expressions for the phenomenon of ESNs are used. We see the large number of different authors (223), the already mentioned different

research groups and the adjacency of ESNs to other research areas as an explanation. Additionally, an analysis of the 106 articles revealed that the terms used to describe ESNs have shifted over time. In the early years of ESN research (2004-2012), paraphrases like intranet embedding social arrangements [56] and intranet with social aspects [40], or terms like Corporate Social Network [23, 57] were used frequently. Lately, we see a shift towards the use of the term Enterprise Social Network. In fact, with 25 out of 51 publications, it is the term used most often in the last four years (see Figure 6). Further, the term ESN is used in a total of 28 out of the 106 publications and thus is the most-used expression since 2004 (see Figure 7).
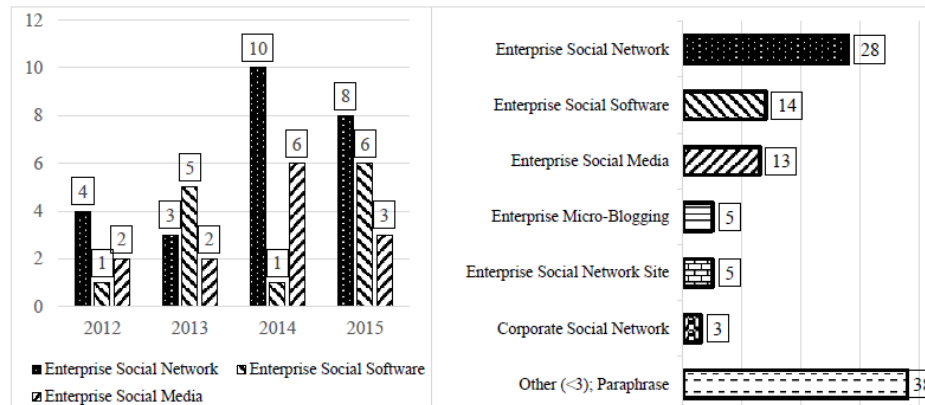

Figure 6: Most frequent used terms since 2012   Figure 7: Used terms since 2004

In summary, our quantitative analysis revealed the increasing relevance of the topic ESN in both academia (see Figure 3) and practice (see Figure 5; cf. [58]). Given the current trend, the number of publications will most likely increase further in the next years. Due to the fact that most articles use the term Enterprise Social Network and that those were published most recently (see Figure 6), we expect the term Enterprise Social Network to be the dominant expression for the future. Still, expressions like Enterprise Social Software will probably be used if an article has a more technical focus. In regard to the discrepancy between the practical and theoretical elaboration of the topic and the still young field of ESNs, we expect an increase of both theoretical and practical articles in the near future.

3.2   Classification of articles

After analyzing the quantitative results, we further investigated the articles found in regard to *RQ 2: What topics are currently addressed in IS research on ESNs?*

We analyzed the 106 articles in detail with regard to the two dimensions *focus of investigation* and *ESN implementation status* (see section 2.4) and both researchers classified them independently into our framework. Differently classified publications were discussed with a third researcher until consensus was achieved. Every publication was finally assigned to exactly one area of the framework. Table 2 shows the distribution of the articles in the nine framework areas. Regarding the dimension *focus of investigation*, we see a rather equal distribution with a tendency to the organizational perspective. Most articles deal with the implementation of an ESN on a company level (39.6%), followed by technical topics (32.1%), and employee based topics (28.3%). In contrast, the dimension *ESN implementation status* shows a diverse distribution. While articles classified as ex-ante (41.5%) and ex-post (40.6%) constitute a major part, the number of articles dealing with ongoing ESN implementation is much smaller (17.9%).

		ESN implementation status			
		Ex-ante	**Ongoing**	**Ex-post**	
Focus of investigation	**Individual focus**	12 articles 11.3%	*3 articles 2.8%*	15 articles 14.2%	30 articles 28.3%
	Technical focus	**17 articles 16.0%**	10 articles 9.4%	*7 articles 6.6%*	34 articles 32.1%
	Organizational focus	15 articles 14.2%	*6 articles 5.7%*	**21 articles 19.8%**	42 articles 39.6%
		44 articles 41.5%	19 articles 17.9%	43 articles 40.6%	**N=106**

Table 2: Classification of articles found

By analyzing the nine framework areas, we see a large discrepancy in the distribution of the research. There are only a few articles that analyze ESN implementation in regards to the individual employee (2.8%) and the organization (5.7%). Further, the ex-post analysis of technical topics (6.6%) is poorly covered by current research as well. On the other hand, there is a large number of articles analyzing the ex-post effects of ESN implementation on an organizational level (19.8%) and the prerequisites of an ESN platform before its implementation (16.0%).

On the basis of both the analysis of the two dimensions and the nine framework areas, we see that IS research has been focused on several specific areas so far, while other areas seem to have been neglected by most researchers. To gain further insight into the specific topics of each article, we analyzed the 106 articles regarding the topics they addressed (see section 0).

3.3 Topic analysis

The results of our topic analysis are presented in Table 3. It contains all identified topics in our literature review for each of the nine areas of our framework. We also appended a counter to each topic, indicating the number of publications this topic was addressed by in the particular framework area. Every publication was assigned to at least one and a maximum of three topics. The number of topics per framework area obviously varies due to the different number of underlying publications. The presented topics in each area are sorted by their number of underlying publications. When looking at the occurrence of the individual topics in the nine framework areas, we see that there are one or two mainly addressed topics of research for each area, while the framework in general shows a broad variety of topics.

When looking at the **individual focus**, *ESN usage* and *influencing factors of ESN usage* are the mainly addressed topics in publications focusing on the pre-implementation stage. Examples of the topics addressed in these publications are frameworks for companies on how to include Social Media into the Knowledge Management process [59], analyze usage practices of ESN users [60], or barriers to change when introducing an ESN [61]. Also *motivation factors of ESN usage* and *user requirements regarding ESNs* before its implementation are addressed, both laying out user expectations and providing help in designing an effective ESN implementation process. Publications addressing the ongoing ESN implementation mostly focus on *user behavior in ESNs*. They analyze why employees use ESNs in an early-adoption stage [62] and how their user behavior can be classified in in a post-acceptance stage of ESN implementation [63]. Publications focusing on the post-implementation phase address *user behavior in ESNs* most often, too. Hereby, analysis ranges from how ESN use in disperse teams affects structural change [53] to how an employee's social network affects the assessment by colleagues [64]. There are also some very specific topics that some researchers address, e.g., an analysis of user behavior in regards to *lurking* (only reading and not actively contributing to Social Media) [65] or how users' *privacy issues* affect the intention to use an ESN [66].

		ESN implementation status		
		Ex-ante	**Ongoing**	**Ex-post**
Focus of investigation	**Individual focus**	• (Intended) ESN usage (4x) [21, 54, 55, 60] • Influencing factors of ESN usage (4x) [59, 61, 67, 68] • Motivation factors of ESN usage (2x) [60, 69] • User requirements regarding ESNs (2x) [68, 70] • (Intended) benefits of ESN usage (1x) [54] • (Intended) ESN impact on collaboration (1x) [71] • ESN user acceptance (1x) [23]	• User behavior in ESNs (2x) [62, 63] • ESN impact on knowledge management (1x) [57] • ESN user perceptions (1x) [57]	• User behavior in ESNs (8x) [27, 53, 64, 65, 72-75] • ESN impact on communication (4x) [52, 74, 76, 77] • ESN usage (2x) [78, 79] • ESN impact on knowledge management (2x) [52, 77] • ESN user acceptance (2x) [66, 80] • Network structures in ESNs (2x) [75, 79] • ESN impact on collaboration (1x) [53] • Content shared in ESNs (1x) [73] • Lurking (1x) [65] • Privacy issues of ESNs (1x) [66]
	Technical focus	• Design of ESN systems (7x) [15, 81-86] • (Intended) ESN impact on knowledge management (6x) [25, 83, 84, 87-89] • (Intended) ESN usage (2x) [56, 90] • (Intended) User behavior in ESN (2x) [15, 48] • (Intended) ESN impact on collaboration (1x) [86] • Cultivation of ESNs (1x) [56] • ESN evaluation framework (1x) [19] • Innovation created in ESNs (1x) [24] • Success measurement of ESNs (1x) [48] • (Intended) ESN impact on team performance (1x) [91]	• Implementation of ESNs (3x) [17, 92, 93] • Social search using ESNs (2x) [94, 95] • Benefits of ESN usage (1x) [96] • ESN impact on collaboration (1x) [96] • Content shared in ESNs (1x) [93] • ESN impact on knowledge management (1x) [40] • Project management in ESNs (1x) [97] • ESN in SME (1x) [97] • Best practices of ESN deployment (1x) [98] • Visualization of ESN structures (1x) [99]	• Network structures in ESNs (3x) [100-102] • Success measurement of ESNs (2x) [102, 103] • ESN usage (1x) [104] • Gamification in ESNs (1x) [105] • User behavior in ESNs (1x) [105] • Visualization of ESN structures (1x) [106]
	Organizational focus	• (Intended) ESN impact on knowledge management (5x) [107-111] • (Intended) ESN impact on collaboration (3x) [107, 111, 112] • (Expected) ESN impact on organizational culture (3x) [112-114] • (Intended) ESN impact on communication (2x) [115, 116] • Influencing factors of ESN usage (2x) [117, 118] • Organizational change induced by ESNs (2x) [47, 109] • User behavior in ESNs (2x) [113, 114] • ESN usage (1x) [119] • Success measurement of ESNs (1x) [120] • ESN user acceptance (1x) [117]	• Implementation of ESNs (2x) [121, 122] • Benefits of ESN usage (1x) [123] • Governance of ESNs (2x) [123, 124] • Network structures in ESNs (1x) [122] • ESN impact on organizational culture (1x) [125] • Organizational change induced by ESNs (1x) [126]	• Content shared in ESNs (7x) [127-133] • Network structures in ESNs (7x) [134-140] • ESN usage (4x) [128, 129, 131, 141] • Organizational change induced by ESNs (3x) [130, 133, 142] • User behavior in ESNs (3x) [143-145] • ESN impact on knowledge management (2x) [132, 134] • Benefits of ESN usage (1x) [146] • Cultivation of ESNs (1x) [128] • Governance of ESNs (1x) [145] • Organizational charts deducted from ESN (1x) [140] • Success measurement of ESNs (1x) [127] • ESN tool evaluation (1x) [141] • Visualization of ESN structures (1x) [147]

Table 3: Topic analysis of articles found

The second dimension represents research topics with a **technical focus**. We identified *design of ESN systems* and *ESN impact on knowledge management* as the most popular topics in publications describing the pre-implementation phase of ESNs. *Design of ESN systems* is obviously a major topic when specifying ESNs with technological enhancements or on the basis of new requirements by the workforce. Examples in the identified literature regarding this topic vary from very general guidelines to actual implementation proposals. For example, general guidelines include how platform design affects employee relations, how it affects accessing and sharing content, how it enables users to network more effectively, and how to enable them to share and protect content effectively [15]. Other research focuses on how to implement an automatic tagging of newly posted items to enhance search and recommendation efficiency in ESNs [85]. *ESN impact on knowledge management* is another major topic in this framework area. The identified publications focus e.g., on how to find the real experts, not just managers with higher influence [87], on problems of integrating heterogeneous applications in the emergent enterprise environments [83], or on how ESNs seem to be better suited for improving performance when supporting non-routine tasks [89]. Besides these two primarily addressed topics, we also identified a great variety of 'niche' topics within our literature review, e.g., *cultivation of ESNs, innovation created in ESNs,* or *ESN impact on team performance.* The center area of our framework points out various topics addressed by researchers, with only *implementation of ESNs* and *social search using ESNs* being mentioned more than once. Implementation topics deal with the identification of the essential phases in which sense-making and appropriation take place, contributing to identifying better ways of spreading knowledge [93], or how users seem to adapt their communicative behavior to the context [17]. Social search focuses e.g., on expert finding using social influence analysis [94]. Topics only identified once include the implementation of *ESNs in small or medium-sized enterprises, project management in ESNs* or *ESN impact on collaboration.* While the last framework area described covers the actual implementation and its challenges, the post-implementation literature we identified aimed at the technical focus and mainly addressed analytical questions. We found three publications focusing on *network structures in ESNs,* e.g., analyzing cross-country user interactions in an ESN [101] or analyzing and visualizing experts in an enterprise [100]. Two publications present research in the area of *success measurement of ESNs* (e.g., metrics to measure ESN success [103]). A rather specific topic we identified dealt with *gamification in ESNs* [105].

The third row in our framework contains topics addressing an **organizational focus**. In this context, the emphasis of pre-implementation publications is not as clear as in some of the other framework areas. While we identified *ESN impact on knowledge management* with five publications as the leading topic, we also retrieved five other topics that were at least addressed by two publications (*ESN impact on collaboration/ organizational culture/ communication, influencing factors of ESN usage, organizational change induced by ESNs, user behavior in ESNs*). This wide range of different topics shows the interest of both research and practice in analyzing as many potential effects an implementation of an ESN can entail for a company. Regarding *ESN impact on knowledge management,* we identified several grounded theory publications, e.g., dealing with analyzing "*the effects of trust, risk and benefits, critical mass, and social influence on knowledge sharing intentions of employees using social media technology in the organization*" ([108] , p.1). *ESN impact on collaboration* addresses e.g., the importance of distance and frequency of relationships for knowledge exchange [107]. An example for *ESN impact on organizational culture* research was identified as the analysis of how Social Media use facilitates the socialization of newly hired employees [113]. Publications on ongoing implementation also show a wide diversity of topics. Besides the obvious topic

implementation of ESNs from a company's perspective (e.g., regarding challenges and outcomes of ESN implementation [121]), we found some otherwise hardly mentioned topics like *Governance of ESN* (e.g., Social Media Guidelines for enterprises [124]), *ESN impact on organizational culture* (e.g., the challenges when a company with an organizational culture that conflicts with ESNs still implements an ESN [125]) and *organizational change induced by ESNs* (e.g., the challenges of completely replacing e-mail communication by an ESN [126]). This can be easily explained by the fact that these topics play an important role when implementing an ESN on the enterprise level. The last remaining area in our framework contains the highest number of publications (see Table 2). Despite its variety , we could identify two leading topics with seven occurrences each: *content shared in ESNs* and *network structure in ESNs*. *Content shared in ESNs* can only be performed ex-post when actual data is available, which is why this topic was not assigned to the first two stages of the ESN implementation status. Examples for this topic include the impact of hierarchy and communication activity on user's influence in ESNs [133] or a genre analysis of employees posts within an ESN [128, 129]. An example of a *network structure in ESNs* topic is the identification of factors relating closeness between employees in professional vs. personal life [138]. *ESN usage* as a closely related topic was mentioned four times and thus entails the third most publications. An example for this topic is the identification of use cases within an ESN [141]. *Organizational Change induced by ESNs* (3x), *user behavior in ESNs* (3x), and *ESN impact on knowledge management* (2x) are the remaining topics addressed more than once. A unique topic found was the comparison of *organizational charts* with a 'hierarchy' *deducted from an ESN* [140].

3.4 Discussion of the Current State of Research

After revealing the main research topics of the 106 publications, we further examined our findings to gain more insights into the current state of research. We analyzed the topics addressed by the identified publications (see section 3.3) from a general point of view. When looking at the absolute numbers of topics addressed, we see *ESN impact on knowledge* (17) ahead of *user behavior in ESNs* (16) and *ESN usage* (14) as the TOP-3 topics in ESN research. The follow-ups are *network structures in ESNs* (12), *content shared in ESNs* (9), *design of ESN systems* (7), and *ESN impact on collaboration* (7). However, it is more interesting to analyze topics addressed over time than in total to reveal past developments and current trends. Figure 8 presents the distribution of the mentioned seven most addressed topics over the last six years (2010-2015). The publication frequency before 2010 was very low and thus would exaggerate the importance of earlier addressed topics compared to the ones after 2010.
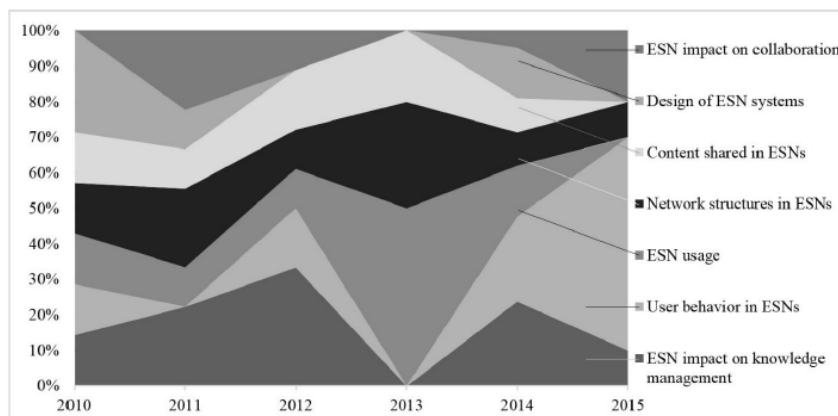

Figure 8: ESN research topic distribution over time (TOP 7 topics)

In the following, we point out some interesting patterns regarding changes in the addressed topics by researchers over time that we identified from Figure 8. For every topic described, we provide an explanation and interpretation of the pattern based on our point of view.

ESN impact on knowledge management was the main topic of ESN research in our literature review. In the early years of ESN research (2004/2005), this topic clearly dominated the publications (cf. [40, 109]). Afterwards, it has lost some importance as other topics arose when technology was advancing. However, it has been constantly regaining attention over the last seven years except for 2013. We see a rather simple explanation for this pattern: knowledge management is an essential task for today's enterprises as their knowledge must be made available to their employees in an adequate and sustainable manner (cf. [148]). Despite all research in the knowledge management field, companies have been struggling ever since to motivate employees to share their tacit knowledge with their colleagues (cf. [149]). With ESNs, this dilemma could be solved as reputation in social networks is built on knowledge sharing and communication (cf. [64, 150]). Thus, knowledge management is a continuous topic in ESN research.

Research regarding *design of ESN systems* seems to reemerge periodically, once around 2009 and once in 2014. We explain this with the successful implementation of the first enterprise microblogging platforms, e.g., Yammer was introduced at Capgemini in late 2008, and Siemens introduced their own proprietary solution in early 2009 (cf. [151]). These new developments raised an initial interest in the first decade of the millennium and thus inspired researchers to thoroughly investigate system design questions in this area in 2010/2011. After the initial hype of enterprise microblogging platforms (e.g., [119, 130]), there have only been minor advancements shortly thereafter, which is reflected in lower interest in the IS research community. Around 2012/2013, new developments of extensive 'next-level' ESNs that provided new social features and extended their functionalities from simple enterprise microblogging platforms to feature-rich social networks (cf. [151]) created new use cases and consequently led to a second, though smaller focus of IS research on design of ESN systems in 2014.

Interestingly, we see *ESN impact on collaboration* topics always occurring shortly after a high interest in *design of ESN systems* (e.g., in 2011 and 2015). We assume this coherence is related to the fact that new developments concerning ESN platforms also provide new forms and possibilities of enterprise collaboration, and thus analyzing the effects on collaboration after an initial ESN implementation seems to be an important starting point for further ESN research (cf. [53, 71]).

ESN usage has been constantly addressed over the last decade and reached its maximum of relative importance in 2013. However, the interest of researchers in this topic has diminished lately and is basically non-existent in 2015 anymore. A very similar pattern also accounts for research on *network structures in ESNs* and *content shared in ESNs*. Both topics were drivers for ESN research in the timeframe from 2011 to 2014, but have steadily been losing interest from IS researchers lately. We can explain these patterns by researchers' long-term goal to deduct design recommendations for ESNs by analyzing the users' relationships (e.g., [136]), their behavior (e.g., [144]), and their reasoning for using ESNs (e.g., [69]). After initially focusing on the analysis of network structures (e.g., by centrality metrics [24]) to identify key users [27] and the relationships among users in general ("*who*")), research went on to the analysis of content (e.g., by genre analysis [141]) to identify *what* users are sharing through an ESN. These two topics have already been addressed thoroughly, leading to a profound

understanding of *how* ESNs are organized and of how employees communicate, leaving little room for immediate further research.

The reasoning for actually using an ESN ("*why*") is covered by the topic *user behavior in ESNs*, which has gained a lot of momentum in the last two years and seems, according to our research, to be the most trending topic for researchers right now. This new focus of research can be explained by the fact that user behavior is most likely the major instrument for better understanding why ESNs are accepted or rejected by the workforce [66, 117]. Consequently, this focus hints at how to prevent ESN implementation to fail and how to explain the main factors of its successful application (cf. [103, 127]).

4   Research Agenda

After analyzing the state of the current ESN research in section 3, we now identify further research topics to support researchers in advancing ESN research. In this regard, our procedure comprises of two steps: first, we analyze the articles of the literature review to identify explicitly mentioned areas of further research. We use our framework dimension *focus of investigation* (see section 2.4) and the topics presented in section 3.3 for classifying promising areas of further research. These questions are compared to research that has been conducted in the meantime to avoid asking research questions that have already been answered. We generalized the questions to fit a broader scope to allow researchers to include their own ideas. Second, areas of further research are identified on the basis of the overall distribution of the articles (see Table 2), the topic analysis (see Table 3) and the discussion about trending topics (see section 3.4). The upcoming research questions are classified in the dimensions and topics, too.

4.1   Individual Focus

In regard to the individual focus, further research suggestions regarding the topic *content shared in ESNs* are frequently found. A linguistic analysis of content in ESNs will provide new insights into conversations [52], enables researchers to assess the different organizational rhetorical practices of different stakeholders [116] and reveals peculiarities of different types of content, e.g. messages, posts or comments [85]. In particular, different types of messages should be analyzed to assess their individual effects or to check how non-work communication contributes to work-related topics like collaboration [115]. Finally, the analysis of individual relationships will provide new insights into the dynamics of relationships [136] and the quality of relationships, e.g. as information source [74]. The topics *privacy issues of ESNs* raise questions about employee privacy, in particular regarding the reduction of privacy concerns [66], privacy in the workplace [104] and legal challenges, e.g. after privacy violations [81], the moderator effect of trust [66], and how trust influences the willingness of knowledge sharing [108]. *ESN impact on organizational culture* in its various aspects is an interesting field in regard to ESNs, too. Authors propose to gather data to evaluate cultural differences [59, 70], e.g. to assess usage differences between employees and managers [123], the influence on employees' social connectedness [144] and differences between users [104]. In addition, contextual cultural factors should be defined, quantified and their influence be evaluated [59], e.g., on socialization processes, on ESN introduction [90], and on the effects in heterogeneous teams and processes [86]. *Influencing factors of ESN usage* have already been elaborated [117]. Still, they need to be evaluated and checked for completeness in regard to specific issues, e.g., which factors motivate the abandonment of knowledge in ESNs [59]. In this regard, *ESN user perceptions* have to be further examined, e.g., the perceived usefulness and the perceived ease of use [114]. As research methods, an online survey [67] or additional case studies [68] are proposed. These will give further insights into the reasons why ESN implementations were successful or why

they failed [127]. In terms of *benefits of ESN usage* (cf. [96]) , it is necessary to structure and conceptualize the individual benefit dimensions of employees and explore the causes and relations [63], e.g., perceived fairness, turnover intentions and organizational commitment [23]. In contrast, also negative effects of ESN usage should be examined [78]. The questions that seem to be the most interesting ones are the effects on *user behavior in ESNs*. ESNs constitute a technology which affects the communication and interaction between employees. Thus, the changing behavior is one important research area [89], e.g., in taking decisions with ESNs being an additional information source [143], how ESNs affect everyday work of employees [131], which usage patterns can be identified [48], the combination between (online) relations using the ESN and (offline) relationships [141], the different behavior of employees in OSNs and ESNs [132], and the influence of the organizational network on personal behavior [142]. Furthermore, the interrelation between different user types, e.g., key users, should further be specified [27], as well as the difference between active and inactive users [52].

We realized that no study has yet analyzed the user groups of ESNs in detail. From a long-term perspective, it would be very interesting to analyze if users with different demographic attributes (e.g., age, gender, education) show a different behavior in ESN usage. Interesting research questions could thus entail if "Generation Y" [5] uses ESNs differently from previous generations, or if the ESN acceptance rate is higher among different age groups. In this regard, behavioral differences have already been identified in OSN [152] and could serve as a starting point. A correlation between general Social Media competence and the intention to use ESNs may bring further insights into how to better motivate employees to use ESNs. In addition, it would be interesting to analyze the willingness of employees to combine private and professional Social Media usage, and their connection strategies (cf. [153]), e.g., to whom employees are connected or if they are willing to use a private Social Media account to connect to their employer's ESN and share private content in that ESN. The various questions in this dimension are generalized and summarized in Table 4.

	Topic	Arising research questions
Individual focus	Content shared in ESNs	• How do linguistic practices in ESNs content influence user behavior? (cf. [52, 85, 116]) • What are the individual effects of different types of messages? (cf. [115]) • How do individual relationships shift and how can they be used for personal interest? (cf. [74, 136])
	Privacy issues of ESNs	• Which special role does privacy play for employees? (cf. [66, 81, 104]) • Which effects has trust on user behavior in ESNs? (cf. [66, 108])
	ESN impact on organizational culture	• Which cultural differences between users exist and what are their effects on further ESN topics (e.g., trust)? (cf. [59, 70, 104, 123, 144]) • How do contextual cultural factors influence ESN introduction, usage and collaboration? (cf. [59, 90])
	Influencing factors of ESN usage	• Which influencing factors of ESN usage exist and how can they be evaluated? (cf. [59, 117])
	ESN user perceptions	• What is the influence of user perception on the success of ESN implementation? (cf. [67, 68, 114, 127])
	Benefits of ESN usage	• How can benefit dimensions be framed and what are their exact causes? (cf. [23, 63]) • Which negative effects of ESNs can be identified? (cf. [78])
	User behavior in ESNs	• How is user behavior changed and how can these effect dimensions be framed? (cf. [48, 89, 131, 132, 141-143]) • Can behavior patterns in ESNs be identified? (cf. [27, 52]) • How do users with different demographic attributes show different behavior in ESNs? (cf. [152]) • How can private and business use of ESNs be usefully combined? (cf. [153])

Table 4: Further research areas on the basis of the dimension individual focus

4.2 Technical Focus

Research addressing a technical focus mainly entails questions regarding the *design of ESN systems*. Frequently, platforms have gone through a steady evolution with added functionalities over time, e.g., collaborative functionalities like wikis have been added to what initially were micro-blogging sites only [131]. Due to this collocation of different functionalities, single functionalities have to be better integrated and improved, e.g., on the basis of technological innovations [94, 129], or they have to be aligned, e.g., with a greater sensitivity to relationship facets [138]. Hence, a further evaluation of user satisfaction is necessary, e.g., by evaluating hedonic components in ESNs [103]. Besides research on current functionalities, also new functionalities will be added to ESNs, e.g., an automated assignment of team members to a new project on the basis of further metadata [139]. This metadata could automatically be gathered by implementing interfaces to other systems or by integrating external applications in ESNs [97]. To generally evaluate the maturity of an ESN, a maturity framework of the application should be developed including metrics and measures [103]. The topic *ESN impact on organizational culture* is an additional area for further research in this dimension. As ESNs are often implemented in international companies, user groups from different nations may use it. With their different intentions and values, the relationship between culture and technology has to be further investigated [115]. Possibly, an ESN should be differently designed on the basis of a shifting user group with a different cultural background.

Looking at ESN software in particular, a comprehensive tool comparison is missing. We could imagine a comparison of different ESN tools like Yammer, tibbr or Jive on the basis of a predefined set of characteristics to better support companies in choosing an appropriate tool for their individual needs (see [154] as an example). Additionally, with ESNs becoming a more and more integral part of today's enterprises, the question of how to model an ESN arises. Networks in general can be modeled using nodes and edges [155]. However, the existing network modeling notations mainly serve as a possibility to analyze the network structure, not taking into account the particular characteristics of ESN communication (e.g., what information is shared among whom). Thus, a modelling language that covers the specifics of ESNs is missing. In the field of network modeling, various tools like Gephi are available (cf. [156]). These tools provide established instruments for network analysis, which can possibly be used for analyzing several aspects of ESNs. Finally, as ESNs combine various Social Media technologies like microblogging, wikis, instant messaging and feeds, we suggest analyzing their individual usage within the ESN and their interrelated positive or negative effects on each other. The various questions in this dimension are generalized and summarized in Table 5.

	Topic	Arising research questions
Technical focus	Design of ESN systems	• What is an optimized collocation of functionalities provided by an ESN? (cf. [94, 103, 129, 131, 138]) • Which functionalities based on current needs and innovations should be implemented into an ESN? (cf. [97, 139]) • How should an ESN maturity framework look like? (cf. [103]) • Which ESN tools exist, how can they be compared, and how do they differ? (cf. [154]) • What is the individual usage of the employed Social Media technologies in an ESN and which positive and negative interrelation among them exist?
	ESN impact on organizational culture	• What is the influence of culture on the design and adoption of ESNs? (cf. [115])
	ESN modelling	• Which particular characteristics of ESNs can be modelled and how does a modelling language to model ESN look like? (cf. [155])

Table 5: Further research areas on the basis of the dimension technical focus

4.3   Organizational Focus

The third dimension, organizational focus, comprises the largest amount of arising research questions. In regard to the topic *privacy issues of ESNs*, current research has not yet provided a set of security regulations for ESNs that prevent confidential information from spilling over to competitors or the public in general [110]. *ESN impact on organizational culture* deals with the organizational change due to ESN usage, e.g., power struggles for social dominance should be explored [113]. To analyze cultural differences, data should be collected [59], e.g., to systematically analyze global challenges and check how these can be solved by ESNs [88] and to compare ESNs in different companies to solve a possible ESN-culture conflict [125]. Further, organizational cultural factors should be revealed [142], for example to uncover settings that support or hinder ESN adoption (e.g., the industrial context) [145]. Many open questions in regard to *ESN impact on knowledge management* still need to be answered, too. Authors ask for factors that activate knowledge socialization [59], e.g., organizational affordances to share knowledge [25] on the basis of the analysis of current knowledge sharing activities [115] and how non-work communication contributes to knowledge sharing [115]. Communication on a network basis gives insights into network characteristics and their effects on knowledge transfer [134] and into how cognitive and relational dimensions have influence on knowledge transfer [132]. Information quality in knowledge environments is another promising area, e.g., the analysis of the impact of knowledge requested and the quality of answers in direct messaging [132] - also referred to as tacit knowledge [117]. In this regard, the type of company (e.g., service industry, manufacturing) that takes the most advantage needs to be determined on the basis of defined parameters like knowledge intensity [60]. The topic *benefits of ESN usage* on a company level raises questions whether the benefits will be long lasting over time [122]. Some benefit dimensions, like the impact on general innovation capacity, need to be further evaluated [23]. In regard to *innovation created in ESNs*, the question of how ESNs can best be used to foster innovation management and how the innovation process can be optimized using ESNs, starting from ideas arising in direct messages or discussion boards to a final innovation, are still unanswered [24]. Further topics with less literary reference are (i) *success measurement of ESNs*, e.g., the causal relationships between ESN investment, ESN assets and ESN impacts towards organizational performance [120] or measuring productivity in system support work [61], (ii) *visualization of ESN structures*, e.g., a graphical analysis of activity graphs in ESNs [27], (iii) *ESNs in SMEs*, e.g., the impact of company size on ESN success [145], (iv) *network structures in ESNs*, e.g., examine network characteristics to facilitate ESN implementation success [102] and (v) *governance of ESNs*, e.g., analyzing further social media guidelines to set up a governance framework [124].

In this dimension some crucial aspects have not yet been investigated at all. Current publications mostly focus on data of one particular company only (e.g., [101, 118, 130]). Thus, a survey with a large number of participating companies from various industries with a sufficiently large data sample is missing. This data would deliver new insights into the challenges and best practices of ESN adoption across various companies and industries. A regulatory issue that has not yet been answered is data ownership [157]. This seems to be an important issue not only from a privacy point of view, but also in how it affects legal and strategic choices for ESN implementation (cf. [158]). For example, if a company implements an ESN and decides to switch ESN providers after a certain timeframe, how can this company migrate the data from the old into the new ESN? Is data stored in a universal data format and accessible by the company or will the old ESN provider take the company 'hostage' by withholding their data? Thus, we also suggest the investigation of a universal data exchange format for ESNs as well as the development of guidelines for both companies and ESN service

providers. A further area of research we encourage researchers to explore is the impact of ESNs on business processes (cf. [159]). Possible hypothesizes would be, for example, that ESNs increase the flexibility of the innovation process, that they can be used as a further information source in service processes, or that they support business processes with communication among distributed members. The effects of these new use cases on organizational culture (cf. [160]), e.g. hierarchy, can then be observed. The various questions in this dimension are generalized and summarized in Table 6.

	Topic	Arising research questions
Organizational focus	Privacy issues of ESNs	• Which ESN regulations prevent confidential information from spilling over to competitors? (cf. [110])
	ESN impact on organizational culture	• How do ESNs change the organizational culture (e.g., shifting power/hierarchy)? (cf. [113]) • How do ESNs support companies in solving global challenges? (cf. [88]) • Which organizational cultural factors support or hinder ESN adoption? (cf. [142, 145])
	ESN impact on knowledge management	• Which factors increase knowledge sharing among employees? (cf. [25, 59, 115]) • How can knowledge transfer be optimized in ESNs? (cf. [132, 134]) • How can tacit knowledge be manifested? (cf. [117]) • Which parameters (e.g., knowledge intensity) best support a community in regard to knowledge management in ESNs? (cf. [60])
	Benefits of ESN usage	• Will the benefits of ESNs be long lasting over time? (cf. [122]) • Which benefit dimensions exist and how can they be evaluated? (cf. [23]) • Which challenges and best practices can be identified between various industries and company sizes?
	Innovation created in ESNs	• How can innovation management be fostered on the basis of ESNs? (cf. [24]) • How can the innovation process be adapted to better utilize the advantages of ESNs? (cf. [24])
	Success measurement of ESNs	• What are the causal relationships between ESN investment, assets and organizational impact? (cf. [61, 120])
	Visualization of ESN structures	• Which insights can be observed from a graphical analysis of relationships in ESNs? (cf. [27])
	ESNs in SMEs	• What is the impact of company size on ESN success? (cf. [145])
	Network structures in ESNs	• Which network characteristics facilitate ESN implementation success? (cf. [102])
	Governance of ESNs	• How could a governance framework for ESNs look like? (cf. [124]) • Which legal and regulatory issues have to be dealt with when implementing an ESN? (cf. [157])
	ESN impact on Business Processes Management	• How do ESNs effect the design of business processes? (cf. [159]) • How can ESNs be used in business process improvement initiatives? (cf. [161])

Table 6: Further research areas on the basis of the dimension organizational focus

5 Conclusion

In our paper, three research questions dealing with ESNs were defined. The first question focused on the elaboration of terms and definitions used for the phenomenon of ESNs in the IS research community. We delineated the term ESN from others like OSN and on the basis of the subsequent analysis, we identified the term *Enterprise Social Network* to be the one used most often in general and in the last four years specifically. Thus, we expect the term ESN to be the dominant expression in the future for describing this phenomenon.

The second research question dealt with the current state of IS research on ESNs. We chose the literature review as our research method [12]. Its application resulted in 106 relevant articles

for further qualitative analysis. For the detailed analysis of the articles, we developed a two-dimensional framework containing the dimensions *focus of investigation* [37] and *ESN implementation status* [19]. This framework enabled us to classify all publications thus providing a collection of relevant publications for researchers and practitioners. Each article was further examined and classified according to its mainly addressed topics, e.g., *user behavior in ESNs*, *privacy issues of ESNs*, or *success measurement of ESNs*. By adding the topics into our framework we provide a comprehensive view of the current state of IS research in regard to ESNs. The third research question asked for topics of future research. Based on the analyzed articles, we extracted future research areas and defined specific questions, which we then classified. Further, we defined interesting questions in regard to ESNs, which were analyzed in adjacent research fields.

With our analysis, we contribute to both research and practice. To research, we contribute in three ways. We showed that there are various terms used to describe the phenomenon of ESNs and, thus, we support the community's process of term consolidation by presenting the most commonly used ones. Further, we have developed a framework, which we used to classify the current state of ESN research. Consequently, we enable researchers to directly identify which topics have been covered by research in detail so far. In addition, the identified future research areas show interesting and highly relevant questions to be addressed by researchers. Furthermore, we provide additional research ideas inspired by our literature review and enhanced with our own experiences from research and practice. From a practitioner's perspective, the large number of case studies being part of the analysis provide references for best-practices on ESN implementation and success factors. Further, practitioners can use the topic analysis in the framework to specifically search for individual topics they are currently struggling with.

However, our research is not without limitations. By its nature, a literature review only captures a snapshot of publications available at a certain point in time. In a young and trending field like ESNs (see chapter 3.1), a large number of publications is to be expected in the upcoming years requiring a continuous update of our work. Additionally, we cannot guarantee that we found all relevant articles as we may unintentionally have sorted them out during the selection process, e.g., due to the definition of the search terms. However, as two researchers conducted the search and selection process independently from each other, we reduced this issue as much as possible. Finally, we revealed that nearly one in three articles was published by a relatively small number of co-authorships, which possibly led the research of ESNs in specific directions. This fact, of course, influences our quantitative analysis, especially when comparing absolute numbers. Nevertheless, with the disclosure of all relevant details of both our procedure and analysis, we comply with well-known research methodologies that make our research replicable. Finally, we strongly encourage other authors to research in the interesting and innovative field of ESNs, which will definitely remain a relevant topic in IS research in the next years.

Appendix

Journals	Academy of Management Journal
	ACM Computer Networks/Database Systems/Transactions
	AI Magazine
	AIS Transactions on Human-Computer Interaction
	Artificial Intelligence
	Business & Information Systems Engineering (BISE)
	Computer Networks
	Communications of the ACM
	Communications of the AIS
	Decision Science
	Decision Support Systems (DSS)
	European Journal on Information Systems (EJIS)
	Harvard Business Review (HBR)
	Human-Computer Interaction
	IEEE Transactions (Software/Software Engineering/Systems, Management and Cybernetics/Computers)
	Information and Management (I&M)
	Information Systems Frontiers/Journal/Research (ISR)
	International Journal of Electronic Commerce
	Journal of the AIS (JAIS)
	Journal on Computing
	Journal of Computer and System Sciences
	Journal of Computer-Mediated Communication
	Journal of Information Technology
	Journal of Information Technology Theory and Application
	Journal of Management Systems
	Journal of Management Information Systems
	Journal of Strategic Information Systems
	Journal of the ACM
	Management Information Systems Quarterly (MISQ)
	Management Science
	Organization Science
	Sloan Management Review
Conferences	Americas Conference on Information Systems (AMCIS)
	Australasian Conference on Information Systems (ACIS)
	Computer Supported Cooperative Work (CSCW)
	European Conference on Information Systems (ECIS)
	European Conference on Social Media (ECSM)
	Hawaii International Conference on System Sciences (HICSS)
	International Conference on Design Science Research in Information Systems and Technology (DESRIST)
	International Conference on Information Systems (ICIS)
	Internationale Tagung Wirtschaftsinformatik (WI)
	Pacific Asia Conference on Information Systems (PACIS)

Appendix 1: Selected Journals and Conferences

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2.4 Beitrag 4: Assessing the Accuracy of Sentiment Analysis of Social Media Posts at Small and Medium-sized Enterprises in Southern Germany

Die Nutzung von Social Media hat sich in den letzten Jahren auch bei kleinen und mittleren Unternehmen etabliert. Insbesondere die Nutzung Sozialer Netzwerke eröffnet KMUs die Möglichkeit, ein direktes Kundenfeedback zu erhalten. Die Analyse dieser VoCs kann wertvolle Informationen zu Problemen in Unternehmensprozessen enthalten und so direkt das BPM unterstützen. Mit steigenden Nutzerzahlen steigt die Arbeitslast bei der Analyse der Kundenpost jedoch ebenfalls an. Der vierte Beitrag untersucht daher, wie hoch die Güte einer automatisierten Sentimentanalyse von Kundenposts im direkten Vergleich zu einer manuellen Klassifikation ist. Hierzu wurde für diesen Beitrag eine Extraktions- und Analysesoftware entwickelt, die Beiträge von der Facebook-Seite eines Unternehmens extrahiert, verarbeitet und im Rahmen einer Sentimentanalyse bewertet. Im Zusammenhang mit der Gegenüberstellung der automatisierten mit der manuellen Kategorisierung werden die Besonderheiten und Herausforderungen, die sich durch die Untersuchung von Kundenposts bei KMUs ergeben, beleuchtet. Damit behandelt dieser Beitrag die vierte Forschungsfrage:

> **Forschungsfrage 4:**
>
> *Wie kann die Kundenstimme aus sozialen Netzwerken extrahiert werden und wie hoch ist die Güte einer automatisierten Analyse dieser Kundenposts?*

Titel	Assessing the Accuracy of Sentiment Analysis of Social Media Posts at Small and Medium-sized Enterprises in Southern Germany
Autoren (Anteile)	*Josef Schwaiger, Markus Lang, **Christian Ritter**, Florian Johannsen* (50%-25% - **15%** - 10%)
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Tabelle 5: Details zu Beitrag 4

ASSESSING THE ACCURACY OF SENTIMENT ANALYSIS OF SOCIAL MEDIA POSTS AT SMALL AND MEDIUM-SIZED ENTERPRISES IN SOUTHERN GERMANY

Completed Research

Schwaiger, Josef, University of Regensburg, Universitaetsstraße 31, 93053 Regensburg, Germany, josef-michael.schwaiger@wiwi.uni-regensburg.de

Lang, Markus, University of Regensburg, Universitaetsstraße 31, 93053 Regensburg, Germany, markus.lang@wiwi.uni-regensburg.de

Ritter, Christian, University of Regensburg, Universitaetsstraße 31, 93053 Regensburg, Germany, christian.ritter@wiwi.uni-regensburg.de

Johannsen, Florian, University of Regensburg, Universitaetsstraße 31, 93053 Regensburg, Germany, florian.johannsen@wiwi.uni-regensburg.de

Abstract

In recent years, small and medium-sized enterprises (SMEs) have increasingly adopted Social Media technologies with the purpose of fostering the bidirectional communication with customers or to facilitate the collaboration between employees amongst each other. Thereby, customer posts in a company's Social Media channels capture consumers' current attitude towards product and service offerings or the enterprise as a whole. An automatic analysis of these posts does not only provide a firm with valuable knowledge on the customer relationship, but also frees up human resources in case the posts were screened by employees manually hitherto. However, posts in Social Media channels of SMEs are characterized by certain peculiarities such as regional slang or off-topic discussions amongst others. The study at hand investigates the impact of such characteristics on the accuracy of results received from an automatic sentiment analysis of corresponding posts. In this context, we revert to Social Media posts of five SMEs from southern Germany. The results show that an adaption of approaches used for sentiment analysis to the specific language of customers and firms is mandatory for achieving a high level of accuracy.

Keywords: Social Media, sentiment analysis, small and medium-sized enterprises.

1 Introduction

With affordable and reliable internet service for everyone and information technology evolving quickly, Social Media began to emerge massively at the turn of the millennium (Heidemann et al., 2012). According to current studies (cf. Statista, 2015a; PWC, 2012), the number of active Social Media users is estimated to be 2.44 billion worldwide in 2018. This is an increase of 37% compared to user statistics for 2015. In January 2015 alone, the social network Facebook had about 1.36 billion users and the microblogging service Twitter counted 284 million subscribers for instance (cf. Statista, 2015a).

As Social Media had developed into being a major part of communication in the private life of the majority of the young generation (PWC, 2012), many larger scale companies decided to join Social networks and microblogging platforms (cf. Gallaugher and Ransbotham, 2010). Literature presents a variety of benefits that companies may achieve by the purposeful introduction of Social Media technologies with either the individual, a team or the organization as a whole profiting (Lehner and Fteimi, 2013). For example, van Zyl (2009) points out that Social Media helps to find experts and business partners, to increase staff motivation, to accumulate organizational knowledge, to develop innovations,

and to strengthen customer relationships. Further, the creation of customer adapted services and products is emphasized frequently (cf. Mitic and Kapoulas, 2012; Ramaswamy, 2010). This is particularly important as customer requirements are rapidly changing these days due to increased market transparency (cf. Goodrich and de Mooij, 2014; Sharma and Baoku, 2013). Social Media offers the opportunity to gain insights into customers' attitudes, supports brand building and thus contributes to establishing long-term customer loyalty (Chua and Banerjee, 2013; Chikandiwa et al., 2013; Parveen, 2012).

Lately, small and medium-sized enterprises (SMEs) have increasingly started to apply Social media, too (Meske and Stieglitz, 2013; Lee et al., 2008; Durkin et al., 2013). In this context, the improved bidirectional communication with consumers, the easy access to company knowledge, and a positive impact on the company culture are particularly accentuated (cf. Meske and Stieglitz, 2013; Lee et al., 2008). Besides these benefits, the introduction of Social Media in a company is reported to be comparatively easy (Bell and Loane, 2010), which increasingly tempts SMEs to apply corresponding technologies for supporting the day-to-day business.

Though, many of the benefits associated with the external use of Social Media (e.g., strengthened customer relationship, customer co-creation of services and products) (cf. Sigala, 2012; Ramaswamy, 2010) can be traced back to a deeper understanding of customer concerns and expectations gained by applying corresponding technologies. Social Media posts, e.g., on an enterprise's Facebook page, represent the "voice of the customer (VOC)" (cf. Pande et al., 2000) and capture current customer attitudes towards products, services or the company in general. The analysis of these posts can provide valuable information on consumers' behavior and serve as a base for triggering word-of-mouth (WOM) efforts (cf. Oh et al., 2016), product development projects or business process improvement (BPI) initiatives for example. As customer posts in Social Media platforms become visible without any delay, companies can immediately analyze them and retrieve a customers' current sentiment (cf. Liu, 2012). This is a clear advantage over the collection of secondary data (e.g., quality reports), which is often outdated, or the costly and elaborate conduction of customer surveys (cf. Meran et al., 2013).

However, to fully utilize the information captured in Social Media posts, all posts have to be analyzed and interpreted. Since the amount of posts quickly rises when a company establishes a Social Media strategy, enormous human efforts are required in case the analysis is performed manually. This is a major challenge for SMEs regarding limited human resources and the lack of time available to monitor Social Media channels besides the daily routines. Contrary to large enterprises that usually create own positions for Social Media responsibles, SMEs often charge employees of their operational divisions (e.g., marketing) with Social Media efforts. As a result, these employees cannot dedicate a lot of time into monitoring Social Media channels without sacrificing their daily routine. Against this background, the necessity for an automated sentiment analysis of Social Media posts becomes evident. Several approaches (cf. Liu, 2012) and tools have been developed to fulfill this purpose in recent years (e.g., Brandwatch, SocialBench, etc.), anyway, it is a market still in the process of maturation (cf. Paltoglou, 2014). Additionally, customer posts in Social Media channels of SMEs are characterized by colloquial language, consumers' regional dialects and an industry-specific terminology amongst others. What is missing yet are profound insights regarding the accuracy of automatic approaches for conducting sentiment analyses in comparison to manually performed analyses of corresponding posts at SMEs. Due to the lack of grammatical structure and industry-related language encountered in Social Media posts we consider dictionary-based approaches as particularly well suited for the analysis. We thus post the following research questions:

- RQ1: What accuracy does an automatic sentiment analysis using a dictionary-based approach provide for posts in SMEs' Social Media channels in southern Germany in comparison to the results of a manual classification?

- RQ2: What peculiarities of the customer posts can be reverted to for explaining a potential inaccuracy of the analysis results?

By the first research question, we aim to provide a better understanding for the capabilities of established approaches for the automatic sentiment analysis to correctly assess customers' current attitudes towards

a company. In this context, we investigate Social Media posts of five SMEs from southern Germany. Generally, SMEs play a decisive role in the German economy (cf. Söllner, 2014) with 99.3% of all companies being assigned to this enterprise category in 2013 (Statistisches Bundesamt, 2015a). Especially in southern Germany, SMEs employ a majority of the workforce (cf. Söllner, 2014; Handelskammertag BW, 2015); e.g., in Bavaria 99.6% of the employees in the private sector work for SMEs (Statistisches Bundesamt, 2015a, 2015b). Nevertheless, from an economic perspective, southern Germany is also characterized by a vast amount of underdeveloped rural regions (cf. Bavarian Ministry of Agriculture and Forestry 2006). Consequently, the region of southern Germany is particular interesting for studies dealing with the application of information technology at SMEs to raise business performance. The second research question aims to uncover deficiencies of the automatic sentiment analysis and to investigate the causes for these drawbacks reverting to the characteristics of customer posts. These insights help SMEs to decide whether an automatic sentiment analysis is worth the investment of resources. Therefore, our findings are particulary interesting for practitioners disussing the potentials of Social Media introduction.

The paper unfolds as follows: in section 2, foundations on Social Media, sentiment analysis and peculiarities of customer posts at SMEs are introduced. Afterwards, the procedure of our research is presented (section 3). Section 4 highlights the result of the investigation. The results are discussed and interpreted in section 5. The paper is rounded off with a conclusion, limitations and an outlook.

2 Foundations

2.1 Social Media and Peculiarities of Posts in SMEs

Social Media entails „ ...*a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content*" (Kaplan and Haenlein, 2010, p. 61). These Internet-based applications incorporate blogs, social networking sites, collaborative projects, content communities, virtual social worlds as well as virtual game worlds (Kaplan and Haenlein, 2010). At first, Social Media was used as a way for individuals, mostly students, to maintain long-distance friendships or relationships. Many social networking sites like Six Degrees (founded 1997), Friendster (2002), MySpace (2003) and Facebook (2004) emerged by providing a solution for this need to its users. Microblogging platforms like Twitter (2006) provided additional ways to inform your friends or "followers" about your daily life events.

In today's market, Social Media technologies are increasingly adopted by enterprises integrating them with their business processes to support value-creation. SMEs can easily engage in Social Media as costs are minimal and the level of IT skills needed is low (Abed et al., 2015). For example, SMEs can benefit from using social networks like Facebook to gain positive impact, e.g., by reducing costs for customer service, by improving customer relations, or by improved information accessibility (Ainin et al., 2015). Alongside, recent studies revealed that one of the main strategic goals of German SMEs is to improve customer service (Statista, 2015b). To support this goal, direct access to customer data is required and *"...social media usage has a positive influence on information accessibility. Organizations can get information about their potential customers, their tastes, their wants easily from the conversations in the social media sites such as Facebook pages, twitter sites etc."* (Parveen et al., 2015, p. 11). However, the use of Social Media in SMEs is very diverse since the owner-managers are a heterogeneous group, e.g., in regards to their preference for face-to-face interaction with customers, or the knowledge and skills in the e-Business context (Derham et al., 2011). A major driver for Social Media adaption in organizations is identified as institutional pressure from the external environment, e.g., customers, or competitors (Parveen et al., 2015). Especially for customers Social Media is a quick and easy channel of communication that enables them to interact with a company publicly.

Social Media data commonly consists of the following elements: a username, the shared content, the time and date of the post, the self-reported location of the user, references to other users or sites, and the network of the user (Murphy et al., 2014). Posts in Social Media distinguish from other communication

in three points. First, the posts are by default either accessible by the public or at least by several members of a personal network. Hence, Social Media posts usually address more than one person. The second characteristic of Social Media posts is the shortness of the post, triggered by either technical limitations of the platform (e.g., 140 characters on Twitter) or by constraints of the user (e.g., typing a post on a mobile device on the subway). In either case posts need to be concise (Zhao and Rosson, 2009). Consequently, text economy increases, e.g., whitespaces are spared as well as words are replaced by numbers of similar pronunciation (Laboreiro et al., 2010; Petz et al., 2013). Additionally, there is a high usage of emoticons to express emotions (Pak and Paroubek, 2010; Petz et al., 2013). A third differentiation point of Social Media posts results from the meshed structure of a social network. Posts reflect this structure by adapting it, for example by allowing users to provide direct feedback to other users' posts or by offering the possibility to add references into posts (Naaman et al., 2010).

Aside from these aspects, Social Media posts show several specifics in regards to the language used. Especially non-standard language elements like emoticons (see section 4.2), "internet slang" (e.g., the expression "4u"), multiple languages within one posts, or spelling errors (e.g., "Helllllooooo") typically occur and should thus be regarded (Laboreiro et al., 2010; Petz et al., 2013). As Social Media posts can be created on many different devices without the ability of spellchecking, an increase of spelling mistakes can be observed (Laboreiro et al., 2010; Naaman et al., 2010).

Beside these general characteristics of Social Media posts, there are some additional peculiarities of posts relating to SMEs in southern Germany that influence the content and structure of the posts. SMEs usually show a limited regional presence (Durkin et al., 2013; Lee et al., 2008). This typically results in a more direct communication between the companies and their customers and employees (Durkin et al., 2013). This stronger relation can also be observed in corresponding Social Media posts, which often address specific products, services or local events hosted by the companies. While little research has been focusing on this topic, we were able to retrieve some peculiarities by interviewing several Social Media representatives of SMEs in southern Germany. We received multiple feedback from our interviewees that pointed out that their target audience uses a very specific language. As SMEs tend to be niche players in their industries, their customers tend to use very special language and expressions as well as product and company names. Additionally, customers may use the Social Media channel as a first approach for complaints and customer service requests since SMEs usually do not maintain call centers or local service centers. Thus, we expect a lot of posts carrying service requests and therefore have a rather negative annotation. Furthermore, we identified a difference in usage of Social Media among the SMEs interviewed. While some use Social Media channels strictly as a marketing channel to present new products or upcoming events, others try to involve their users in general discussions. We also identified open innovation as a potential usage scenario of Social Media for SMEs. As SMEs account for the majority of companies in a nation, the individual companies differ vastly in size and public recognition. As a result, we also expect customer involvement in Social Media channels to be very heterogeneous and very dependent of the popularity of the product or service offered.

2.2   Approaches for Sentiment Analysis in Social Media

Automated sentiment analysis of specific text is an interdisciplinary research field. In consequence, there are a variety of publications in the areas of Natural Language Processing, Text Mining, Web Mining and Information retrieval (Liu, 2012). Sentiment analysis consists of different subareas, such as subjectivity detection, sentiment classification and opinion summarization (Kumar and Sebastian, 2012).

Approaches with reference to sentiment analysis can be categorized into three different classes. At first, document-based approaches aim towards the classification of the sentiment of a whole text corpus, for example newspaper articles. The second category focuses on sentence-based approaches, which analyze whether a single sentence can be classified as having a positive, negative or neutral sentiment. The third category considers aspect-based approaches which focus on entities and their aspects. For example, in product reviews the attributes (aspects) of the reviewed products (entities) could have different characteristics (Vohra and Teraiya, 2012; Feldman, 2013; Liu, 2012).

Considering the research questions, the focus of the study was to analyze Social Media posts in SMEs. Accordingly, we focused on sentence-based approaches, namely *dictionaries, corpus-based approaches, syntactic patterns, artificial neural networks* and *treebanks* (Medhat et al., 2014). When using *dictionaries,* the sentiment of each entity (e.g., each word) from a text is classified into a positive or negative class using dictionaries. The dictionaries annotate opinion carrying words. The sentiment of the whole text is determined by considering the sum of the combined scores of all its entities (Turney, 2002; Kundi et al., 2014). *Corpus-based approaches* determine the sentiment based on a domain specific text corpus regarding the context of the sentence, which can be recognized by particular adverbs (Liu, 2012). *Treebanks* disassemble the sentence into a hierarchical grammatical structure (tree). With respect to the purpose of sentiment analysis, this structure could be used either to identify recursively restraining negations or to determine the semantic orientation of the sentence by means of adverbs and adjectives (Turney, 2002; Sadegh et al., 2012). *Artificial neural networks* consist of parallel operating units (neurons) to classify the sentiment of a sentence. The words that need to be classified traverse the network through weighted branches. The network can be trained by adjusting the weights of the branches (Sebastiani, 2002).

Although sentiment analysis is a lively discussed field of research, the available approaches and solutions do not reach satisfactory accuracy levels for practical applications yet (Collomb et al., 2014). This is particularly true when it comes to German Social Media posts. The German language contains a vast amount of complex language-specific grammatical rules and thus many approaches initially designed to interpret English fail in delivering acceptable accuracy levels (cf. Waltinger 2010). Challenges for the approaches especially occur in case the posts capture regional slang or irony. For the purpose of irony detection, knowledge about the topic addressed, the events related to ironic statements (e.g., special incidents), and correctly identified emotions, e.g., expressed by emoticons, are important factors (Carvalho et al., 2009; Davidov et al., 2010; Derks et al.,2008; Gonzales-Ibanez et al., 2011). To identify slang, current sentiment analysis approaches build on dictionaries covering branch-specific or topic-related expressions for instance (Asghar and Zubair, 2014; Nielsen 2011). However, generally valid cross-industry dictionaries do not exist yet. Accordingly, a case-dependent adaption of current approaches for sentiment analysis or a value-adding combination of them is required in practice (cf. Gonçalves et al., 2013). To sum it up, sentiment analysis research still is in a maturing phase with commercial social monitoring tools requiring further improvements to be beneficially applied at SMEs (cf. Sponder, 2010).

3 Procedure of the Research

For answering the research questions, we followed the procedure as shown in figure 1. The steps are part of a larger Design Science project (cf. Hevner et al., 2004), aiming at the development of a Social Media monitoring tool adapted to the needs of SMEs in southern Germany in particular.
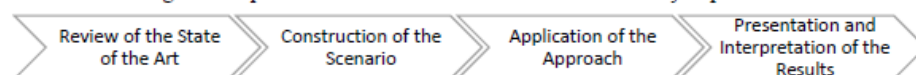
Figure 1. Procedure of the research

To identify existing approaches for sentiment analysis, the first step was to *review the state of the art.* For this purpose, we examined 196 relevant publications resulting in 17 identified approaches potentially suitable for automatic sentiment analysis of textual elements. Social Media posts represent a specific area of application, for which only a limited number of algorithms are applicable. Thus, a main task was to identify a suitable approach for the given area of application.

Within the *construction of the scenario,* we cooperated with five SMEs from southern Germany. Each company operates at least one Facebook page and is heavily engaged in the field of Social Media. In a discussion with representatives of the five companies we defined the further elements of our scenario (e.g., languages analyzed, timespan of the data extraction).

For the next phase, the *application of the approach*, we used a well-established text-mining procedure (cf. Aggarwal and Zhai, 2012). Its first step is the extraction of the Social Media data from every company's Facebook page. For this objective, we developed an extraction tool based on public API libraries. Our extraction tool connects to existing Facebook and Twitter developer interfaces and stores the extracted data in a universal file format. The extracted data is then used for further data preprocessing and analysis. Due to the linguistic and structural characteristics of Social Media posts, we had to adjust the existing sentiment analysis algorithms to fit our specific requirements. Aside from customizing the algorithms for the shortness of Social Media posts (Zhao and Rosson, 2009), we focused on the integration and detection of emoticons, media-specific words and multiple languages in a single text (Laboreiro et al., 2010). As a result, we created a software application that can automatically conduct a sentiment analysis on Social Media posts in German language, specifically aimed at the peculiarities of SMEs.

The last step of our research procedure is the *presentation and interpretation of the results*. For the evaluation of the results generated by the automated application, it was necessary to first assess the test data manually. For this purpose, the sentiment of every single extracted post was determined by a group of six researchers and discussed with at least one representative of each participating company. The agreed-upon sentiments served as a comparative value for our automatic sentiment analysis. As we eliminated subjectivity as much as possible, we considered the manual sentiments identified as "reality". To determine the accuracy of the automated analysis, we used the commonly accepted metrics *precision, recall* and *f-measure* (Christen, 2012). The results were then discussed and evaluated at a workshop with representatives of all participating companies.

4 Identification of Peculiarities in the Application of Sentiment Analysis in the Context of SMEs in Southern Germany

4.1 Construction of the Scenario

As mentioned earlier, we generally considered 17 algorithms for sentiment analysis as appropriate for our research. With regards to the stated peculiarities of Social Media posts in the context of SMEs (see section 2.2), the implementation of a dictionary-based algorithm was seen as the most promising approach for multiple reasons: first, Social Media posts do not provide a precise grammatical structure; much more they often contain a set of "fuzzy" text fragments. Second, we expected a lot of specialized resp. industry-related language to occur in Social Media posts of SMEs. Hence, algorithms for sentiment analysis requiring a correct grammar or orthography of the texts to be analyzed will not achieve a convincing classification. Therefore, the algorithm to be selected needs to be able to cope with these circumstances by taking into account every single entity (e.g., word) of the post. Additionally, the dictionary-based approach allows for a simple customization and thus enables its application for the different requirements of the cooperating companies (Liu, 2012).

After selecting the approach for further evaluation regarding the quality of the sentiment analysis, we defined a structured evaluation scenario. To gain valuable insights into the specifics of Social Media posts in SMEs in general, we selected the Facebook sites of five SMEs for our data collection. For this purpose, a company search was performed. Freely available online databases with addresses of German companies and the internet were analyzed in that context. The search was directed at enterprises of small and medium sizes across all industries, openly declaring their commitment to Social Media. The commitment could be shown by a link to Social Media channels on the firm's website, by inviting visitors to become "fans" on Facebook, or by encouraging them to follow the company's Twitter account.

The Social Media presence for each firm identified was then analyzed to see whether up-to-date content was regularly pronounced by the company (e.g., announcement of events, etc.) or not. Further, the number of followers of a company's Social Media channels was drawn upon to judge its online visibility, and only those enterprises that continuously updated their Social Media presence were further considered. In these cases, the companies' dedication to Social Media could be acknowledged from an external perspective making them potential candidates for our evaluation. Relevant firms were then contacted

and asked if they were willing to participate in our evaluation. A total of five companies from various industries and different target audience decided to join our study (see table 1). The companies mentioned the vast amount of posts generated by the high number of followers as their main reason for the need of an automatic analysis and thus for joining our study. To generate comparable results for all companies, we agreed on only analyzing the companies' Facebook pages and focusing on posts in German language.

Company	Industry/Description	# of Employees (approx.)	# of FB fans (approx.)
Company A	Market leader in fun sport equipment for watersports	80	4,000
Company B	Online Store for children's fashion, baby fashion, toys and children's furniture	400	85,000
Company C	Manufacturer and distributor of high-quality toys, games & room decor for kids of all ages	1,200	30,000
Company D	Leading manufacturer and distributor of equipment for day-care centers, kindergartens, and schools	200	2,000
Company E	Leading manufacturer of RVs, mobile homes and caravans	1,200	1,500

Table 1. Participating companies in our evaluation

First, we extracted all posts from the Facebook pages for a ten week timespan (July 25th to October 6th 2015), providing us with a total of 1,554 initial posts (see table 2). However, the extracted posts also entailed posts by the companies' own Social Media teams as well as posts in non-German languages. Thus, we had to eliminate these from our dataset which subsequently shrank to exactly 1,000 posts to be analyzed. We continued our research by conducting a workshop with Social Media representatives from the five companies. In this workshop, we selected approx. 40 eye-catching posts per company and discussed the specifics of these in regards to special expressions and meanings of the corresponding industries. After this valuable input from practice, six researchers were able to determine the sentiment for each of the 1,000 posts individually. The results were then discussed and aggregated to the sentiment agreed upon (402 positive, 455 neutral, and 143 negative). The resulting list of 1,000 posts and their corresponding sentiment were the foundation for the evaluation of the algorithm in regards of its accuracy to estimate sentiments in Facebook posts for SMEs in German language.

company	# of extracted posts	# of relevant posts
Company A	325	125
Company B	416	260
Company C	351	316
Company D	90	34
Company E	372	265
total	1,554	1,000

Table 2. Number of extracted and relevant Facebook posts per company

4.2   Application of the Approach

For the evaluation of the approach for analyzing the sentiment, the application follows the general method of text analysis as shown in figure 2 (cf. Aggarwal and Zhai, 2012).

Figure 2. Selected approach for sentiment analysis

As a starting point, data (e.g., posts or tweets) is extracted from Social Media channels and converted to a consistent data format for further effective processing (Akaichi et al., 2013; Feldman, 2013). Even though we focused on the companies' German Facebook pages, one of the main problems during our

evaluation was the mixture of English and German language in the extracted Social Media posts. As many of the preprocessing techniques are language dependent and we focused on posts in German only (see section 4.1) this issue needed to be addressed. Thus, we implemented a language detection prior to the other steps to determine the language of every single post and eliminated non-German posts.

Subsequently, data preprocessing, including various techniques like tokenization, stop word reduction, stemming and normalization, is required (Aggarwal and Zhai, 2012). Tokenization describes the decomposition of posts into smaller parts, e.g., single words. Additional symbols, punctuation and special characters are removed (Carstensen et al., 2010). Afterwards, stop word reduction is performed. Hereby, words that do not carry opinions are removed (Angulakshmi and ManickaChezian, 2014). To identify these, publicly available stop word lists are applied. The next preprocessing technique used is called stemming. During the stemming process, prefixes and suffixes are eliminated and words are reduced to their stem or basic form. For example, the verb "walking" is stemmed to its base form "to walk" (Akaichi et al., 2013). Normalization is the last of the mentioned preprocessing techniques. Thereby, all remaining text is transformed to lower case characters (Angulakshmi and ManickaChezian, 2014).

Despite the mentioned preprocessing techniques, most approaches for sentiment analysis cannot handle some special content immediately. Therefore, a feature extraction composed of defining feature types and selecting specific features (e.g., emoticons, part of speech, sentiment carrying expressions) is necessary (Selvam and Abirami, 2009). Due to the frequent occurrence of these features in our dataset, we integrated particular dictionaries to meet this specific characteristic of Social Media posts. To establish a proper feature resource, we examined our dataset and extracted the most common features. A collection of examples is presented in table 3.

Features indicating a positive sentiment	Features indicating a negative sentiment
(y) | :-) | ;-) | =) | :-D | XD | (x | (= | ^^ | *O* | :-* :') | <3 | :-P | :o) „Yeeha"| „rock&roll"| „Bang!" | „wow"	:-(| /: | :' | :'(| :_(| T_T | ;-; | Dx | 'n' | :\ | :/ | >:o D: „#soEinShice" | „das macht betroffen"

Table 3. Examples for features found in our dataset

After completing the steps data extraction, data preprocessing and feature extraction the act of *knowledge extraction* follows. As presented in section 2.2, a variety of algorithms for conducting this task exists. Due to the emphasized characteristics of Social Media posts, as mentioned, dictionary-based approaches represent a generally accepted approach for the automated sentiment analysis of such textual content. Dictionaries represent lexical resources with annotated words (Feldman, 2013). Depending on the sentiment of each word, the annotated value is either positive, neutral or negative. It is expressed by a number within a predefined range (a higher value is more positive) (Feldman, 2013). For example, given a value range of [-2;+2], the word "fantastic" would be annotated with a value close to +2, while the word "horrific" would be annotated with a value close to -2.

A widely accepted implementation of a dictionary-based approach is SentiWordNet 3.0. SentiWordNet 3.0 represents a lexical resource for automated sentiment classification (Baccianella et al., 2010). However, SentiWordNet 3.0 only provides a lexical resource for English. To support German Social Media posts as well, we used SentiWS, a German language resource for analyzing the sentiment of German texts (Remus et al., 2010). As SentiWS did not match the structural requirements of the SenitwordNet 3.0 approach, we adapted SentiWS by converting the structure of the German dictionary to fit the one of SentiWordNet 3.0 (Remus et al., 2010). Both resources contain lists of positive and negative opinion carrying words.

For acknowledging irony and slang the dictionary was extended with expressions pointing to special events (e.g., product launch) of the branches considered. Also we classified the appearing emoticons into positive and negative ones to identify the expressed emotions within the posts. Further, a manual screening of posts on the companies' Facebook sites was performed to extend the dictionary by words capturing slang expressions.

4.3 Presentation and Interpretation of the Results

To measure the accuracy of our approach, we used the commonly accepted metrics *precision, recall* and *f-measure* (Christen, 2012). To calculate these metrics, we had to define the underlying variables. The approach allocates the analyzed posts to three different sentiments (S), namely positive, negative, or neutral. For each sentiment we thus needed to define a differentiation between the two categories for the true and false allocation of the relevant posts. Consequently, we identified six categories which oppose the results of the automated approach to the real world data mentioned earlier (see table 4). Based on these categories, the accuracy of the implemented approach could be measured.

Sentiment (S)	Category	Description
Positive	true positives	posts, which are correctly assigned to the sentiment *positive*
	false positives	posts, which are assigned to the sentiment *positive*, but are not positive in real world data
Negative	true negatives	posts, which are correctly assigned to the sentiment *negative*
	false negatives	posts, which are assigned to the sentiment-category *negative*, but are not negative in real world data
Neutral	true neutrals	posts, which are correctly assigned to the sentiment *neutral*
	False neutrals	posts, which are assigned to the sentiment *neutral*, but are not neutral in real world data

Table 4. Sentiments and related categories

The metric *precision* focuses on the implemented approach. It calculates the amount of correctly assigned posts in relation to all automatically classified posts for a given sentiment S:

$$precision(S) = \frac{|true\ (S)|}{|true\ (S)| + |false\ (S)|}$$

For example, a high value for *precision* (e.g., close to 1) predicates that a very high number of posts that are assigned to the sentiment S by the algorithm are classified correctly. Contrary, a low value of *precision* (close to 0) indicates that a high number of posts are not classified correctly. When looking at our dataset (see table 5), 48 posts of company A were classified positive by the algorithm, but only 45 of them are truly positive and thus classified correctly. Consequently, the *precision* for the sentiment *positive* for company A is 45/48 = 0.94, resulting in a *precision* of 94 percent.

In comparison, the metric *recall* calculates the amount of correctly assigned posts in relation to all posts classified in the real world data for a given sentiment S.

$$recall(S) = \frac{|true\ (S)|}{all\ posts\ classified\ in\ the\ real\ world\ data\ for\ (S)}$$

Hence, a high value (close to 1) for *recall* for positive posts indicates that most of the truly positive posts are also classified correctly as being positive. A low value for *recall* indicates that the share of the automatically and correctly classified posts for a sentiment in relation to all posts of this sentiment is low. For example, the *recall* for the sentiment *positive* for company A in our dataset in table 5 is calculated by dividing 45 correctly classified positive posts by all 52 positive posts in the real world (0.87).

Since *precision* and *recall* aim at different objectives, there is a third metric called *f-measure*. It merges *precision* and *recall* to their harmonic mean and gives an overall view of the accuracy of the used approach (Makhoul et al., 1999; Hripcsak and Rothschild, 2005).

$$f - measure\ (S) = \frac{2 * recall\ (S) * precision(S)}{recall(S) + precision(S)}$$

In our example, *f-measure* of company A for the sentiment *positive* is 2*0.94*0.87/0.94*0,87 = 0.90.

The following table 5 shows all results of our application of the dictionary-based approach on the extracted dataset provided by the five Facebook pages of the cooperating companies.

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The first column ("real # of posts") represents the number of positive, neutral and negative posts, agreed upon by the six independent researchers and verified with the responsible experts from each company. The second column ("classified # of posts") represents the number of automatically classified posts into positive, neutral and negative sentiments. The numbers for true positive, true neutral and true negative posts are written in bold. Consequently, the other numbers in this column represent the false positive, false neutral and false negative numbers of posts. For example, company E has a total of 95 positive posts in the "real world". The dictionary-based approach classified a total of 89 posts as positive, whereas 70 were true positive (classified correctly) and 19 were classified incorrectly (false positive).

		real # of posts			classified # of posts				precision			recall			f-measure		
		+	o	-	+	o	-	Σ	+	o	-	+	o	-	+	o	-
company A	+	52			45	1	2	48	0.94			0.87			0.90		
	o		64		6	61	2	69		0.88			0.95			0.92	
	-			9	1	2	5	8			0.63			0.56			0.59
	Σ				52	64	9								Ø	0.80	
company B	+	73			58	37	10	105	0.55			0.79			0.65		
	o		135		13	78	9	100		0.78			0.58			0.66	
	-			52	2	20	33	55			0.60			0.63			0.62
	Σ				73	135	52								Ø	0.64	
company C	+	165			140	14	4	158	0.89			0.85			0.87		
	o		124		22	101	3	126		0.80			0.81			0.81	
	-			27	3	9	20	32			0.63			0.74			0.68
	Σ				165	124	27								Ø	0.79	
company D	+	17			17	1	1	19	0.89			1.00			0.94		
	o		12		0	10	0	10		1.00			0.83			0.91	
	-			5	0	1	4	5			0.80			0.80			0.80
	Σ				17	12	5								Ø	0.88	
company E	+	95			70	9	10	89	0.79			0.74			0.76		
	o		120		20	107	16	143		0.75			0.89			0.81	
	-			50	5	4	24	33			0.73			0.48			0.58
	Σ				95	120	50								Ø	0.72	
total	+	402			330	62	27	419	0.79			0,82			0.80		
	o		455		61	357	30	448		0.80			0.78			0.79	
	-			143	11	36	86	133			0.65			0.60			0.62
	Σ				402	455	143								Ø	0.74	

Table 5. Results of the application

As the results shown in table 5 demonstrate, the implemented dictionary-based approach achieved an aggregated *f-measure* of 74 percent. Although, the particular results for the different companies and sentiments vary significantly. Most of these differences can be explained by the peculiarities of Social Media posts for SMEs as described earlier in section 2.1.

For example, there are consistently high *f-measure* values (avg. 88 percent) for company D, the leading manufacturer and distributor of equipment for daycare centers, kindergartens, and schools. These high values can be explained by the very structured, clear and correct language within the posts of company D (e.g., see table 6 example #1). We see the fact that the target audience are mainly business customers as the underlying reason for this observation.

However, we also identified cases where the application of the automatic approach resulted in indifferent values. Considering company B, an Online Store for children's fashion, baby fashion, toys and children's furniture, the *f-measure* for positive posts is 65 percent and the *f-measure* for neutral posts is 66 percent, both significantly lower compared to all other companies. We analyzed the respective posts and noticed a high level of off-topic discussions that do not relate to the company's products or services (see table 6 example #2). During the initial manual classification, the researchers agreed upon that these off-topic discussions belonged to the *neutral* sentiment. In contrast, the automatic approach processes all posts

word by word without knowing the context of the post. Thus, it classified these posts *positive* or *negative*, based on the annotation of the containing words.

Another peculiarity of Social Media posts we observed in the posts of company A is industry-specific language. As company A is a market leader in fun sport equipment in the watersports industry, we noticed industry-specific components (e.g., slang, jargon) to be commonly used in positive posts of our dataset (see table 6 example #3). Based on these observations, we enhanced the existing feature libraries and included several generally known expressions of the fun- and watersports industry. After integrating these industry-specific items, we achieved a recognition rate of about 90 percent for positive posts.

A lot of times Social Media posts demonstrate a network character by addressing more than one person, for example when fans congratulate a company for winning a certain award or when they provide general feedback to certain events, e.g., sweepstakes or giveaways (see table 6 example #4). This could be repeatedly observed in the posts of company C, a manufacturer and distributor of high-quality toys, games & room decor for kids of all ages.

Generally, it is noticeable that positive posts are classified very well. Especially companies whose posts are written in a certain language that is typical to the relevant industry or region (company A / company E) or directly address specific products or services (company C) achieve high values for *f-measure* for positive posts. Additionally, the frequent use of emoticons to express sentiment within Social Media posts contributes to a higher accuracy of the algorithm (see table 6 example #5). We see these two reasons as a main driver resulting in an aggregated *f-measure* value of 80 percent for all positive posts.

However, there is a discrepancy in negative posts. The classification of negative posts resulted in an aggregated *f-measure* of 62 percent for all posts, which is significantly lower than the average *f-measure* value of positive posts. This gap can be explained by two factors. On the one hand, several customer complaints about malfunctions contain company-specific expressions and are written in a neutral way, which makes it impossible for the approach to identify them as negative posts (see table 6 example #6). This results in low *f-measure* values of 59 percent for company A and 58 percent for company B. On the other hand, we identified a number of posts that contain negation and irony, which results in comparatively lower *f-measure* values for negative posts.

#	Example (in German language)	Translation to English / Explanation
1	*Es wäre schön wenn es auch was für die unterstützte Kommunikation nicht sprechender Kinder gäbe, solche Kinder gibt es ja auch in Kindergärten und Krippen.*	It would be nice if you offered products to support the communication of not speaking children, as they also visit kindergartens and nurseries.
2	*Unser 4-jähriger schläft immer bei uns und ich genieße es. Vergeht ja viel zu schnell die zeit.....*	Our four-year-old still sleeps at our place and I'm appreciating it. Time is running too fast…
3	*Schon ausprobiert, 9er bei 32 Knoten: So hoch war ich noch nie!!! Yeehaa*	Already tried it, 9's at 32 knots: I've never jumped so high!!! Yeehaa
4	*Wann erfährt man denn, ob man dabei ist, wenn schon die erste Spielefamilien testen können? Hatte mich am 10. September schon beworben.*	When do I get informed if I'm involved, since the first families are already testing the products? I already applied on September the 10th.
5	*:D*	:D
6	*An wen wende ich mich, wenn mein Van einen Konstruktionsfehler hat bezogen auf die Scheibenwischer.*	Who should I contact if my Van has construction errors concerning its windshield wipers.
7	*gefelt mir*	Spelling error (correct would be "gefällt")

Table 6. Examples for peculiarities identified

Additionally we identified that spelling mistakes are widely spread in our dataset. Due to the diversity of users within social networks, spelling mistakes reoccur constantly in Social Media content (Agichtein et al., 2008). This fact also lowers accuracy as misspelled expressions cannot be identified by the approach (see table 6 example #7).

In summary, regarding research question 1 (RQ1), the highest value for the *f-measure* received was 88 percent for company D while the lowest value was 64 percent for company B. Correspondingly, dictionary-based approaches provide a high level of accuracy in case the Social Media posts have a structured, clear and correct language. With an increase of off-topic discussions, slang, spelling errors or industry-specific expressions the accuracy decreases which clearly becomes evident in table 5. Considering our second research question (RQ2), we observed a strong variation among the investigated companies' posts. This is justified through several peculiarities of Social Media posts in SMEs: by specialized industry- and product-specific language, by off-topic discussions that do not cover company-specific topics, by industry specific components (e.g., slang, jargon) and company-specific expressions (e.g., surfer jargon in fun- and watersports or dedicated vehicle parts). It also is notable that the correct classification is highly influenced by the usage of emoticons to express sentiment.

5 Discussion

Generally, the sentiment analysis as performed above provides valuable insights into customers' current attitude towards a company. For example, a high number of posts classified as "negative posts" can be seen as an indicator for consumer dissatisfaction requiring a firm to trigger corresponding countermeasures such as product or service campaigns. Further, a high number of positive posts may indicate a generally optimistic mood amongst customers, positively shaping the company image. From that point of view, the sentiment analysis serves as a valuable indicator as to whether a company's efforts to meet customer requirements (e.g., by the current product and service portfolio, etc.) are successful or get out of hand. All participating SMEs of the study agreed that the automatic analysis will lead to a tremendous cutback of human efforts as the assessment of the posts' sentiment was usually done manually by the companies hitherto which is a time-consuming and error-prone task. As shown in table 5, the accuracy of the analysis varies for different companies, but the f-measures generally were above the expectations of the firms participating *(see RQ1)*. In this regard, the data also confirmed the strong use of Social Media channels for the bidirectional communication between SMEs and customers as described in literature (cf. Meske and Stieglitz, 2013) because a large number of company posts (e.g., answer to requests, support for common problems) mixed with posts from the customer side.

Nevertheless, the study also showed that the accuracy of the sentiment analysis at SMEs, using a dictionary-based approach, strongly depends on a proper extraction of features inherent to consumers' Social Media posts as well as a decent adaption of the dictionaries regarding the terminology used by enterprises and their customers *(see RQ 2)*. Accordingly, slang as well as industry- and product-specific expressions need to be adequately considered for instance as shown in section 4.3.

From this point of view, our investigation does not only provide beneficial insights for SMEs using Social Media, but also contributes to the current body of knowledge on sentiment analysis. In our study, we used a dictionary-based approach, which is widely established in literature (e.g., Turney, 2002; Kundi et al., 2014). Many freely available lexical ressources for automatic sentiment analysis exist (e.g., SentiWordNet 3.0). However, these are not customized for certain industries or types of companies in the region of southern Germany. Furthermore, the amount of lexical resources in German language is limited. Thus, for raising the accuracy level of dictionary-based approaches, the lexical ressources need to be translated from English into German and enhanced by the peculiarities of Social Media posts at corresponding companies.To our best knowledge, a systematic uncovering of such characteristics for firms in southern Germany has not been performed yet.

Language-specific peculiarities that could be deducted from research refer to expressions capturing slang at first. These can be used to revise existing dictionaries. Further, we were able to identify expression related to special events (e.g., new product launch) for the branches considered, which is a prerequisite to unveil irony (e.g., Davidov et al., 2010). Thereby, the selection of companies was helpful for finding expressions related to slang and irony, since the customer base of the five different SMEs was rather diversified. Contrary to a very homogeneous customer group, e.g., as given for direct banks, a strong variation in the use of language was observed. This positively affected the extraction of a set of

expressions supporting irony and slang identification (e.g., 'incredible customer service ;)'). Additionally, a large set of branch-specific jargons was identified, with detailed findings for the toy, children fashion and child equipment industry as companies B, C, and D came from that particular field. By enhancing existing dictionaries accordingly, the accuracy of the sentiment analysis could be further improved significantly. The results as presented are the base for the development of a dictionary for SMEs in southern Germay, which we will pursue in future work.

More, six researchers were engaged in assessing the sentiment of the posts in our database to mitigate subjectivity and conduct the assessment. In practice, such a use of human resources is unrealistic, especially for SMEs with a limited number of employees. Thus, an automatic sentiment analysis with adapted dictionaries, leading to precise results, is a great support for SMEs as confirmed by the participating companies.

6 Conclusion and Outlook

In the research at hand we conducted an automatic approach for sentiment analysis using Social Media posts from five SMEs. Therefore, posts from the companies' Facebook sites were extracted with help of a prototype, preprocessed and then classified using SentiWordNet 3.0 and SentiWS as a combined dictionary. The results show that a considerable level of accuracy was reached. Nevertheless, to receive results that are more precise, an adaption of the dictionaries to the specific terminology of a company and its customers alike is required.

By the sentiment analysis as described, practitioners are given means to determine consumers' current attitude by an automatic approach. This is highly beneficial for SMEs who usually do not have the resources to monitor their Social Media channels on a regular basis besides the day-to-day business. Based on the insights into customers' mood, a company may start initiatives to clarify misunderstandings or to restore customer satisfaction for example.

The findings of this study are also beneficial for research as the impact of peculiarities of customers' Social Media posts at SMEs are investigated more profoundly. There still is a vague understanding of how the characteristics of Social Media posts influence the accuracy of the automatic analyses using dictionary-based approaches. The research at hand addressed this gap by explicitly focusing on SMEs in southern Germany. Thereby, the peculiarities of according posts were uncovered in detail. It became evident, that adapting the dictionary to a firm's terminology – determined by the product and service portfolio – as well as customers' language use is mandatory to receive a high-level of accuracy.

There are some limitations to this study: at first, we focused on SMEs from southern Germany which is a restriction in terms of the generalization of the results. Though, the focus on a particular geographic region allows to draw more detailed results for that particular area. Second, the number of SMEs participating in the study is limited to five. Considering additional enterprises might have provided further peculiarities of posts not explicated yet. Third, the manual sentiment analysis which was used to judge the accuracy of the automatic approach underlies subjectivity to a certain degree. We mitigated this by having six researchers perform the analysis and consolidate the results. Posts were further discussed with representatives of the affected companies. However, complete objectivity cannot be assured.

As this research is part of a larger Design Science project, we will further develop the aforementioned prototype to better match the requirements of SMEs in future work. This includes the company-specific adaption of freely-available dictionaries amongst others. Thereby, based on the findings, mechanisms to identify slang and irony more precisely will be pursued reverting to the knowledge gained on industry-specific topics for instance. Further, the creation of algorithms for automatically clustering customer statements, e.g., based on keywords identified within posts, is to be done. Currently, such in-depth insights are usually gained by manually screening data collections of customer statements, using techniques such as the CTQ-Matrix for example (cf. George et al., 2005), which is time-consuming and resource-intense revealing the necessity for automatic clustering approaches.

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2.5 Beitrag 5: A new Approach for Measuring National Culture: Analyzing Business Processes in Germany and India

Der fünfte Beitrag schließt die Bearbeitung der zweiten Zielsetzung der Arbeit ab. Er untersucht, inwiefern sich Hinweise auf die nationale Kultur in Prozessmodellen identifizieren lassen. Hierzu werden Metriken für die Prozessbewertung erarbeitet, die sich aus den Kulturdimensionen nach [Hofstede 1983] ableiten. Zur Validierung der Metriken werden diese im Anschluss auf einen für beide Firmen existierenden Produktentwicklungsprozess bei einer deutschen Firma und deren indischer Tochter angewandt. Damit beantwortet dieser Beitrag die fünfte Forschungsfrage:

> **Forschungsfrage 5:**
>
> *Wie können aus Prozessmodellen Hinweise auf die nationale Kultur identifiziert werden?*

Titel	A new Approach for Measuring National Culture: Analyzing Business Processes in Germany and India
Autoren (Anteile)	*Benjamin Wehner, Thomas Falk,* **Christian Ritter***, Susanne Leist* (50% - 20% - **20%** - 10%)
Eingereicht bei	24th European Conference on Information Systems (ECIS 2016), Istanbul, 12.-15. Juni 2016.
Ranking	B
Status	Eingereicht und abgelehnt

Tabelle 6: Details zu Beitrag 5

A NEW APPROACH FOR MEASURING NATIONAL CULTURE: ANALYZING BUSINESS PROCESSES IN GERMANY AND INDIA

Completed Research

Abstract

Nowadays, many companies face problems because of cultural differences, especially when collaborating in multinational settings. Traditionally, national cultures have been identified by questionnaires asking participants about feelings, beliefs, values, morale, or behavior in certain situations. These invisible elements of culture become manifest in tangible artifacts such as concrete actions (e.g., behavior, ceremonies, rituals) or structures (e.g., organizational charts). Process models serve as a graphical representation of business processes precisely describing activities, responsibilities and process flows. Thus, we anticipate that the behavior becoming apparent in business process models provides insights into national cultural characteristics. Consequently, the goal of this paper is to develop an approach to measure national culture in business process models. Based on Hofstede's (1983) cultural dimensions, we define metrics that can be applied to business process models. We demonstrate the use of these metrics by applying them to a product development process of a German company and its Indian subsidiary. The results were analyzed and confirmed a correspondence of the metrics' results with Hofstede's findings. Our approach contributes to a research gap in the area of BPM and national culture. Additionally, its practical application seems promising to support particularly process improvement initiatives or cross-cultural mergers and acquisitions.

Keywords: National Culture, Business Process Model, Metric, EPC.

1 Introduction

National cultural characteristics and their influence on collaboration, both within and among companies, is an important research area in times of globalization (vom Brocke and Sinnl, 2011). Neglecting cultural peculiarities in a business setting may lead to disastrous consequences. Two plane crashes of Avianca Airlines in the 1990's that were, ultimately, caused by specific cultural behavior of the crew members may serve as warning examples. In the first crash, the co-pilot did not challenge a wrong interpretation of instruments by the flight captain because he came from a country where subordinates are generally afraid of expressing disagreement with superiors. In the second crash, the first and second officers did not inform the captain about the worsening fuel situation, as both of them came from nations where people shy away from conveying bad news (Helmreich, 1994).

In IS research, problems caused by cultural differences have been addressed. In cross-cultural IT projects, cultural issues amongst team members have been identified in various settings: caused by different appreciation of hierarchy, status and power (between India and Britain (Krishna et al., 2004)); caused by different communication styles leading to poor information sharing (between Japan and the US (Brett et al., 2006)); caused by different norms for decision-making (between Mexico and South Korea (Brett et al., 2006)). Culturally induced disputes are also well-known in offshore outsourcing projects (cf. (Dibbern et al., 2008, Winkler et al., 2008, von Stetten et al., 2012, Ranganathan and Balaji, 2007).

To make a global collaboration setting more beneficial for all parties, it is essential to be aware of all cultural peculiarities and differences of the individual stakeholders, e.g., customers, suppliers and partners in foreign countries. As all of these stakeholders are connected by business processes, the analysis of cultural peculiarities in relation to business processes is a promising research area. Schein highlights that *"for purposes of cultural analysis, the organizational processes by which such behavior is made routine"* can be used (Schein, 2004). Business processes are generally captured by process models in various process modeling notations, all of them aiming at graphically representing the actual process as closely as possible. Thus, we anticipate that different cultural aspects can be identified in these process models, as they reveal the behavior, responsibilities, and the sequence flow of tasks.

To date, research has assessed national culture by the use of questionnaires (c.f. (Hofstede, 1983, House et al., 2004)) only, asking respondents about their beliefs and assumptions. In this paper, we focus on analyzing the actual cultural behavior of individuals by applying metrics on business process models. We assume that an analysis of business processes in terms of national culture will provide a company with valuable insights. This knowledge can then contribute to uncovering process improvement possibilities, e.g., by improving the collaboration between project partners from different countries thus preventing problems induced by cultural differences from occurring. Additionally, measuring national culture in business process models can be used to determine a cultural fit of two companies' processes during mergers and acquisitions.

Research in the area of Business Process Management (BPM) concerning national culture has so far not been focusing on the question of how cultural peculiarities are reflected in business process models. Hence, the goal of this paper is to develop an instrument to measure national characteristics by means of business process models. The resulting metrics form the basis for discussions about discrepancies between national culture and its manifestation in companies.

The remainder of this paper is organized as follows: in section two, related work about culture, business process management and measurement of national culture is provided. Section three presents our measurement approach containing the operationalization of the metrics. In section four, we apply these metrics to process models of two companies, one from Germany and one from India, and present the results. The insights gained from the application of the metrics are discussed by comparing them to the comprehensive study by Hofstede (1983). In addition, further research for a broader evaluation is presented (section five). Section six concludes the paper with an outlook.

2 Related Work

2.1 National Culture

Culture is a rather diffuse concept with different meanings depending on the context (cf. a collection by Kroeber and Kluckhohn (1952) listing 164 definitions of the term culture). A definition often used, as it comprises the general aspects of culture, was evolved by Schein (2004) with culture being referred to as shared values of a group which can be recognized in actions and structures.

Culture can generally be presented as an iceberg model (Schmiedel et al., 2010, Selfridge and Sokolik, 1975), with both invisible and visible elements. Invisible elements are *Underlying Assumptions* as well as *Espoused Beliefs and Values* (Schein, 2004), often subsumed by researchers under the term values (Hofstede et al., 2010, Leidner and Kayworth, 2006, Schmiedel et al., 2010). *Underlying Assumptions* are at the core of the cultural system and involve the subconscious mind including ideology, feelings, taken-for-granted beliefs, deeply embedded thoughts, and truth (Schein, 2004, Leidner and Kayworth, 2006, Schmiedel et al., 2010). *Espoused Beliefs and Values* are shared by a particular group as part of their joint social experience. These beliefs and values serve as a basis of human behavior in certain situations, including assumptions about what is right or wrong (e.g., morale, ethical norms, and rules), and make behavior predictable (Schein, 2004, vom Brocke and Sinnl, 2011). Invisible elements of culture manifest themselves in tangible *Artifacts* (Schein, 2004), which represent the visible elements such as concrete actions or structures (Schmiedel et al., 2010). Actions are typical behavior, ceremonies, and rituals, while structures are found in organizational charts, technology, products, mission statements, and the physical environment (Schein, 2004, Schmiedel et al., 2010).

According to the range of influence, different levels of culture can be defined, e.g., national (Leidner and Kayworth, 2006, Baba et al., 1996, Hofstede, 1983), organizational (Leidner and Kayworth, 2006, Baba et al., 1996), and subgroup/workgroup culture (Baba et al., 1996, vom Brocke and Sinnl, 2011). Each cultural group shares characteristics distinguishing one from another, i.e. different cultural groups vary in their behavior in certain situations (Hofstede, 1983). As mentioned in the introduction, being afraid of expressing disagreement with superiors and shying away from conveying bad news are examples of national characteristics (Helmreich, 1994). In this paper, we focus on national culture that is stable over time and difficult to influence as it represents the basic behavior and values of a particular society (vom Brocke and Sinnl, 2011). Even though personal behavior of individuals within a national group may differ, generally valid tendencies can be observed for certain cultural dimensions such as Power Distance or Uncertainty Avoidance (Hofstede, 1983, Hofstede et al., 2010).

2.2 Culture and Business Process Management

Culture has been identified as an important aspect of BPM (Rosemann and vom Brocke, 2010, Niehaves et al., 2012), and the number of publications linking the two topics has indeed increased in recent years. Research in this area can be classified on the basis of two dimensions: the interrelation between culture and BPM, e.g., the influence of different cultural settings on BPM, and the referenced cultural group, e.g., national, organizational. (vom Brocke and Sinnl, 2011). In this manner, the main emphasis lies on organizational culture and its impact on BPM activities or business process performance (cf. (Ruževičius et al., 2012, Grau and Moormann, 2014, Schmiedel et al., 2014)). Besides, the concept of a distinct *BPM culture* was identified and its values operationalized (Schmiedel et al., 2013, Schmiedel et al., 2012).

The role of national culture within BPM is much less highlighted in existing research. Authors dealing with this topic e.g., analyze the national influence on BPM (Jayaganesh and Shanks, 2009) and the application of its concepts in different national contexts (Baba et al., 1996, Martinsons and Hempel, 1998, Niehaves et al., 2012). Central to BPM is the notion of a business process consisting of a cohesive sequence of functions that create an output by adding value to the input and thus fulfil an organizational task (Griesberger et al., 2011, Davenport and Short, 1990). Business processes represent a socio-technical system where humans collaborate and carry out the single tasks to achieve the process output (Shaw et al., 2007). They are designed by and for people with a specific cultural background, who, in

turn, are subject to cultural influences. This process design is – besides the organizational culture – aligned to a particular national culture, which we focus on in this paper. Previous studies (e.g., (Hofstede, 1983, House et al., 2004)) have shown that significant cultural differences exist among a number of nations. Accordingly, it may be anticipated that business processes are designed differently, too. However, research on national cultural characteristics and how they manifest in the design of business processes is scarce.

2.3 Measurement of National Culture

So far, national culture in a broader field has been assessed by means of surveys, asking respondents questions about their feelings, beliefs, values, morale, or how they would behave in certain situations (House et al., 2004, von Stetten et al., 2012, Hofstede, 1983). Well-known examples are a survey by Hofstede with approx. 116,000 respondents in 76 countries (Hofstede, 1983) and the GLOBE study with 17,300 interviewees in 63 countries (House et al., 2004). Questions in cultural surveys generally target the two layers of *underlying assumptions* and *espoused beliefs and values*. As a result, visible *artifacts* such as the actual behavior in real-life situations are not observed.

An important category of visible artifacts are process models as a graphical representation of business processes precisely describing process flows (Stein et al., 2009). Business process models are a core result in BPM as they aim among others at adopting and improving business processes on the basis of process analysis (Dumas et al., 2013, Becker et al., 2011, Rosemann and vom Brocke, 2010). Process models describe the sequence flow, including activities to be performed by organizational units, created result and documents, and decisions leading to a parallel or sequential flow of the process. All these elements in a process model represent the behavior of the employee executing the process. Therefore, we anticipate that business process models are a promising starting point to identify and measure national cultural influences. To date, an instrument to measure national culture in business processes is missing. To fill this research gap, we develop a measurement approach.

3 Measurement Approach

Our approach is based on predefined metrics that are applied to business process models. As the latter graphically represent business processes, the layer of visible artifacts is explicitly addressed. The definition of the required metrics comprises three steps: first, we analyze the operationalization of cultural dimensions in general (see 3.1). Second, the national cultural dimensions by Hofstede (1983) are presented and then used to deduct metrics to measure the four dimensions *Power Distance*, *Uncertainty Avoidance*, *Individualism/Collectivism* and *Masculinity/Femininity* (see 3.2). Finally, we describe the process of data collection, which is the basis for the calculation of the metrics using both the syntax and semantics of process models (see 3.3).

3.1 Operationalization of Cultural Dimensions

The best-known classification in national cultural research are the dimensions by Hofstede (Leidner and Kayworth, 2006), which represent the basic behavior and nature of national cultures: Power Distance, Uncertainty Avoidance, Individualism/Collectivism, and Masculinity/Femininity (Becker et al., 1995, von Stetten et al., 2012, Hofstede, 1983). Further studies expand these basic dimensions by detailing or extending the four dimensions, by e.g., gender equalitarianism, assertiveness, future, performance and humane orientation (House et al., 2004), time orientation, monochronism/polychronism, context, and locus of control (Leidner and Kayworth, 2006). As Hofstede describes the most popular conceptualization of national culture (Becker et al., 1995, von Stetten et al., 2012), in this paper, we take his taxonomy as a basis. In section 3.2, these dimensions are explained in more detail.

Generally, each cultural dimension (CD) comprises several characteristics (C) that can be measured. Metrics (M) are defined to measure the extent of each characteristic. Afterwards, the metrics are aggregated (Agg) for each cultural dimension to obtain a tangible value that can further be interpreted and compared. Figure 1 provides an overview of all components of our measurement system.
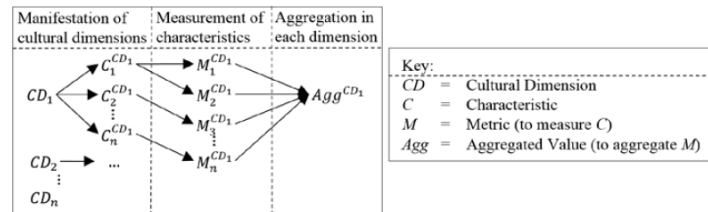

Figure 1.   Measurement Approach

To obtain the values for the metrics, the syntax and the semantics of the business process models are analyzed. Business processes are graphically represented using business process modeling languages. There is a great variety of business process modeling languages, the most popular ones being the business process modeling notation (BPMN), the event-driven process chain (EPC) and the UML Activity Diagram (Stein et al., 2009). Even though different languages exist, most of them offer similar key elements: functions, organizational units, application systems, information objects, and connectors (Griesberger et al., 2011). These elements are used to calculate the metrics by analyzing the semantics and the syntax of a process. Elements can be classified in regards of semantics by their element type and by interpreting their labels. Syntax is analyzed to identify sequential, parallel, or alternative process paths (see the example in Figure 2).

3.2   Deduction of Metrics from National Dimensions

The four aforementioned cultural dimensions by Hofstede (1983) are manifested in several characteristics, which are explained in the following. The characteristics are further deducted to metrics that can be applied to business process models.

In a cultural group, the power of individuals is not distributed equally. *Power Distance* describes the extent of this power and the degree to which the less powerful accept the existing distribution, e.g., that power is concentrated in single people in a society (House et al., 2004, Hofstede, 1983). As process models do not 'betray' any personal feelings, it is not possible to identify acceptance of inequality by the less powerful ones in them. Thus, we focus on the extent of unequal distribution of power. The allocation of power can be identified by looking at individual functions, which can be performed by either an organizational unit on a lower or on a higher level. These tasks usually are checks of results, e.g., the quality check of a prototype, and making decisions. If a check is performed by a superior and not by a regular employee, the power is focused on the higher levels. Thus, the derived metric indicates the share of check functions that are performed by organizational units on a higher level in relation to all check functions performed within the process. The assignment of the right to make decisions, e.g., to refuse the development of a product, is the second area to show the distribution of power depending on the hierarchy level of organizational units. The metric indicates the share of decision functions that are performed by organizational units on a higher level in relation to all decision functions in the process.

Uncertainty Avoidance deals with the unpredictability of situations. It is defined as the extent to which individuals try to avoid uncertain situations by relying on common norms, rituals and practices, e.g., by using standardized documents (Hofstede, 1983). Future orientation is one further characteristic of Uncertainty Avoidance, which includes planning activities and investing in the future (House et al., 2004, Hofstede, 1983). The first characteristic is measured by two metrics. To measure the first characteristic, we explicitly search for functions dealing with quality issues, e.g., the use of a checklist or the four-eyes principle, including all check functions. Quality functions are usually meant to document a current state

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or to check for a deviation of the outcome, which indeed reduces uncertainty as regards the specified topic. Thus, if the share of quality functions in relation to all functions is high, a high degree of uncertainty avoidance is measured. In addition, information objects in process models, e.g., checklists, indicate a reduction of uncertainty. The second metric for this characteristic shows the share of quality documents in relation to all documents in a process. An example for a quality document is a checklist, while a pricing catalogue is not. The second characteristic, future orientation, becomes visible in process models by looking at functions that comprise planning and thus have a future perspective, e.g., the planning of a project schedule. The metric for this characteristic shows the share of planning functions in relation to all functions of the process.

Individualism/Collectivism refers to the intensity of the interdependence of members of a cultural group and the extent of people taking care of each other. In individualistic societies, members look after themselves and their direct environment only, while people in collectivistic societies belong to groups and take care of each other. For example, people working in project teams with a high degree of interdependence and a lot of meetings form a collectivistic group (Hofstede, 1983). The intensity of interdependence can be identified in a process model by looking at the organizational units for each function. Functions with more than one organizational unit, e.g., the participants of a meeting, the discussion of a product design, or information exchange via phone or mail show the interaction among organizational units. A small share of those functions in relation to all function indicates a small degree of interdependence and an individualistic attitude. While databases are often used to share information, they also represent a form of individualism if they are not shared among employees. Employees create their own data storage, e.g., a sales person who stores product data on his own device when traveling. The metric measures the share of isolated databases in relation to all databases. A high value indicates that data is not available to other employees. The degree as to which people take care of each other is not directly measurable, as process models do not show in what way people interact with each other.

Cultural Dimensions (CD)	Characteristics (C)	Metric (M)	Operationalization of characteristics for Measurement based on Business Process Models
Power Distance	Extent of unequal distribution of power	PD_1	Organizational units of a higher hierarchical level performing a check function CF_{HL} for a result, generated at a lower hierarchical level in relation to all check functions CF
		PD_2	Organizational units of a higher hierarchical level perform decision functions DF_{HL} in relation to all decision functions DF
	Acceptance of inequality by the less powerful persons	-	-
Uncertainty Avoidance	Extent to which the number or the intensity of uncertain situations are avoided	UA_1	Functions, which are performed to avoid errors and to check quality QF in relation to all functions F
		UA_2	Documents dealing with quality issues QD in relation to all documents D
	Future orientation	UA_3	Planning functions PF in relation to all functions F
Individualism/ Collectivism	Intensity of interdependence	Ind_1	Functions, which are performed by only one organizational unit $F_{OU=1}$ in relation to all functions F
		Ind_2	Isolated databases $DB_{OU=1}$ used by only one organizational unit in relation to all databases DB
	People taking care of each other	-	-
Masculinity/ Femininity	Assertiveness	Fem_1	Decisions taken by an organizational unit that the process owner has no influence on DF_E in relation to all decisions DF (indicating Femininity)
		Mas_1	Decisions taken by a process participant that influence third parties DF_I in relation to all decisions DF (Indicating Masculinity)
	Gender equalitarianism	-	-

Table 1.   *Operationalization of characteristics to measure national culture in business processes*

Masculinity/Femininity refers to the competitiveness, perseverance, and success of a group. This dimension is further specified by the attributes gender equalitarianism (the degree of gender role differences) and assertiveness (the degree to which members are assertive, confrontational and aggressive)

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(Hofstede, 1983, House et al., 2004). Gender equalitarianism cannot be identified in process models because organizational units do not carry any information about the gender of the performing employees. The second characteristic, assertiveness, can be identified by means of functions of external organizational units that are part of the process, e.g., customers and suppliers. If such an external party makes decisions that directly influence the internal process flow, this suggests a weak position, as the process owner is dependent on third parties (Femininity). On the other hand, if a third party is influenced by internal decisions, a strong position in relation to the third party may be assumed (Masculinity). In both cases, the metrics compare the number of decisions influencing others or the number of decisions being influenced by others in relation to all decisions in a process model.

The Cultural Dimensions by Hofstede (1983) and their characteristics are illustrated in Table 1, including a description of the deducted metrics. For three out of the eight characteristics, we could not define any metrics. The reasons why they are not applicable in the context of business process models were explained for each of them. Even though these three characteristics cannot be measured, at least one characteristic of each cultural dimension is operationalized by metrics.

3.3 Process of data collection

To apply the metrics on process models, their elements, namely functions, organizational units, information objects, application systems and connectors, as explained in section 3.1, have to be analyzed. Figure 2 illustrates an exemplary analysis of a business process model with the cultural values extracted from it. For each metric, we present a detailed procedure on how to gather the values.
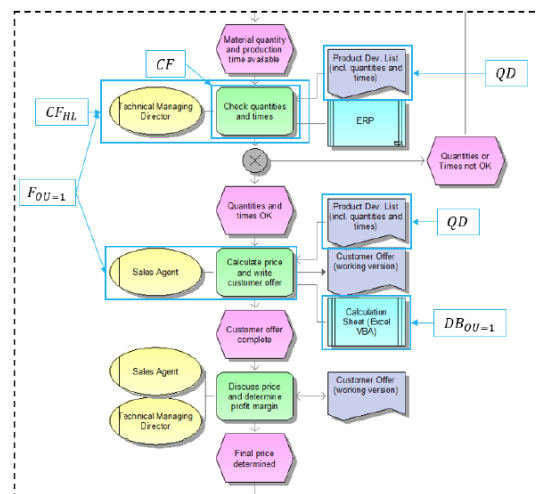

Figure 2.   *Example of the data collection*

Check functions (CF) are identified by a semantic analysis of two consecutive functions, with the first one producing a result that is checked in the second one, e.g., manufacturing a prototype and afterwards checking whether it fits the specification. If this check is performed by an organizational unit of a higher hierarchical level, e.g., the prototype is manufactured by a regular employee of the production department and the check is performed by the supervisor, there will be a value for variable CF_{HL}.

Decision functions (DF) are identified by analyzing the syntax and the semantics of functions and the process flow. Decision functions are followed by alternative process paths indicated by "XOR" or "OR" connectors, e.g., the decision whether a product will be developed or not. Depending on the organizational unit that performs the function, different decision functions can be identified: DF_{HL} indicates a

decision made by an organizational unit of a higher hierarchy level than the other organizational units in the process, e.g., a managing director. DF_E indicates a decision that is made by an external organizational unit affecting the internal process flow, e.g., a customer who places an order or not. DF_I indicates a decision made by an internal organizational unit, which affects external organizational units, e.g., the purchase department choses one out of many offers from suppliers.

Planning functions (PF), e.g., planning of the project schedule, as well as quality functions (QF), e.g., creation of a product specification, can be identified by a semantic analysis of functions. Functions that are performed by only one organizational unit ($F_{OU=1}$) can be identified by a syntactical analysis of the related organizational units which perform a function individually.

In addition to functions, information objects are used to measure cultural characteristics. Quality documents (QD) are a subset of all documents (D). They can be identified by selecting those documents dealing with quality issues, e.g., checklists or test reports. Furthermore, isolated databases ($DB_{OU=1}$) can be identified by identifying the connection between databases and organizational units. If a database is used by only one organizational unit, it is referred to as an isolated database.

4   Application of Metrics

4.1   Business Processes from Germany and India used for the Application

As cultural values are only meaningful by comparison (Hofstede et al., 2010), the metrics derived are applied on business processes of two small and medium-sized enterprises (SMEs) in Germany and India. The Indian company has about 500 employees and is a legally independent subsidiary of the German parent company employing about 150 people. Both act as suppliers developing and manufacturing similar small electronic components. They also put huge emphasis on quality, which is reflected in certifications to several quality standards (e.g., DIN EN ISO 9001:2008 and 14001:2009).

Out of all business processes, the customer-specific product development process was chosen for the cultural analysis, as both companies develop similar products with an almost identical complexity. Due to the high number of products (approx. 700) that have been developed so far, a high degree of process standardization is available. These factors ensure the comparability of the German and Indian processes. Further, the product development process was chosen because it is performed completely manually (non-automated) and therefore thoroughly reflects the cultural characteristics based on human behavior.

The process models we used for our cultural analysis were created in a prior project using the EPC modeling language. Even though they were modeled by one and the same modeler, in accordance with the same modeling guidelines and at a comparable level of detail, it was necessary to understand all details of the processes and check if they were up-to-date. For this purpose, we conducted personal interviews with both the German and the Indian employees involved in the process. In addition, we were informed about all documents and information systems during on-site visits. The customer-specific product development process, similar for both companies, starts with a customer asking for a custom-tailored product in the form of a request or tender sent to the SME. This step is followed by an initial design and a subsequent quotation submitted to the customer. In case the customer places an order, the SME designs the product in detail and builds a prototype, which is sent to the customer. After the approval of the prototype, production is planned and initiated. The final steps comprise invoicing and handling of payments. This process is executed in both companies, with some differences regarding the actual process flows and responsibilities. The individual processes are comprised of 60 functions in the German company and 71 in the Indian subsidiary. Against this background, the values of the variables were independently assessed by two researchers and their results compared afterwards, being identical in almost all cases, showing only slight differences for the rest. The differences were discussed with the companies and consolidated afterwards to ensure a maximum objectivity when applying the metrics. For example, a document labeled "Manufacturing Operation Card" was classified as a quality document by one researcher and as a regular document by the other one. After consulting the company, it turned

out that this document included quality standards in regards to the manufacturing steps and the quantities of materials to be used, even though the label did not suggest this. Therefore, mistakes in this document would lead to quality problems later on. Thus, it was finally classified as a quality document.

4.2   Results of the Application

The values of the variables to calculate the metrics were collected in way of a semantic and syntactical analysis of the processes for both SMEs as described in section 3.4. Table 2 shows the defined metrics including a short description, the absolute numbers gained from the process analysis, and the calculated metrics for the German and the Indian company for each cultural dimension. According to our measurement approach (see section 3.3. and Figure 1), the values of the individual metrics (e.g., PD_1 and PD_2) are aggregated for each cultural dimension (e.g., Power Distance) as well.

Regarding the cultural dimension *Power Distance*, the aggregated value Agg^{PD} is determined by calculating the average of PD_1 and PD_2. Both metrics deal with the allocation of responsibilities to single functions that are performed by an organizational unit (OU) of a higher level in comparison to all of these functions (checks, decisions). Possible and expected values range from 0 (low) to 1 (high Power Distance) for each metric and thus for the aggregated value as well. PD_1, PD_2 and Agg^{PD} all show a significantly higher value for the process in the Indian company as compared to the process in the German company. In the Indian company, 50% of the check functions and even 72% of the decision functions are performed by higher level organizational units, while in the German company only 29% of the checks and 22% of the decisions are made by them. The aggregated value is 0.61 for the Indian and 0.25 for the German company. Based on these values, we can state that the process reflects a higher Power Distance in the Indian than in the German company.

The aggregation for *Uncertainty Avoidance* is determined by calculating the average Agg^{UA} of the three metrics associated with this cultural dimension. Metrics UA_1 and UA_3 deal with special functions avoiding uncertainty (quality, planning), whereas UA_2 addresses quality documents. For all three metrics, possible values range from 0 (low) to 1 (high Uncertainty Avoidance), which is also valid for the aggregated value. For metrics UA_1 and UA_3, expected values differ from those theoretically possible. Quality functions (UA_1) deal with quality issues only, but there are further functions in every process, e.g., administrative functions. As the denominator counts all functions within the entire process, a value of 1 will most likely not be achieved in real life processes. Instead, values in the lower to mid-section may be expected. Planning functions (UA_3) usually only play a minor role in processes, which is why even smaller values are to be expected. Metrics UA_{1-3}, as well as Agg^{UA} show higher values in the German process than in the Indian one. UA_1 reveals that the German process has a share of 28% of quality functions, which means that almost one in three of all functions is quality-related. The Indian process shows a lower share of 17%, which equals less than every fifth function. This tendency is also reflected in the share of quality documents (UA_2) with 50% in the German and 16% in the Indian company. Metric UA_3 (planning functions) is very small for both companies with a share of 3% in the German and 1% in the Indian process. When looking at the absolute numbers of this metric, there are two planning functions in the German and only one in the Indian process, which underlines the same tendency towards a higher future orientation in Germany. In summary, the aggregated values of 0.27 in the German and 0.11 in the Indian company reflect a higher avoidance of uncertainty in the German company.

The aggregated value of the dimension *Individualism/Collectivism* is determined by building the average (Agg^{Ind}) of the metrics Ind_1 and Ind_2, with 1 indicating a high degree of Individualism and 0 indicating a high degree of Collectivism. Ind_1 measures the share of functions performed by only one organizational unit as opposed to functions where different organizational units are involved. For this metric, expected values tend to be higher since processes are normally designed in such a manner that functions are assigned to one specific organizational unit. Otherwise, a waste of resources or discrepancies between process structure and organizational structure would be likely to occur. The metric values show that in the German process 83% of all functions are performed individually, which indicates a higher

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degree of individualism than in the Indian process with value of 70%. Metric Ind_2 reflects the usage of isolated databases as opposed to shared databases. In the German company, 50% of all databases and 33% in the Indian subsidiary are only used individually. Even though the number of databases is small in general (2 vs. 3), this means nonetheless that in Germany a higher amount of data is stored individually and is thus not available to others. This may lead to problems if employees are on vacation or leave the company. The aggregation Agg^{Ind} results in a value of 0.67 in the German and 0.52 in the Indian company, indicating that the German company is more individualistic than its Indian affiliate.

The aggregation of the metrics for *Masculinity/Femininity* is different from the other metrics. As Fem_1 (influence of external organizational units) shows the degree of Femininity and Mas_1 (influencing external organizational units) the degree of Masculinity, aggregation Agg^{Mas} is performed by subtracting Fem_1 from Mas_1, which results in a possible range between -1 and 1. Afterwards the range is normalized between 0 (high degree of Femininity) and 1 (high degree of Masculinity). The exact calculation is $Agg^{Mas}=(Mas_1 - Fem_1 +1) / 2$. The values of the metrics for Mas_1 and Fem_1 are both slightly higher in the German than in the Indian company (see Table 2). The difference in both cases is due to a different denominator (9 Decision Functions in Germany versus 11 in India). The absolute numbers of decisions influenced by and influencing external units is identical in both countries. Thus, even though the aggregated value shows a slightly higher degree of Masculinity in the Indian company, a clear tendency for one country cannot be stated regarding this cultural dimension.

In summary, all of the derived metrics were applicable on the modeled processes in both the German and the Indian companies, and a clear tendency for three out of four cultural dimensions was identified.

Cultural Dimension	Metric	Description	Absolute Numbers		Calculated Metric	
			Germany	India	Germany	India
Power Distance	$PD_1 = \dfrac{|CF_{HL}|}{|CF|}$	Check Functions of OUs of a higher level / Check Functions	$\dfrac{2}{7}$	$\dfrac{4}{8}$	0.29	0.50
	$PD_2 = \dfrac{|DF_{HL}|}{|DF|}$	Decision Functions of OUs of a higher level / Decision Functions	$\dfrac{2}{9}$	$\dfrac{8}{11}$	0.22	0.72
				Agg^{PD}	0.25	0.61
Uncertainty Avoidance	$UA_1 = \dfrac{|QF|}{|F|}$	Quality Functions / Functions	$\dfrac{17}{60}$	$\dfrac{12}{71}$	0.28	0.17
	$UA_2 = \dfrac{|QD|}{|D|}$	Quality Documents / Documents	$\dfrac{8}{16}$	$\dfrac{4}{25}$	0.50	0.16
	$UA_3 = \dfrac{|PF|}{|F|}$	Planning Functions / Functions	$\dfrac{2}{60}$	$\dfrac{1}{71}$	0.03	0.01
				Agg^{UA}	0.27	0.11
Individualism/ Collectivism	$Ind_1 = \dfrac{|F_{OU=1}|}{|F|}$	Functions performed by only one OU / Functions	$\dfrac{50}{60}$	$\dfrac{50}{71}$	0.83	0.70
	$Ind_2 = \dfrac{|DB_{OU=1}|}{|DB|}$	Isolated Databases used by only one OU / Databases	$\dfrac{1}{2}$	$\dfrac{1}{3}$	0.50	0.33
				Agg^{Ind}	0.67	0.52
Masculinity/ Femininity	$Fem_1 = \dfrac{|DF_E|}{|DF|}$	Decision Functions by external OUs / Decision Functions	$\dfrac{2}{9}$	$\dfrac{2}{11}$	0.22	0.18
	$Mas_1 = \dfrac{|DF_I|}{|DF|}$	Decision Functions influencing external OUs / Decision Functions	$\dfrac{1}{9}$	$\dfrac{1}{11}$	0.11	0.09
				Agg^{Mas}	0.44	0.45

Table 2.   Application of the derived metrics

5   Discussion and Outlook

5.1   Discussion

As we have demonstrated in the previous section, it is possible to identify and measure cultural dimensions in business process models. We operationalized Hofstede's (1983) four cultural dimensions in

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process models by deriving metrics analyzing the use and structure of process model elements. In section 4.2, we applied our metrics on two business process models representing the same underlying process, one in a German and one in an Indian company. Our analysis of the results revealed a clear diversity between the German and the Indian process models regarding our cultural metrics. Even though we cannot interpret the derived values as absolute numbers, a clear tendency towards the four cultural dimensions for each of the two process models is obvious. For a better interpretation of our results, we opposed them to the findings of Hofstede's comprehensive study regarding the four cultural dimensions in the two countries Germany and India (see Table 3). Hofstede uses a scale from 0 (low) to 100 (high) to rate his cultural dimensions. In comparison, our metrics' values range from 0 (low) to 1 (high). While this means that we cannot directly compare the two scales, we can, however, compare the values of the two countries for each scale to reveal a tendency concerning the cultural dimensions.

	Process Models (aggregated metrics)			Hofstede 1983 (survey)		
	Germany		India	Germany		India
Power Distance	0.25	<	0.61	35	<	77
Uncertainty Avoidance	0.27	>	0.11	65	>	40
Individualism/Collectivism	0.67	>	0.52	67	>	48
Masculinity/Femininity	0.44	~	0.45	66	>	56

Table 3.   Comparison of calculated metrics and survey results by Hofstede (1983)

Looking at *Power Distance*, Hofstede states a value of 35 for Germany and 77 for India, representing a clear difference in the two cultures, as Germany has a lower Power Distance than India (Hofstede, 1983). Our analysis of the process models comes to a very similar conclusion as our metrics classified the process models of the German company (0.25) showing a lower Power Distance than the ones of the Indian company (0.61). *Uncertainty Avoidance* has a value of 65 in Germany and 40 in India according to Hofstede, displaying a higher avoidance of uncertainty in Germany. These findings are congruent with our measures: The analyzed process models evidence that there is a higher avoidance of uncertainty in the German company (0.27) than the Indian one (0.11). Hofstede's third cultural dimension rates the degree of *Individualism/Collectivism* in a society. His survey states a value of 67 for Germany and 48 for India, reflecting a higher Individualism for Germany in comparison to India. Our results are in accordance with this tendency as we calculated 0.67 for Germany and 0.52 for India using our metrics. As concerns the last cultural dimension *Masculinity/Femininity* Hofstede sees a value of 66 for Germany and 56 for India, suggesting that Germany has a more masculine culture than India. Our metrics showed an equilibrium between the values of the German company (0.44) and its Indian subsidiary (0.45). Thus, according to our metrics, we cannot state whether one of the two culture is more masculine or feminine. The comparison between the values of Hofstede's study and the aggregated values of our metrics shows that for three out of the four cultural dimensions our results are in accordance with Hofstede's findings. By applying our metrics in two companies in Germany and India, we have proven that it is possible to measure cultural characteristics in business processes. However, for a better interpretation and evaluation of the resulting values, further applications of the metrics in different companies, business processes, and countries are necessary.

To sum it up, we see a contribution of our research for both theory and practice. From a scientific point of view, cultural aspects in BPM have mostly been disregarded (Rosemann and vom Brocke, 2010), even though culture has a direct influence on process performance (Grau and Moormann, 2014). Our metrics are a new instrument to measure national culture in process models and thus contribute to this research gap of BPM. Up to now, cultural research has largely relied on questionnaires, which primarily focus on the layers of underlying assumptions and espoused beliefs and values. In contrast, our proposed metrics focus on the layer of artifacts, thus allowing for further aspects of cultural research. Our metrics are easy to apply to any business process model that is in accordance with general modeling requirements, contains the necessary key elements, and therefore provide a transparent, independent and unbiased analysis of the underlying cultural dimensions. Our long-term goal is to create a complementary database of values for certain types of different processes, industries and countries thus providing researchers as well as practitioners with valid and comprehensive benchmark values for our metrics.

We see a high practical contribution due to the fact that our metrics are well-defined and the data collection instructions are quick and easy to apply in a real-life context. The extraction of the underlying process variables is very cost-effective as compared to a questionnaire, since the necessary information is inherent in BPM systems and thus data collection may in many cases be automated. Additionally, our metrics and future reference values (see 5.2) contribute to practice in several other areas. The first area of application is the design phase of the BPM cycle. The process modeler designs a process that has to be aligned to the national cultures of the involved users. The designer may use our metrics to check whether the process s/he designs fits the cultural expectations in advance and therefore can ensure a high rate of adaption among the users. While this preliminary check is already helpful when designing a process for one's own company, the importance of culturally aligning a business process that involves users from several other countries and cultures is obvious. For example, it is necessary to consider the national culture when designing offshoring processes or when implementing a global IT-system.

We see a second area of application for our metrics in the analyze phase of BPM. When a company experiences problems with process performance, e.g., right after implementing a new process, our metrics help to analyze whether cultural issues are the cause for these shortcomings. This affects multinational companies in particular. Problems due to their different cultural backgrounds when employees from different countries work together can be expected (Stetten et al., 2012). Our metrics support the company by indicating whether a process design fits the cultural needs and expectations of all parties involved.

Our approach also provides a valuable contribution to practice in terms of mergers and acquisitions. Our metrics can point out the cultural compatibility with the processes of the company intended to be acquired. A high degree of cultural equality between the two companies' processes will lower integration costs and help employees to easier adapt to the new joint processes. The same reasoning is valid for outsourcing initiatives. A close cultural fit of the insourcer's processes with the ones of the outsourcing company can be seen as an indicator of a seamless integration. In addition, a company also has to deal with the authorities and rules and regulations when operating in a foreign country.

5.2   Outlook and further research

For a broader evaluation of our approach, we have defined several requirements when applying our metrics and identified further research possibilities. Despite the fact that gathering underlying data was quite easy to do, we found that in future it will be necessary to identify reference values fully interpret our metrics. As stated earlier, we plan to apply our metrics in other companies, to a wider range of business processes, and in several other countries. The long-term goal is to establish a *benchmark* for several individual countries, process types, and industries. In this context, finding similar processes implemented in several companies operating in different countries to generate valid reference data may present a major hurdle. To overcome this problem, we plan to analyze standardized processes from various internationally accepted process frameworks like ITIL, SCOR, or COBIT so that we will be able to identify the cultural specifics in actual implementations of standard processes.

Presently, we assume that cultural differences will only be reflected by processes with a high share of manual tasks, as only humans reflect cultural characteristics. Our hypothesis is that fully automated processes will therefore not vary between different cultures. In addition, we need to further investigate the value range of our metrics. All metrics presented in this paper range between 0 and 1. We have identified a discrepancy between possible and reasonable values. For instance, metric UA_3 is the fraction of planning functions of all functions. It is in the nature of the case that planning functions only represent a smaller share of all functions in typical business processes, thus the theoretical maximum for UA_3 will most likely never be achieved and only small values are to be expected. In a more comprehensive evaluation, we will determine *reasonable values for each metric*.

For ensuring a certain quality of our calculations and the calculated values, we identified several requirements that need to be addressed in future research. First, we found that a certain *level of detail* of

the process models is necessary. This includes the modeling of single process steps, performing organizational units, information objects and information systems. A high-level process model is too generic to reflect the influence of national culture as important details are missing. Thus, in a broader evaluation, basic requirements for the level of detail should be determined. Additionally, process models should adhere to predefined *modeling conventions* to ensure better comparability of the process models. Models should be based on the Guidelines of Modeling (GoM) (e.g., (Mendling et al., 2010, Becker et al., 2000)) and abide by the syntax of the particular modeling language. This assures better comparability of various process models. So far, we only analyzed processes modeled as EPC. As mentioned in 3.1, the metrics should be generally applicable to *other modeling notations*, as long as they provide the necessary key elements. Thus, we plan to investigate the influence of different modeling notations, e.g., BPMN, on our metrics, as not all companies use the same notation, and, even though most notations share the same key elements, they differ in terms of notation rules, element specialization, and naming conventions.

6   Conclusion

In this paper, we point out a lack of research regarding national culture in relation to business processes. We present a measurement approach as a valuable means for further analysis to identify national culture in business process models. To address the research gap, we defined nine metrics for the Cultural Dimensions Power Distance, Uncertainty Avoidance, Individualism/Collectivism and Masculinity/Femininity. As a proof of concept, we applied the metrics to business process models of a German company and its Indian affiliate. We demonstrated that our metrics are applicable in this context and that they provide further insights into the cultural characteristics of the two companies. We derived tendencies of the characteristics for the German and Indian company and compared them to those of Hofstede (1983).

The proposed approach for measuring national culture based on business process models contributes to both research and practice (see section 5.1). So far, cultural research has mainly relied on questionnaires to measure underlying assumptions and espoused beliefs and values for identifying national culture. We contribute by presenting first steps to measure culture based on documented actions and behavior, thus providing a transparent, independent and unbiased analysis of the underlying cultural dimensions.

For practice, we see several areas of contribution. In the design phase of BPM, our metrics support the modeler e.g., by checking whether the process s/he designs fits the cultural expectations of the involved parties before its actual implementation. Our Metrics can also support in the process analysis phase, e.g., by potentially identifying cultural problems causing performance issues. Furthermore, the analysis of the national culture in process models can be applied when measuring the cultural fit of two companies, e.g., in the context of mergers and acquisitions, or outsourcing.

However, our research is not without limitations. So far, we have only applied our metrics to a single business process in two companies from two countries. It is necessary to apply the metrics to further business processes and different countries to allow for a better evaluation. Besides, additional factors that influence process design may be evaluated, e.g., organizational culture. Even though process models are a means of quality documentation in companies, their quality and actuality cannot always be ensured. Last but not least, we could not operationalize some characteristics of Hofstede's Cultural Dimensions (see 3.2).

We have identified various areas for further research referred to in section 5.2: first, to evaluate the metrics on a larger scale, a comprehensive study including companies from further countries and other types of business processes is necessary. The long-term goal is to establish a *benchmark* for each individual country, process type, and industry. Additionally, we want to determine reasonable values for each metric to allow users for a better understanding of the outcome. Finally, we want to identify the influence of different modeling notations on our metrics.

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2.6   Beitrag 6: A Prototype for Supporting Novices in Collaboration Business Process Modeling Using a Tablet Device

Der letzte Beitrag dieser Arbeit beschreibt eine iPad Applikation zur Unterstützung von Novizen bei der kollaborativen Prozessmodellierung. Der Prototyp ermöglicht es Unternehmen, die Prozesserhebung in der Fachabteilung zu vereinfachen, indem die Mitarbeiter subjektorientiert alle für sie relevanten Aktivitäten selbst erfassen. Zudem zielt der „Erlebnisfaktor iPad" auf eine stärkere Motivation der Fachabteilung zur Beteiligung an Prozessmodellierungsinitiativen ab. Die auf einem Server gespeicherten Prozessabläufe der einzelnen User können automatisiert in ein jeweils eigenes BPMN-Modell exportiert und von einem Modellierungsexperten nachbearbeitet und zusammengefasst werden. Der Beitrag zeigt damit eine Möglichkeit auf, wie neue Technologien das BPM bei der Prozessmodellierung unterstützen können und bezieht sich damit auf die sechste Forschungsfrage:

Forschungsfrage 6:

Können neue Technologien das BPM bei der Prozessmodellierung unterstützen?

Titel	A Prototype for Supporting Novices in Collaboration Business Process Modeling Using a Tablet Device
Autoren (Anteile)	***Christian Ritter**, Josef Michael Schwaiger, Florian Johannsen* (**45%** - 45% - 10%)
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Tabelle 7: Details zu Beitrag 6

A Prototype for Supporting Novices in Collaborative Business Process Modeling Using a Tablet Device

Christian Ritter[✉], Josef-Michael Schwaiger, and Florian Johannsen

Chair of Business Engineering, University of Regensburg, Regensburg, Germany
{christian.ritter,josef-michael.schwaiger,
florian.johannsen}@wiwi.uni-regensburg.de

Abstract. Business process modeling is a decisive task as process models prepare the ground for business transformation and process improvement initiatives. However, modeling projects fall short of their initial aim when process participants are not involved in the act of model creation. The employees' individual process knowledge has been recognized as a crucial success factor to define high-quality process models that reflect a company's working procedures correctly. This paper introduces a prototype supporting collaborative modeling of business processes on tablet devices aimed at process modeling novices.

1   Introduction and Problem Statement

In today's fast-changing markets, companies are struggling to keep pace with constantly changing customer requirements [1]. New technologies (e.g. Web 2.0) lead to a high market-transparency, providing consumers with up-to-date information on product reviews, prices and alternative offers [2]. To face these challenges, companies are increasingly performing business transformation and business process improvement projects [3]. In this context, business process modeling is a decisive task. Process models do not only prepare the ground for process redesign initiatives but also foster the communication about working procedures amongst others [4]. However, enterprises encounter several obstacles during process modeling.

At first, process modeling is usually believed to be the responsibility of a few specialists only, rather than being recognized as an organizational task. If these specialists lack skills in translating staff comments and workshop documentations into proper process models, modeling initiatives will inevitably fall short of their initial aim [5]. We need to keep in mind that the process of model creation is highly subjective (cf. [6]). Second, employees' tacit process knowledge is essential to design process models that reflect a company's real working procedures (cf. [7]). Employees, having explicit knowledge of how business processes are executed on a daily basis, need to be involved in modeling projects [5]. This is especially relevant for inter-organizational business processes as companies tend to have isolated views only on processes within their own organization (cf. [8]). Thus, a collaborative (cf. [9]) and subject-oriented (cf. [10]) modeling approach, that integrates the process participants in model creation, is required. Instead of a specialist modeling a process end-to-end from an outsider's perspective, employees capture their specific work tasks as corresponding partial models [10]. As tablet devices are gradually adopted in the business

world, they can support collaborative business process modeling (CBPM). They can be easily shared within the workforce and thus help to consolidate employees' isolated views on a business process into one integrated process model [9], [11].

The aim of the paper is to introduce a prototype for CBPM using a tablet device. The prototype allows to collaboratively design process models using an intuitive user interface that is easily comprehensible even by process modeling novices. It supports the user to capture process-related knowledge (e.g. activities to be performed, roles etc.) in an intuitive way without requiring in-depth knowledge of specific modeling guidelines. However, all captured information can be automatically transformed and exported as BPMN (Business Process Model and Notation [12]) models.

The contribution of this research is twofold: at first, we introduce a concept supporting process modeling novices in transforming their tacit process knowledge into explicit models, a central success factor in modeling initiatives (cf. [5]). Second, we provide a prototype to foster collaborative and subject-oriented process modeling.

Our research follows the design science research methodology proposed by Peffers et al. [13]. This section describes the problem and motivates the context. In the next section, the objectives and the design of the artifact (prototype) are presented. A first demonstration of the prototype is described in section 3. Section 4 highlights the significance of the research. The paper is rounded off with a conclusion and an outlook.

2   Design of the Artifact

Several requirements derived from the problem statement and backed by literature arose on the prototype, a tablet application for process modeling by novice users:

(I) The first requirement of novice users visualizing business processes without having advanced knowledge in process modeling is an easy-to-understand user interface (UI) (cf. [14]). A process participant without any previous process modeling experience should be able to capture the main steps of his or her daily work without the help of a modeling specialist. Besides a well-designed UI, the modeling notation used by the prototype should be subject-oriented and easy to understand.

(II) The second requirement represents the prototype's support of CBPM (cf. [9], [15]). The user should be able to gather process information on her/his own, by interacting with coworkers on the same tablet, or by interacting with other users on different tablets. The information gathered by all users needs to be consolidated in a central database and made available to everyone involved in the modeling initiative.

(III) While the modeling approach is subject-oriented, process models are usually required to display the control flow using standard notations (e.g. BPMN) to comply with company regulations (cf. [16]). Thus, transforming the gathered process activities into BPMN syntax and exporting it in a standardized way is the third requirement.

(IV) The fourth requirement concerns the actual organizational use of the process model (cf. [5]). The prototype should enable process experts to adjust the BPMN model to fit the company's modeling rules and integrate it into the process repository.

With the implementation of our prototype, we developed an approach for fulfilling the presented requirements. A major challenge for tablet applications is to provide a slim and easy to use UI and simultaneously deliver a wide range of functionality [11]. Consequently, it is necessary to build on a modeling notation that is suitable for the

restricted modeling knowledge of novice users (requirement I). In that context, BPMN has emerged as a widely accepted industry standard. According to Recker [14], the existing amount of BPMN elements offers a huge diversification, which challenges novices to use it in the right way. As a result, we only picked the mostly used BPMN elements to be supported by our prototype: *start, end, activity, gateway, control flow, lane, and message flow*. We redesigned the selected elements to simplify them and to provide an easy-to-understand UI for unexperienced users (see Fig. 1). Users can name the current activity, attach a detailed description, and select internal or external preceding and succeeding activities. The number of possible predecessors and successors depends on the chosen connector. The description enables the user to include additional information (e.g. rules, input or output documents).
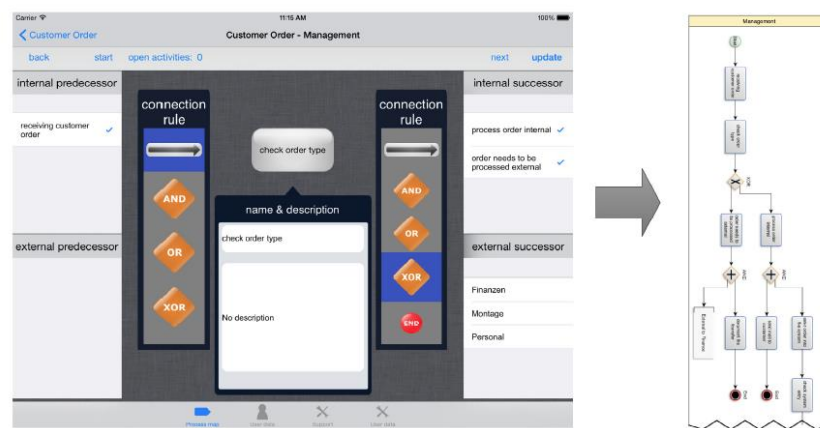

Fig. 1. Screenshot of the prototype and example export to BPMN via GraphML

Requirement II is the support of collaborative modeling. We achieve this by a client-server-architecture of the prototype that consists of three components (see Fig. 2): (1) A tablet application written in objective-C for use on iOS devices, (2) a PHP backend-server to manage the central database including user/role access and synchronize data on different devices, and (3) an export interface to convert the collected data into a BPMN model using GraphML as an exchange format. The architecture offers the possibility to work simultaneously on process models. To avoid concurrency conflicts, we prevent access to already opened processes temporarily, ensuring that only one user can edit a specific lane at a time. As users model their own view on the process only, lanes in the resulting process model are determined by the role of the user in the access management database (e.g. a user in the marketing department can only model a process in the marketing lane). To offer cross-system compatibility, we chose the open format *GraphML* (graphml.graphdrawing.org) for exporting the model as it provides the possibility to create models in BPMN notation (requirement III). The export is performed on the server and transforms the captured activities and dependencies stored in the database into proper BPMN syntax. The user can trigger the creation of an export file for each process lane on the tablet device when the lane is modeled completely (= has no

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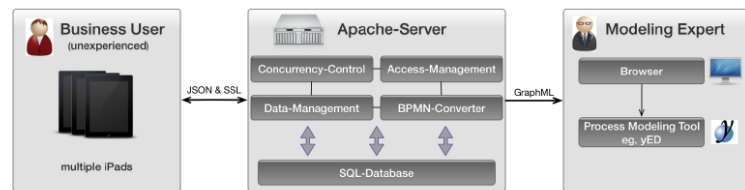
Fig. 2. Architecture of the prototype

undefined activities or 'dead ends'). The modeling expert can then download the file(s) from the server and view, edit, or combine the BPMN models (one lane per file) with the free software *yED* (www.yworks.com/en/products/yfiles/yed) (requirement IV).

3   Demonstration

Following Peffers et al., the use of the artifact is to be demonstrated before its evaluation [13]. At first, feedback from four Master's students proved that the artifact is fully functional and can be used for CBPM. As a next step, we demonstrated the artifact to three independent experts from different industries: The head of process and quality management of a German direct bank, the head of HR of an international power engineering company, and the head of process and quality management of a German financial services provider. The feedback we received from these three demonstrations was positive and provided us with helpful insights about the individual needs and wants from the practitioner's side. All three pointed out that the idea of integrating the workforce into the process modeling activities would be beneficial for correctness of the derived process models as well as helping to keep the process models up-to-date. Additionally, the 'fun' aspect of using a tablet was seen as a good way to motivate employees to engage in process modeling activities, which is usually seen as 'imposition'. However, some minor limitations of our prototype were seen as challenging for modeling very complex business processes. As a final step of the demonstration the prototype was presented at a conference for practitioners in the banking industry in front of an audience of approx. 30 professionals on the management and executive level. The discussion afterwards was positive and the feedback went along with the three interviews before. The idea of involving the individual employees on the operational level in process modeling was seen as very promising.

4   Significance of the Research

Our prototype is highly significant for research as well as for practice. At first, we provide a subject-oriented modeling approach which supports the transfer of employees' individual process knowledge into a corresponding process model building on an easy-to-use UI. Novices in process modeling may thus participate in modeling projects providing their valuable in-depth knowledge on working procedures (cf. [5]). In addition, our approach contributes to current research on how to support modelers during the process model creation (cf. [6]). Further, by using a tablet device, practitioners profit from the advantages of mobile solutions as these can be shared among employees.

A user then captures those parts of the holistic process (s)he is responsible for. This helps to gather models representing the actual working procedures.

5   Conclusion and Outlook

This paper presents a prototype for CBPM using a mobile tablet device. The usability of the prototype was demonstrated in expert interviews and a live presentation at a practitioner conference in the banking industry. The positive feedback received so far encourages us to develop the prototype further. In a next step, the prototype will be evaluated in a real world context by using it in modeling projects at companies of different size and branch. The insights gained will serve as base for refining the prototype to better match practitioners' specific needs. More information about the prototype can be found at: *http://www-be.uni-regensburg.de/Projekte/BPMN-Tool.html.en*

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3 Schlussbetrachtung

Dieses Kapitel fasst in Abschnitt 3.1 zunächst die Ergebnisse der Dissertation zusammen und geht auf die gewonnenen Erkenntnisse ein. Abschnitt 3.2 hinterfragt die Forschungsergebnisse kritisch. Mit einem Ausblick auf den weiteren Forschungsbedarf schließt Abschnitt 3.3 diese Dissertation ab.

3.1 Zusammenfassung und Fazit

Die vorliegende Arbeit hat drei grundsätzliche Zielsetzungen (vgl. Abschnitt 1.1). Im Folgenden werden die Ergebnisse der einzelnen Beiträge den Zielsetzungen gegenübergestellt und die gewonnenen Erkenntnisse diskutiert.

> **Zielsetzung 1 (Z1):**
> *Untersuchung der Erfolgsfaktoren für die Unterstützung des BPM durch eine kontinuierliche Prozessverbesserung mittels PPM*

Die erste Zielsetzung dieser Arbeit wurde durch zwei Forschungsfragen operationalisiert und mittels der ersten beiden Beiträge adressiert. Der erste Beitrag konnte, ausgehend von einer Expertenbefragung, die folgenden Erfolgsfaktoren für das PPM bei Banken identifizieren: Integration des PPM in die Unternehmensstrategie, Verknüpfung der Mitarbeiterentlohnung an das PPM, Notwendigkeit der sinnvollen Auswahl an KPIs, Notwendigkeit der Sicherstellung der Vollständigkeit der KPIs. Die identifizierten Erfolgsfaktoren sind allgemeingültig und damit auch auf andere Branchen als die untersuchte Bankenbranche übertragbar. Sie adressieren typische Probleme des PPM, die sich auch in Fallstudien zum PPM wiederfinden.

Der zweite Beitrag beinhaltete zwei vorgeschaltete Literature Reviews, die einerseits Fallstudien zum PPM und andererseits generelle Publikationen zum PPM untersuchten. Die Ergebnisse der Analyse konnten zur Identifikation typischer funktionaler Anforderungen an Softwarelösungen für das PPM genutzt werden. Der daraus abgeleitete Kriterienkatalog wurde auf zehn kommerziell erhältliche Softwarelösungen für das PPM angewandt. Dabei wurde deutlich, dass die einzelnen Tools unterschiedliche Schwerpunkte bei der Bereitstellung von PPM-Funktionalitäten bieten und daher die Auswahl eines geeigneten Tools maßgeblich von den Rahmenbedingungen und Anforderungen des individuellen Unternehmens abhängt.

Durch die beiden Beiträge konnte beleuchtet werden, wie eine Unterstützung des BPM durch die Nutzung „klassischer", kontinuierlicher Ansätze zur Prozessverbesserung unterstützt werden kann. Es zeigte sich, dass die Erfolgsfaktoren für das PPM primär bei der strategischen bzw. organisatorischen Einbindung des PPM in das Unternehmen sowie bei der Kennzahlendefinition zu suchen sind. Verfahren zur kontinuierlichen Prozessverbesserung können folglich nur dann erfolgreich funktionieren, wenn ein langfristiges Commitment zur Unterstützung durch das Top Management besteht und die individuellen, strategischen Ziele des Unternehmens in passende KPIs operationalisiert werden können.

> **Zielsetzung 2 (Z2):**
> *Untersuchung der Möglichkeiten für die Unterstützung des BPM durch den Einsatz von Enterprise Social Media unter Berücksichtigung interner sowie externer Stakeholder*

Die zweite Zielsetzung dieser Arbeit befasst sich mit dem Einsatz von Enterprise Social Media zur Unterstützung des BPM. Hierzu wurden drei Forschungsfragen definiert, die von den Beiträgen drei bis fünf beantwortet wurden.

Das Literature Review zu ESN lieferte Hinweise auf eine sich konsolidierende Begriffswelt zum Phänomen ESN und präsentierte zahlreiche Ansatzpunkte für den Einsatz von ESN, sowie aktuellen und zukünftigen Entwicklungsrichtungen. Eine Analyse der behandelten Themenfelder zeigte, dass insbesondere Themen zum Wissensmanagement, zur Analyse des Nutzerverhaltens sowie zur Nutzung von ESN in der bisherigen Forschung betrachtet wurden. Damit werden Themen adressiert, die auch für die mögliche Unterstützung des BPM relevant sind. Sie gehen beispielsweise der Frage nach, warum ESN grundsätzlich genutzt werden, welche einzelnen Funktionalitäten von ESN im Detail genutzt werden oder wie sich die Nutzung von ESN im Zeitverlauf ändert. Diese Erkenntnisse können Unternehmen dabei helfen, den zu erwartenden Nutzen durch den Einsatz von ESN im Rahmen des BPM besser einzuschätzen.

Während ESN primär die internen Mitarbeiter unterstützen, betrachtet der vierte Beitrag die Einsatzmöglichkeiten von Enterprise Social Media im Rahmen der externen Kommunikationsbeziehungen. Das vorgestellte Verfahren zur automatisierten Auswertung und Sentimentanalyse von Kundenposts auf den Firmenseiten in sozialen Netzwerken zeigt eine Möglichkeit auf, wie neue Technologien Prozesse effizienter gestalten können. Die Analyse der Kundenposts aus sozialen Netzwerken stellt gerade auch für KMUs eine wichtige Möglichkeit zum ungefilterten Empfang von weltweiten Kundenfeedback dar. Die Analyse ist jedoch sehr zeitaufwändig und erfordert im Extremfall eine 24/7-Überwachung der Firmenseite im sozialen Netzwerk. Durch die Automatisierung entfällt diese Arbeitslast und die Mitarbeiter können sich folglich auf ihre Kernaufgaben sowie die Interpretation des Kundenfeedbacks aus der Sentimentanalyse konzentrieren. Die Nutzung der automatisierten Lösung wird jedoch sehr stark von der Güte des Algorithmus bestimmt. Daher erfolgte ein Abgleich der automatisierten mit der manuellen Analyse, die von mehreren Forschern gemeinsam durchgeführt wurde. Es zeigte sich, dass die automatisierten Verfahren grundsätzlich eine hohe Klassifikationsgüte aufweisen, jedoch insbesondere bei der Fachsprache für bestimmte Kundengruppen (z. B. im Bereich Funsport) die Fehlerrate stark ansteigt. Hier besteht also durchaus noch weiterer Forschungsbedarf.

Der fünfte Beitrag befasste sich mit der Identifikation kultureller Unterschiede in Prozessmodellen. Die definierten Metriken konnten bis auf eine Ausnahme für die Messung nationaler Kultur in Prozessmodellen validiert werden. Der vorgestellte Ansatz kann das BPM beispielsweise in der Designphase unterstützen, indem Prozesse vor der Implementierung auf ihren „cultural fit" in ihrem geplanten Umfeld hin geprüft werden können. Zudem unterstützt der Ansatz auch in der Analysephase des BPMs, indem kulturelle Abweichungen zwischen dem Prozess und der nationalen Kultur als mögliche Einflussfaktoren auf die Prozessleistung identifiziert werden können. Ein weiteres Anwendungsgebiet liegt in der Untersuchung der „kulturellen

Kompatibilität" von Prozessen bei länderübergreifenden Firmenzusammenschlüssen oder Kollaborationsprojekten.

Zusammenfassend kann festgehalten werden, dass neue Technologien das BPM auf vielfältige Weise unterstützen können. Am Beispiel von Enterprise Social Media wurde aufgezeigt, wie interne Verbesserungen durch die Nutzung von ESN realisierbar sind und wie externe Social Media Kanäle für das Customer Relationship Management eingesetzt werden können. Kulturelle Einflüsse können in beiden Fällen relevant sein, bei ESN z. B. durch die Integration von Mitarbeitern aus weltweiten Niederlassungen und bei sozialen Netzwerken durch die Nutzung der Firmenseiten durch internationale Kunden. Die Betrachtung der Geschäftsprozesse unter Berücksichtigung kultureller Einflüsse ist daher hochaktuell.

Im Vergleich zur Anwendung von PPM resultiert die Einbindung neuer Technologien in größeren, teilweise radikalen Prozessveränderungen. Die Einführung eines ESN kann beispielsweise Projektmeetings komplett in die virtuelle Welt verlagern und damit neben der Einsparung von Reisekosten auch die Reaktionsgeschwindigkeit und weltweite Zusammenarbeit beschleunigen. Beim Einsatz von Social Media als Feedback- oder Servicekanal können im Extremfall Call-Center überflüssig werden und sich damit die Kundenserviceprozesse radikal verändern. Auch die Erfolgsfaktoren der beiden Alternativen der Prozessverbesserung unterscheiden sich. Während die erfolgreiche Anwendung von PPM stark strategiegetrieben top-down abläuft, finden Prozessveränderungen durch neue Technologien von außen oder von den Mitarbeitern getrieben ihren Weg in das Unternehmen. Die Erfahrung zeigt zudem, dass die Einführung neuer Technologien durch die IT-Abteilung ohne einen konkreten Bedarf zur Integration dieser Technologien in die Geschäftsprozesse der Fachabteilungen selten erfolgreich ist.

Zielsetzung 3 (Z3):
Beispielhafte Anwendung neuer Technologien zur Verbesserung der Prozessmodellierung

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Die dritte Zielsetzung der Arbeit wurde über eine einzelne Forschungsfrage operationalisiert und durch den sechsten Beitrag adressiert. Die Prozessmodellierung ist der zentrale Ausgangspunkt für jegliche Prozessverbesserungsvorhaben oder Transformationsprojekte. Aus diesem Grund ist sie maßgeblich für den Erfolg des BPM im Unternehmen verantwortlich. Der im Beitrag vorgestellte Prototyp zielt darauf ab, Unternehmen bei der erstmaligen Prozesserhebung zu unterstützen. Dies wird einerseits durch eine starke Abstraktion und Vereinfachung der Modellierungssprache und andererseits durch die Motivation der Fachabteilung zur aktiven Teilnahme an der Prozesserhebung erreicht. Beides wird durch die Nutzung neuer Technologien, konkret durch die Bereitstellung einer Modellierungsapplikation auf einem Tablet, umgesetzt. Nach der Prozesserhebung durch Novizen ist zwar noch zwingend die Nachbearbeitung der Prozessmodelle durch einen Modellierungsexperten notwendig, insgesamt verringert der Prototyp jedoch den Arbeitsaufwand für den Modellierungsexperten deutlich. Erste Tests des Prototyps mit Studierenden verliefen vielversprechend und auch das Feedback aus diversen Expertengesprächen war durchweg positiv. Die Einbindung der Fachabteilung wurde dabei mehrfach als wichtiger Eckpfeiler für die Verbesserung der Prozessmodellierung genannt. Eine Validierung des erwarteten Nutzens anhand einer Fallstudie ist jedoch bisher noch nicht erfolgt.

3.2 Kritische Würdigung

Die in dieser Dissertation erarbeiteten Forschungserkenntnisse sind abschließend kritisch zu hinterfragen. Die folgenden Punkte werden deshalb genauer beleuchtet:

- Stichprobengröße der empirischen Erhebung: Die im ersten Beitrag durchgeführte Expertenumfrage enthielt nach Ausschluss aller unbrauchbaren und unvollständigen Datensätze nur noch 40 Datensätze, die für die Auswertung der Erfolgsfaktoren herangezogen wurden. Es konnte jedoch gezeigt werden, dass die Stichprobengröße für die Validität der Ergebnisse groß genug ist. Zudem muss berücksichtigt werden, dass durch ein striktes Ausschlussverfahren insgesamt 69 der 109 Umfrageteilnehmer aufgrund von unvollständigen Antworten, fehlerhaften Kontrollfragen oder Zeitrestriktionen ausgeschlossen wurden. Somit konnte eine hohe Qualität der Datensätze erreicht und eine Verzerrung der Stichprobe verhindert werden.

- Anwendung des Kriterienkatalogs zur Bewertung der PPM-Softwarelösungen: Die Evaluation der PPM-Softwarelösungen im zweiten Beitrag wurde anhand des entwickelten Kriterienkatalogs durchgeführt. Die Bewertung der Erfüllung der Einzelkriterien wurde jedoch von den Softwareherstellern selbst durchgeführt. Damit ist eine objektive, vergleichende Analyse der einzelnen PPM-Tools nur begrenzt möglich, da eine eher positive Bewertung des jeweils eigenen Werkzeugs durch die Anbieter zu erwarten ist. Für die Lösung dieses Problems gibt es zwei Alternativen: Einerseits könnte man die Bewertung von einer objektiven Stelle vornehmen lassen. Das wäre jedoch mit einem hohen Aufwand verbunden. Zudem müsste sich der Evaluierende in alle Softwarelösungen gleichermaßen gut einarbeiten, um ein objektives Urteil fällen zu können. Eine zweite Alternative wäre die Erstellung einer Fallstudie mit vorgegebenen Rahmenbedingungen, die die Anbieter mit ihrer Software implementieren müssen. Damit könnte eine direkte Vergleichbarkeit geschaffen werden und es würden keine Funktionalitäten der einzelnen Anwendungssysteme aus Unwissenheit unterschlagen. Allerdings wäre man in diesem Fall auf die Bereitschaft der Hersteller angewiesen, den nicht unerheblichen Aufwand in die Bearbeitung der Fallstudie zu investieren.

- Literature Review zum ESN: Ein Literature Review kann niemals absolute Vollständigkeit garantieren, da anhand der Definition der Suchbegriffe und der Auswahl der Datenbanken bereits zu Beginn eine Einschränkung der zu erwartenden Ergebnisse vorgenommen wird. Somit wäre es denkbar, dass relevante Literatur aufgrund eines fehlenden Keywords oder einer nicht genutzten Datenbank unberücksichtigt gelassen wurde. Um diesem Problem zu begegnen wurden im dritten Beitrag mehrere Vorkehrungen getroffen. Zunächst wurden alle Top-30 Journals des MIS Journal Rankings ausgewählt und um weitere relevante Journals aus dem VHB-Jourqual-Ranking ergänzt. Daneben wurden die Proceedings aller relevanten Konferenzen aus dem VHB-Jourqual-Ranking aufgenommen und um weitere, themenspezifische Konferenzen ergänzt. Durch dieses Vorgehen sollten alle wissenschaftlich relevanten Beiträge erfasst worden sein. Für die

Identifikation der relevanten Literatur aus den 3.825 gefundenen Publikationen wurde ein Vier-Augen-Prinzip angewandt, um das versehentliche Aussortieren relevanter Publikationen zu verhindern. Abschließend wurde durch Vorwärts- und Rückwärtssuche in den ausgewählten Publikationen sichergestellt, dass die relevante Literatur so vollständig wie möglich ist.

- Metriken zur Messung nationaler Kultur: Die identifizierten Metriken wurden bisher erst an einem Fallbeispiel validiert. Damit ist eine generelle Anwendbarkeit noch nicht bewiesen. Es müssen daher noch weitere Untersuchungen folgen, die die Metriken auf andere Unternehmen und Länder anwenden.

- Prototyp. Der vorgestellte Prototyp zur Prozessmodellierung auf einem Tablet wurde bisher noch nicht an einem realen Fallbeispiel getestet. Der tatsächliche Nutzen und die angenommene Wirkung auf die intrinsische Motivation der Fachabteilung konnte daher noch nicht bewiesen werden. Es erscheint sinnvoll, den Prototyp zunächst im Rahmen eines Experiments von Studierenden anwenden zu lassen und somit ein erstes Feedback zur Anwendbarkeit zu sammeln. Sofern das Experiment erfolgreich verläuft kann eine Fallstudie mit einem Unternehmen die Akzeptanz und Usability der Applikation in einer realen Umgebung testen.

3.3 Ausblick

Aus den Ergebnissen der Beiträge können folgende zukünftige Forschungsbedarfe identifiziert werden:

Zukünftige Forschungsthemen zu Zielsetzung 1:

- Es sollte eine erneute Evaluation der PPM-Softwarelösungen durchgeführt werden, um den aktuellen Stand sowie die seit der letzten Untersuchung erfolgten Entwicklungen bei PPM-Tools zu identifizieren. Dabei könnte zusätzlich auf die in Abschnitt 3.2 beschriebenen Ideen zur objektiven Bewertung zurückgegriffen werden.

Zukünftige Forschungsthemen zu Zielsetzung 2:

- Die Literaturübersicht zu ESN sollte kontinuierlich um aktuelle Beiträge ergänzt werden. Die Veröffentlichungen zum Themengebiet ESN sind in den letzten Jahren stark angestiegen und werden es wahrscheinlich auch weiter tun, daher ist die Pflege des erarbeiteten Frameworks als „Standard-Nachschlagewerk" sicherzustellen. Zudem könnte dadurch die erarbeitete Forschungsagenda schrittweise angepasst und ergänzt werden.

- Bisher existieren noch keine allgemeingültigen Erfolgsfaktoren für den Einsatz von ESN. Anhand der Begleitung eines Einführungsprojekts könnten Daten vor und nach der Einführung erhoben werden und daraus Ableitungen bzgl. des Erfolgs der Einführung getroffen werden. Die so erarbeiteten Ergebnisse könnte man mit anderen Fallstudien vergleichen und versuchen, gemeinsame Erfolgsfaktoren abzuleiten.

Zukünftige Forschungsthemen zu Zielsetzung 3:

- Der bestehende Prototyp muss, wie bereits in Abschnitt 3.2 erwähnt, noch in der Praxis validiert werden. Funktional bieten sich noch einige Weiterentwicklungsmöglichkeiten an, z. B. die Erhebung von Dokumenten oder die Abbildung von komplexen Verzweigungen im Sequenzfluss. Zudem könnten zur weiteren Steigerung der Nutzermotivation Konzepte aus dem Bereich Gamification in den Prototyp integriert werden. Durch die spielerische Gestaltung der Modellierung und die Nutzung virtueller Belohnungen könnte man eine kontinuierliche Prozesserhebung anstoßen (z. B. durch das Verleihen einer Auszeichnung für die monatliche Aktualisierung der Prozessmodelle über den Zeitraum eines Jahres).

- Auch die Integration von Enterprise Social Media in den Prototypen könnte die Akzeptanz und Nutzungsbereitschaft weiter erhöhen. Vorstellbar wäre die Nutzung von Profilen aus einem ESN, wodurch man einerseits eine unternehmensweite Nutzerverwaltung ermöglichen würde und andererseits die bereits genannten Gamification-Elemente an das Userprofil im ESN verknüpfen könnte. Dadurch würde beispielsweise ein besonders engagierter Mitarbeiter für alle anderen Mitarbeiter im Unternehmen als Prozessexperte sichtbar. Dieser Status könnte zusätzliche Motivation für die weitere Nutzung der Modellierungsapplikation bieten.

Übergreifende zukünftige Forschungsthemen:

- Der Prototyp könnte auch für die Erhebung von Kommunikationsbeziehungen zur Ableitung von Gestaltungsempfehlungen für ESN dienen. Durch den genutzten subjektorientierten Modellierungsansatz bietet der Prototyp bereits jetzt die idealen Voraussetzungen für die Erfassung der sozialen Beziehungen der einzelnen Mitarbeiter. Zudem könnten, anders als bei der Prozessmodellierung, informelle Beziehungen zwischen Mitarbeitern erhoben und folglich auch visualisiert werden. Der Aufwand für die Anpassung des Prototyps für die Erhebung der Kommunikationsbeziehungen ist aufgrund der bereits vorhandenen Struktur als eher gering einzuschätzen.

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