ITM COMMUNICATIONS 2011/1

Role-Oriented Enterprise Systems: Case Studies of Two Vendors

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26 September 2011

ISBN 978-87-92524-16-4

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Abstract

This paper examines the concept of role-oriented enterprise systems by investigating motivations for and approaches to constructing and reflecting predefined organizational roles in user interfaces of packaged enterprise systems. The research is conducted as case studies of Microsoft and SAP, constructed from interviews, documents, and examples of role-oriented enterprise system packages from both vendors. The research indicates that the primary motivation of the vendors for including predefined roles is to complement a function-centric approach with a user-centric approach to the design of user interfaces of enterprise systems. The research furthermore identifies strategies of an *embedded* and an *independent* approach to modeling the role concept and a *unified* and a *componentized* approach to reflecting role aggregation in user interfaces.

Keywords: Enterprise Systems, Organizational Roles, User Interfaces, SAP, Microsoft.

Introduction

Enterprise systems are important to the daily operations of most modern organizations. While early acquisition models relied on in-house development or individual software contractors, packaged systems now dominate the enterprise software market (Janson and Subramanian 1996; Davenport 1998; Markus and Tanis 2000). The universal nature of packaged software entails potential issues of gaps, or misfits, between enterprise systems package and individual customer organizations. (Rolland and Prakash 2000; Soh, Kien and Tay-Yap 2000). While much attention has been paid to the fit of business processes and functions (e.g., Koch 2001; Luo and Strong 2004; Huq, Huq and Cutright 2006), *user satisfaction* has long been acknowledged as playing an important role for the success of information system implementations (DeLone and McLean 1992). Previous research indicates that usability of enterprise systems is closely linked to user satisfaction (Calisir and Calisir 2004) but that several usability issues exists in the user interfaces of enterprise systems, such as easy identification of and access to needed functionality (Topi, Lucas and Babaian 2005). It has been suggested that multiple user interfaces may improve the usability of enterprise systems (Calisir and Calisir 2004) and that a focus on the *organizational roles* of the users may help provide a better fit between enterprise systems and human actors (Worley et al. 2005; Johansson 2009). In tandem, enterprise system vendors have begun to focus their attention on the organizational roles of users (Sleeper 2004; Johansson 2009).

Previous research into the role concept in the fields of organizational role theory and Information Systems indicates that while no common definition of the concept exists (Biddle 1986), the role concept is extensively applied in the IS literature (Zhu and Zhou 2008). Several enterprise models thus include organizational roles (Scheer 2000; Almeida, Guizzardi and Santos 2009) and the role concept is frequently used for managing security rights of end-users in enterprise systems (Kern et al. 2002; She and Thuraisingham 2007). Furthermore, previous research has addressed approaches for reflecting organizational roles in the user interface of Information Systems in general (e.g., Shneiderman and Plaisant 1994) and in enterprise systems in the form of Enterprise Portals (Carlsson and Hedman 2004; Puschmann and Rainer 2004). However, little empirical research has investigated why and how vendors apply

organizational roles to the user interfaces of enterprise systems. This paper thus seeks to answer this question by comparing the approach to role-oriented enterprise systems from Microsoft and SAP.

The remaining parts of the paper are structured as follows: 1) Presentation of previous research relevant to the concept of role-oriented enterprise systems to organizational roles and to representing roles in user interfaces; 2) the research design of the empirical study; 3) presentation of the findings; 4) discussion of the findings; and 5) conclusion and future research.

Previous research

Before embarking on the empirical study to answer the question of how enterprise systems vendors orient their system to organizational roles, we must look into previous research relevant to the concept of organizational roles and approaches to reflecting roles in information systems.

Katz and Kahn (1966) perceive the very essence of organizations as "the patterned activities of a number of individuals" (p. 17) and define a role as: "standardized patterns of behavior required of all persons playing part in a given functional relationship, regardless of personal wishes or interpersonal obligations irrelevant to the functional relationship." (p. 37). The term 'role' is often mistaken as synonymous with the notion of 'position' or 'job title' and the concepts are often used interchangeably in the literature. However, the terms differ conceptually as roles are concerned with *responsibilities* and *obligations*, whereas positions or job titles are concerned with *hierarchical relations* between individuals in the organization (Pareek 1994). Job titles and positions in isolation may thus not capture the "actual work" carried out by individuals in the organization. The concept of organizational roles is closely related to the concept of 'processes' or 'business processes' of the organization (Barros et al. 2000). Business processes may be defined as "[A] structured sets of work activities that lead to specific business outcomes for customers" (Davenport and Beers 1995, p. 57). Organizational roles thus carry out the activities, or tasks, needed to complete the business processes.

An individual in an organization may occupy several roles simultaneously (Katz and Kahn 1966), also referred to as 'role aggregation' (Almeida et al. 2009). Individuals in small organizations often occupy multiple roles at a time, as opposed to large organizations where individuals typically only hold a single role. Fitting enterprise systems to organizational roles by means of predefined roles thus requires addressing the concept of role aggregation to fit organizations with various degrees of role aggregation. Closely related to the concept of role aggregation is the concept of 'role *specialization'*. Role specialization is concerned with the distribution of tasks between roles (Pugh et al. 1968). Roles in SMEs are typically less specialized than roles in large organizations – or as put by Mintzberg (1979): "While it is not uncommon for the president of a small company to roll up his sleeves and fix a machine, or to serve in the role as an analyst in designing an inventory system, we would be surprised to see the president of a large company do these things." (p. 231). The distinction between the concept of role aggregation and role specialization is arguably of little concern to users of enterprise systems, as they primarily focus on the actual tasks they carry out and not whether the tasks belong to one role or another. However, the two concepts conceptually differ, as described above and illustrated in Figure 1, and are important to a role-oriented enterprise system, as the system needs to fit both the level of role aggregation and role specialization, in order to fit the roles of the users.

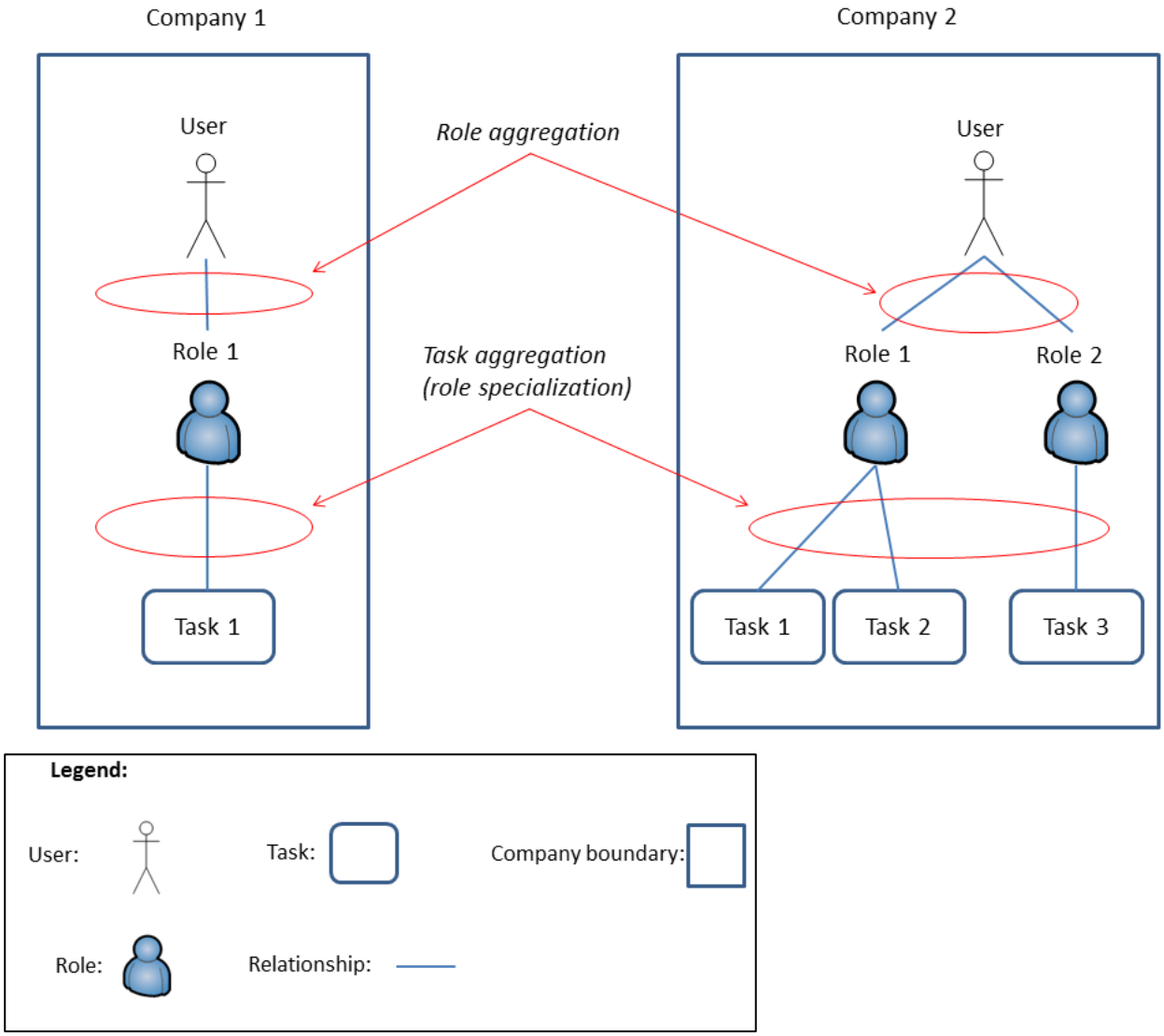

Figure 1. A meta model of role aggregation and specialization.

Organizations may operate in a particular industry, also referred to as an industry vertical. Some organizational roles, such as a 'Bookkeeper' or a 'Sales Order Processor', are found across many different industries. We may term these roles as 'cross-industry'. Other roles, such as an 'Insurance Salesman' or a 'Real Estate Agent', are specific for the industry in which the organization operates and we may thus refer to these roles as 'industry-specific' roles. While there is no clear definition distinguishing cross-industry and industry-specific roles, predefined roles in packaged enterprise systems will have to address the issue of support for both types of roles.

The application of roles in Information Systems

Zhu and Zhou (2008) make an extensive survey of the use of the role concept in the Information Systems field and conclude that while the concept has been extensively applied to various areas of the field, no commonly accepted definition of the term can be found. Previous research in the area of enterprise modeling has addressed organizational roles of users from a modeling perspective. Much of the literature on enterprise modeling, such as UML (Object Management Group 2007) and BPMN (White 2004), allows

non-human agents, such as organization units and information systems, as occupants of organizational roles. While this abstraction offers a wider application of the role concept, it is of little relevance when addressing the topic of predefined roles as a means of supporting end-users in organizations. We thus reserve the occupation of organizational roles to human agents when addressing the topic of role-oriented enterprise systems. In the ARIS business process modeling (Scheer 2000), roles are defined as "a certain type of employee with clearly defined qualifications and skills" (p. 57) and are allocated to business functions. Roles are assigned to one or more 'positions' and positions may occupy multiple roles. ARIS thus addresses the concept relationship between roles and business processes, and the structure of role aggregation from a modeling perspective. While ARIS and other enterprise models capture the basic notion of organizational roles and their relationships to other business concepts, enterprise models are not aimed at capturing how to *reflect* organizational roles in the design of packaged enterprise systems.

Role-Based Access Control (RBAC) has been used extensively for managing security rights of users in enterprise systems (Kern et al. 2002; She and Thuraisingham 2007) and thus represents one approach to reflecting the role concept in design of enterprise systems. However, while implementation of RBAC-roles in enterprise may provide the first step towards reflecting organizational roles in enterprise systems, RBAC-roles has limitations when representing organizational roles in user interfaces. Firstly, RBAC is concerned with security, not with design of user interfaces. Secondly, security rights are "binary" – either the user has access to a specific function or not. Security rights do thus not address the frequency with which an organizational role accesses a certain function or the importance of easy access to certain information.

Reflecting organizational roles in user interfaces

In the field of Computer Supported Collaborative Work (CSCW), Greenberg (1991) suggests multiple user interfaces to accommodate differences in user roles and individual preferences. The implementation of multiple user interfaces has also been suggested in the field of enterprise systems to accommodate increasing diversity of enterprise system users and to increase overall user satisfaction (Calisir and Calisir 2004). Shneiderman and Plaisant (1994) suggest a 'Personal Role Manager' (PRM) as a means of reflecting roles in the user interface by allowing users to select the user interface matching the role they are currently occupying. The purpose of the PRM is thus to reduce "distraction while working in a role, and facilitate shifting of attention from one role to another" (Shneiderman and Plaisant, p. 6).

In the field of enterprise systems, Enterprise Portals have been used to provide a single point of access to organizations' internal and external systems by syndicating information from different sources (Carlsson and Hedman 2004). The very essence of enterprise portals is thus to "group together applications and information through a *role-based* user interface" [italics added] (Puschmann and Rainer 2004, p. 2). Carlsson and Hedman (2004) evaluate 329 predefined roles in SAP's mySAP Workplace Enterprise Portals and conclude, that while the roles have a strong internal and control focus, they lack external focus and support for top managers. Carlsson and Hedman (ibid.) furthermore explicitly suggest further research into the value of applying the role concept in enterprise systems and call for research into the potential issue of role aggregation in SMEs.

Armed with this preliminary understanding of the definition of organizational roles, approaches to modeling roles in the IS field, and previous attempts and suggestion for how to reflect organizational roles

in user interfaces of enterprise systems, we proceed to outline the methodology for the empirical research presented in this paper.

Methodology

The research presented in this paper was conducted as case studies (Yin 2008) of two enterprise system vendors. The case study research is especially useful for investigating problems in which research and theory are in their early stages, and a multiple case study design allows a higher degree of generalization of the findings and emerging propositions (Benbasat, Goldstein and Mead 1987). Selection of the two cases was based on finding vendors that advertised their enterprise systems as oriented towards organizational roles of users. Selecting *large* vendors was emphasized to produce findings that would cover a larger population of customer organizations, as large vendors, all else equal, have a larger customer base. Microsoft Dynamics and SAP AG were thus selected as case study companies for the research, as both vendors explicitly advertise organizational roles as a key concept in the design of their enterprise systems and together they have a combined global market share of more than 1/3 of all enterprise system implementations (Panorama Consulting Group 2011). Data for the case studies consisted of semi-structured interviews (Kvale and Brinkmann 2008), an example of an enterprise system package from each vendor that included and reflected predefined roles in the user interface, and an extensive number of documents describing the role concept and implementation of the concept in the case systems.

Selection of respondents for the interviews was based on finding representatives in each case company who had participated in the process of constructing and implementing the predefined roles. Three interviews with respondents from Microsoft and two interviews with respondents from SAP were carried out, lasting between 51 and 108 minutes. The interviews were conducted between December 2008 and July 2011 and were fully transcribed to allow detailed analysis of the statements from the interview respondents. After the interviews were conducted, a representative from each vendor agreed to participate as co-authors of the paper, ensuring accuracy of the presented findings. Table 1 provides an overview of the positions of the respondents. The Usability Manager from Microsoft had left the company shortly before the interview was conducted to work as an external consultant advising about the role concept to Microsoft's partner companies. After careful consideration, and acceptance from the co-author from Microsoft, the manager was included in the research, as the information provided by the manager provided invaluable insight into the motivation reflecting the role concept in user interfaces at Microsoft.

Company	**Respondent title**
Microsoft	Usability Designer
	(Former) Usability Manager
	Partner Technology Advisor
SAP	Vice President of New Product Concepts
	Vice President of Product Solutions

Table 1. Interview respondents.

Selecting the examples of enterprise system packages from the two vendors of systems was based on identifying system packages that included multiple role-oriented user interfaces, were readily comparable, and were available in the Danish market. At Microsoft, the NAV 2009 RTC with service pack 1 was selected as an example of how the company implemented the role concept. At SAP, the All-in-One version 8.81 with

the NetWeaver Business Client version 3.0 was selected for comparison. Both systems are targeted at SMEs and allow 'on-premise' implementation at customer companies. While NAV 2009 RTC comes with a fixed number of predefined role user interfaces for the Danish market, the role content for SAP All-in-One is delivered in separate packages available from the vendor. The SAP 'Base line' package version 1.604 with cross-industry roles for the local Danish market was thus selected as the example of predefined roles at SAP.

To determine functionality of the two role-oriented systems and to triangulate statements from the interview respondents, an extensive number of documents were obtained from the two vendors. Most of the documents were publicly available, but some were acquired from internal sources. Especially the documents describing the internal process of constructing and communicating the predefined roles at the two vendors were not publicly available. Analysis of the data for the case studies was based on answering the research questions by uncovering: The very motivation for reflecting organizational roles in the user interfaces; the process of constructing the predefined roles and the constructs used in the process; how the predefined roles were reflected in the user interfaces of the systems; and approaches to tailoring and extending the predefined roles to individual customer companies.

Findings from the case studies

Table 2 provides a summary of the findings from the case studies of the two vendors. The findings are elaborated in greater details in the following paragraphs.

Table 2. Summary of research findings.

Analysis category	**Analysis concept**	**Case study findings**	
		Microsoft Dynamics	**SAP AG**
Motivation	Motivation for reflecting the role concept in user interfaces	Shift from a function-centric to a user-centric perspective Easy access to functionality for users Syndication of information	
Modeling of roles in enterprises	Framework for modeling roles	'Customer model'	ARIS/Contextual Design
	Constructs modeling the role concept	Personas Roles Activities/Tasks Business Processes (See Figure 2)	Roles WorkSets Tasks Business Processes (See Figure 3)
Reflecting organizational roles in user interfaces	Example of role- oriented enterprise system	NAV 2009 RTC SP1	All-in-One 8.81 with NWBC 3.0
	No. of predefined role user interfaces in example systems	21	35 ('Base line' package)
	Characteristics of the predefined roles	Cross-industry	Cross-industry ('Base line' package)
	Extending predefined roles to specific industries	Partners	In-house and partners

Motivation for reflecting the role concept

The documentation accompanying the introduction of reflecting organizational roles in the user interfaces of enterprise systems at Microsoft states the motivation for orienting the systems to organizational roles as founded in "*combining the worlds of business process automation and personal productivity*" (Microsoft Dynamics 2007). The Usability Manager at Microsoft elaborated the motivation by emphasizing that the focus on organizational roles entails a move from a focus solely on *functions* to a focus on the needs of the *users*: "*Of course there is also a focus on functionality but that is more in the background. So there is a focus on that the user gets what the user needs. That means that all the information that the user needs is located so that it is easy to access*". The manager further elaborated that the overall goal is to save time for the users: "*By the end of the day, it's about saving time. If [the role-oriented approach] works at is supposed to, then it should save the user a lot of time when looking for information […] needed to take the right decisions and take action.*" The motivation for focusing on organizational roles at Microsoft was furthermore related to syndicating information from different sources in into one user interface.

The SAP documentation explains the purpose of reflecting roles in the user interfaces of the vendor's enterprise systems as: "*In SAP systems, roles provide a convenient way to structure a user's daily tasks into groups of services and transactions, making them accessible from a personalized menu.*"(Schneider 2002). The SAP respondents further explained that, similar to the motivation at Microsoft, the primary reason for introducing the role concept was to center the attention on the *users* as opposed to the functions and processes of the *system*: "*The way ERP systems used to treat roles is really more system-centric. So there was a whole layer of access profiles in the back-end systems where you say, if we give this access role to this user they have access to this and this data or transaction […]. So there was an obvious need for a concept that really thinks about what a user really needs in a certain role.*" (VP of New Product Concepts, SAP). The motivation for introducing the role concept in the enterprise systems of SAP was also related to syndication of information coming from different sources both from within the SAP systems and from external sources: "*So it's a mix of navigation and syndication*", explained the VP of New Product Concepts, SAP.

Conceptual modeling of organizational roles in enterprises

The vendors apply a number of methods and techniques for conceptual modeling of roles in enterprises. The models are based on studies of the work carried out by users in organizations in order to capture the *actual* work of users, rather than founding the models on what the enterprise systems already offer. The goal of the models is to eventually integrate the models with the different enterprise systems to support easy tailoring of systems to fit the individual customer companies.

Roles as embedded concept

At Microsoft, the conceptual modeling of organizational roles is communicated through a 'Customer Model' consisting of a number 'Personas' and their relationships to 'Departments' and 'Processes' (Microsoft Dynamics 2007). Besides description of 'Demographics', 'Psychographics', and a fictitious picture, each 'Persona' contains a description of the 'Primary' and 'Secondary' roles occupied by the Persona. A description of relations to 'Core Activities', such as 'Approve quotes' and 'Pay company bills', is also described for each Persona along with relationships to 'Processes', such as 'Consolidate Orders' and 'Route Shipments'. The 'Core Activities' and the 'Processes' are thus *implicitly* linked to the roles through the Personas, as illustrated in Figure 2. The motivation for using Personas as part of the conceptual modeling of roles is to provide a unified view of typical user of enterprise systems.

The respondents at Microsoft further explained that the benefits of using Personas as part of the Customer Model are related to mapping the individual customer companies with a general enterprise model, and hence easier mapping to the predefined roles of the enterprise system: "*If you go to a customer and say, here is the Customer Model and then you tell me who takes care of your warehousing. If his name is Paul, then we find the place in the Customer Model where it says Eduardo [the Production Planner] and replace with Paul. In that way you get a dialog with the customer and put the customer in context with the Customer Model.*" (Usability Designer, Microsoft).

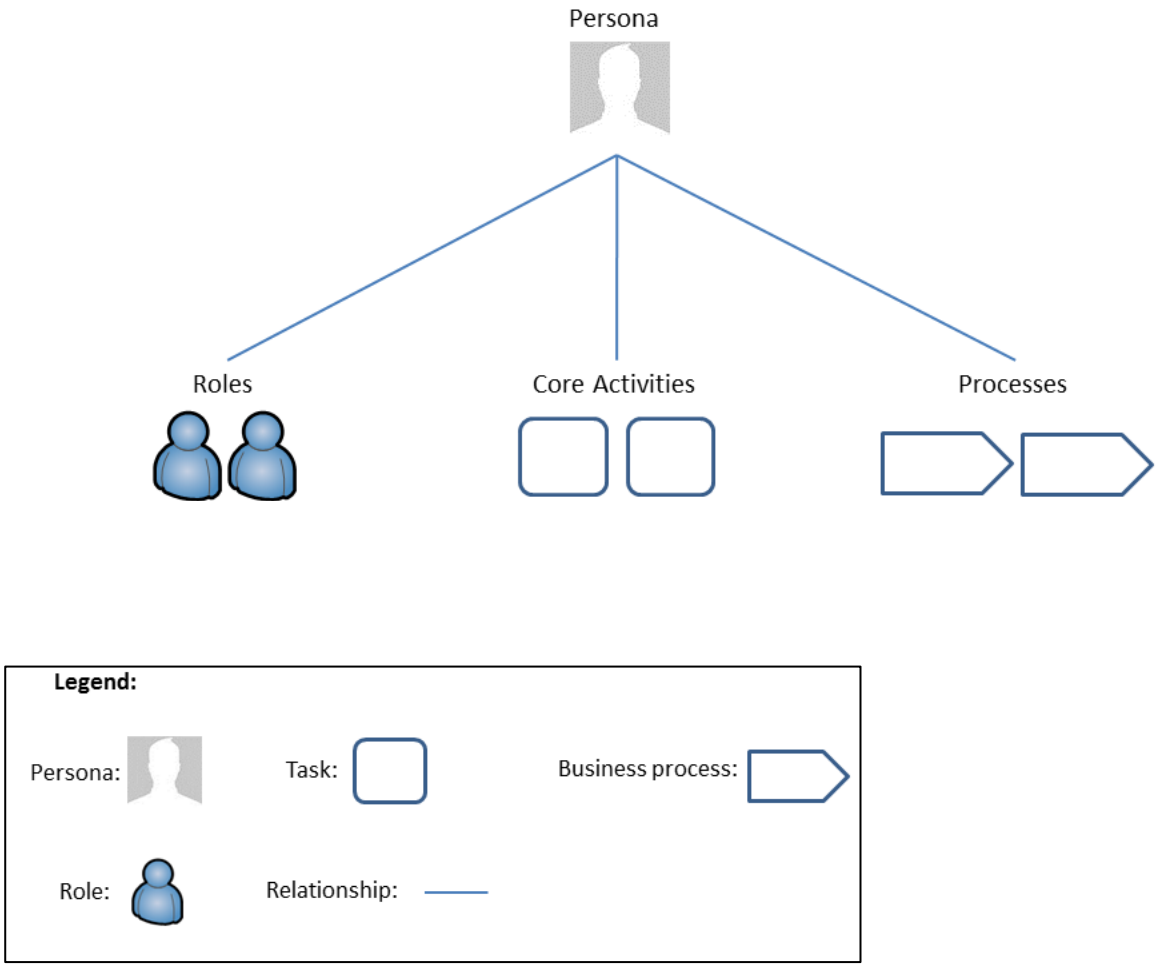

Figure 2. Meta model of roles as embedded concept with implicit relations.

Roles as independent concept

The underlying methodology for enterprise modeling at SAP is ARIS (Scheer and Habermann 2000; SDN 2008). However, Contextual Design (Beyer and Holtzblatt 1998) was used as the overarching methodology for collecting data about users and modeling their roles. The motivation for using Contextual Design as part of the modeling of roles is based on the perception that the method focused on the actual work of the users as opposed to simply modeling the roles based on the users' job descriptions: "*In reality people have certain responsibilities. This might be associated with a job title but is not necessarily so. Some people have*

a job title but do something else, e.g. generic management responsibilities. Contextual design is more a bottom up approach and only keeps the job title as a title for the role." (VP of New Product Concepts, SAP).

The constructs for designing the predefined roles at SAP consist primarily of so-called 'WorkSets': "*It's a kind of bundle of tasks and responsibilities which very nicely hang together. And they might be associated with a job title but it's not mandatory*" (VP of new Product Concepts, SAP). Each role is thus modeled as a number of WorkSets which in turn include a number of 'Tasks', related to 'Business Processes, as illustrated in Figure 3. The motivation for using WorkSets is founded on the principle that while the combination of roles of users is likely to vary between customer companies, the WorkSets themselves are reusable across many different companies, and can thus be combined in different ways to reflect different roles.

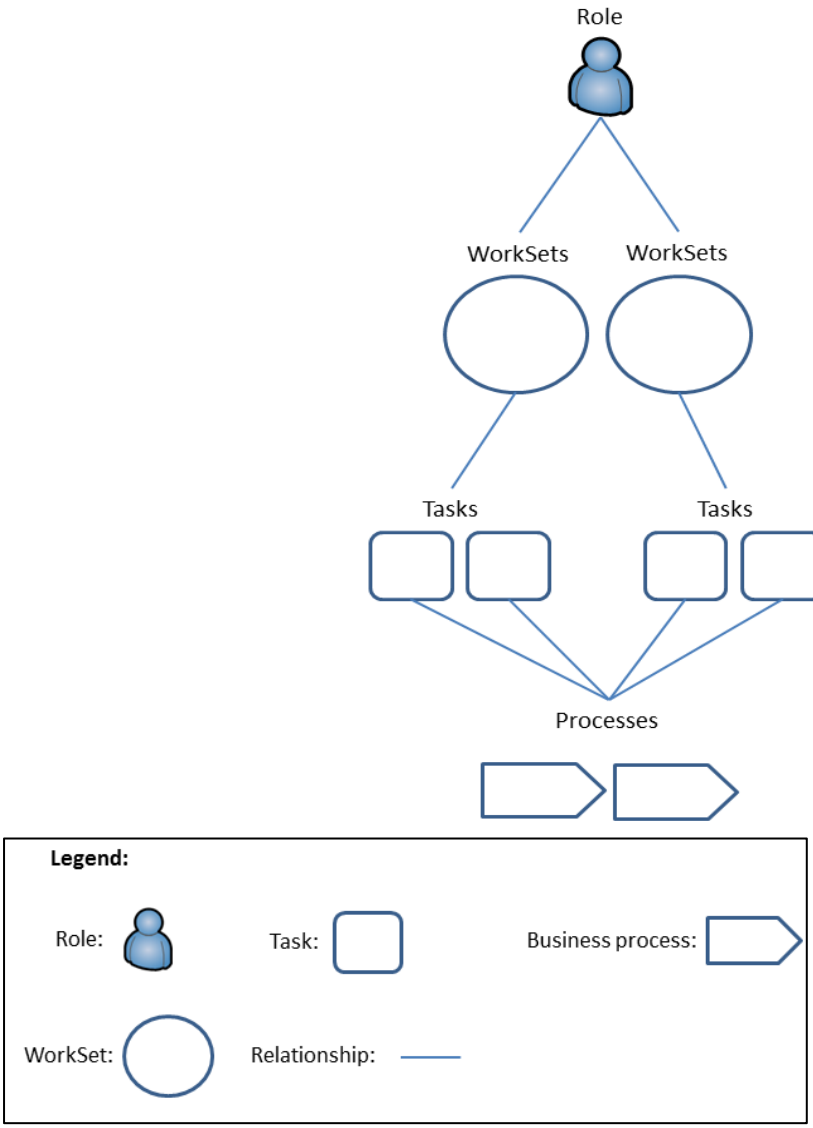

Figure 3. Meta model of roles as independent concept with explicit relations.

Reflecting predefined roles in user interfaces

While both vendors had long applied the role concept for managing security and data access rights in their enterprise systems, the vendors had extended the application of the role concept by including *predefined role-oriented user interfaces* in their systems. Both examples of role-oriented enterprise systems from the vendor thus included a number of predefined role user interfaces to use "out-of-the-box". While the vendors aimed at providing a good fit between the predefined user interfaces and the actual user in organizations, both vendors agreed that it is difficult to include a set of predefined user interfaces that will match all users in all companies: "*The SAP role concept was essential for the information architecture of the Enterprise Portal*[2]*, but it was also a big step forward to accelerate the deployment and adoption of SAP solutions (e.g. Business One). Customers had a good out-of-the-box starting point which they could tailor over time to 100% match the role profiles of their company*." (Vice President of New Product Concepts, SAP).

Predefined role aggregation in the user interfaces

The NAV 2009 RTC ships with 21 predefined so-called 'Role Centers', available to any customer organization acquiring the system. Each Role Center are based on a corresponding Persona in the Microsoft Customer Model and reflected cross-industry roles, such as 'Sales Order Processor' or 'Bookkeeper'. The Role Centers are aimed at supporting users through a *predefined set of aggregated roles* by placing the tasks and information perceived to be of most importance to the multiple roles of the user at the forefront of the user interface. Consistent with the approach of aggregating multiple roles into the same user interface the NAV 2009 RTC only allows association of a user login to a single Role Center at a time, as the goal is for the users to work in a role aggregated user interface, rather than switching between different interfaces. If the predefined user interfaces do not match the tasks associated with the roles in customer organizations, the interfaces can be tailored by implementation consultants or the users themselves to include a different combination of tasks. Users can furthermore personalize various aspects of a Role Center to reflect their personal preference. A screenshot of a Role Center in NAV 2009 RTC can be found in Appendix 1.

Componentized reflection of roles in user interfaces

The NetWeaver Business Client 3.0 implements the role concept by supporting the notion of so-called 'Work Centers', defined as: "*central work environments that provide access to role-specific functions.*"(SAP AG 2011). A user can have multiple Work Centers included in his or her user interface and switch between the Work Centers, through the use of tabs, as portrayed by the conceptual illustration of a Work Center in Appendix 2. The users can furthermore personalize various aspects of the Work Centers to fit their personal preferences and SAP, furthermore, offers a 'Control Center', which syndicates tasks from different Work Centers (WorkSets), to create a unified interface for the user. The actual content for the Work Centers is delivered separately in packages available from SAP. Several hundred predefined roles are available from the vendor for organizations to aggregate into the combination that best fits the role sets of their users. An example of a package of roles from SAP that is comparable to the user profiles in the Microsoft NAV 2009 RTC is the 'Base Line' package for Danish SME companies, containing 35 predefined cross-industry roles, such as 'Asset Accountant' and 'Finance Manager'.

[2] The SAP Enterprise Portals was the first product to reflect roles of user in the user interface.

Extending the predefined role user interfaces

While both vendors support and encourage extension and tailoring of their predefined role user interfaces, the strategies for extension vary between the two vendors. The strategy of Microsoft relies primarily on an ecosystem of Independent Software Vendors (ISVs) for extending their enterprise systems to different industry verticals. This strategy also applies to the extension of the predefined cross-industry user profiles with industry-specific variations. SAP, on the other hand, develops their own industry-specific variations of the predefined roles. The strategic intend of SAP is thus to cover up to 80% of an industry's requirements and let implementation consultants and partner companies add and tailor the remaining 20% to fit the individual customer organization (SAP AG 2010).

Discussion

Studying two of the largest enterprise system vendors indicates that both vendors find the reflection of the role concept in user interfaces useful for complementing a *function-centric* perspective on enterprise systems with a *user-centric* perspective, for the purpose of providing easier access to functions and save time for the end-users. The inclusion of predefined role user interfaces in the enterprise systems reflects an extension of the traditional application of roles for access control (RBAC) only. While predefined role user interfaces are included to provide some initial fit with actual roles of the users in customer organizations, both vendors acknowledge that tailoring of the predefined roles are necessary to achieve a perfect fit with users in the individual organizations. The position by both vendors confirms that the use of 'job titles' or 'positions' is insufficient for capturing the full perspective of the actual work carried out by the users.

However, the different approaches to modeling organizational roles in customer organizations suggests different perspectives on what the role concept may contribute with. The *embedded* modeling of roles as part of a Persona in the Microsoft Customer Model reflects a strategy of focusing on modeling at the *user level*, rather than the role level itself. While the use of Personas, both at Microsoft and in the literature, is primarily used for communicating requirements of the users (Grudin and Pruitt 2002; Pruitt and Grudin 2003; Nielsen 2004), the extension of the Persona technique to the domain of enterprise modeling presents a potential path for bridging user centered design with conventional enterprise modeling. Although the embedded approach to modeling the roles in the Personas entails implicit relationships between the roles and other business entities, the use of Personas does not inherently entail implicit relationships. The approach could thus be extended to include *explicit* relationships between the roles and the other entities, thereby keeping the Personas as the overall user model, while increasing explication of the concepts in the model.

The *single profile* approach of user interfaces of the Microsoft NAV 2009 RTC restates the emphasis on aggregating tasks at the user level, rather than the role level, to ensure a *unified* reflection of all user roles in a single screen. This approach entails some dependence on the predefined role aggregation of profiles fitting the role aggregation of the actual users, if further tailoring is to be avoided. Again, reflecting the roles as an explicit concept in the user interfaces might provide an intermediary level of tailoring between the low level tasks and the high level user profiles.

The strategy of modeling roles as *independent* concepts at SAP reflects a perception of the concept as useful in its own right. This approach corresponds to the conventional approach to modeling the role

concept in most of the enterprise modeling literature (e.g., Barros et al. 2000; Almeida et al. 2009) (Scheer and Nüttgens 2000). However, the use of WorkSets as a collection of tasks adds a layer of aggregation between the concepts of tasks and roles, not commonly found in the enterprise modeling literature. Having both the WorkSets and the roles as layers of aggregated tasks thus provides a very *componentized*, although slightly convoluted, approach to modeling of roles. The fit of the WorkSet approach thus depends on the fit of the predefined task aggregation with task aggregation of the actual users.

The delivery of roles in packages and the possibility of combining multiple predefined WorkCenters in the user interface of NetWeaver Business Client restate the componentized approach to tailoring the user interfaces at SAP. All roles of the user is thus accessible in the same user interface and role aggregation is handled by users switching between different roles, much like in Shneiderman's (1994) concept of a PRM. Although this approach entails a more flexible approach to tailoring the user interfaces, the approach involves switching between roles rather than working from a single screen. However, the inclusion of the Control Center ensures that users can chose to interact with the system in a *unified* interface, if role switching becomes cumbersome or a syndicated interface is preferred.

An overview of the approaches to modeling and reflecting the role concept is presented in Table 3.

Table 3. Strategies for modeling and reflecting the role concept.

Strategies of modeling the role concept	Strategies for reflecting role aggregation in user interfaces
Embedded vs. independent	Unified vs. componentized

Conclusions and future research

The research presented in this paper suggests that enterprise system vendors orient their systems to organizational roles to complement a function-centric perspective with a user-centric perspective to ensure a focus on easy access and a clear overview of tasks and information needed by the users. Inclusion of predefined role-oriented user interfaces may provide an initial degree of fit with the actual roles of users in organizations, although some degree of tailoring is still needed to ensure optimal fit between users and user interfaces. The comparison of the two vendors indicates variations between an *embedded* and a *independent* approach to modeling the roles and differences between a *unified* and a *componentized* approach to reflecting role aggregation in user interfaces. These findings contributes to the scarcity of literature addressing the topic of reflecting organizational roles in user interfaces of enterprise systems and confirms the conceptual distinction between roles and positions, proposed by the literature on organizational roles theory.

While this paper provides some initial insight into reflecting organizational roles in user interfaces of enterprise systems, further research is needed. First, the findings in this paper are based on the enterprise system vendors' perspectives. Empirical research in customer organizations is thus needed to investigate whether the proposed benefits of reflecting organization roles in user interfaces of enterprise systems materialize in real world organizations and how well the predefined user interfaces fit the actual users. It will especially be relevant to study the implementation of the predefined role user interfaces in SMEs to establish if role aggregation presents an issue in real world implementations. Second, the implications of pursuing a *unified* as opposed to a *componentized* reflection of roles in user interfaces should be addressed through usability evaluation studies of user in customer companies. Third, as indicated by both case

studies, vendors expect and encourage tailoring of the predefined role user interfaces to fit individual customer organization. Future research should thus look into the process of tailoring the predefined user interfaces to establish how implementation consultants and other partner companies approach the concept of role-oriented enterprise systems. Finally, more case studies of the motivations and approaches of other enterprise system vendors should be conducted to extend and validate the findings proposed in this paper.

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Appendix 1

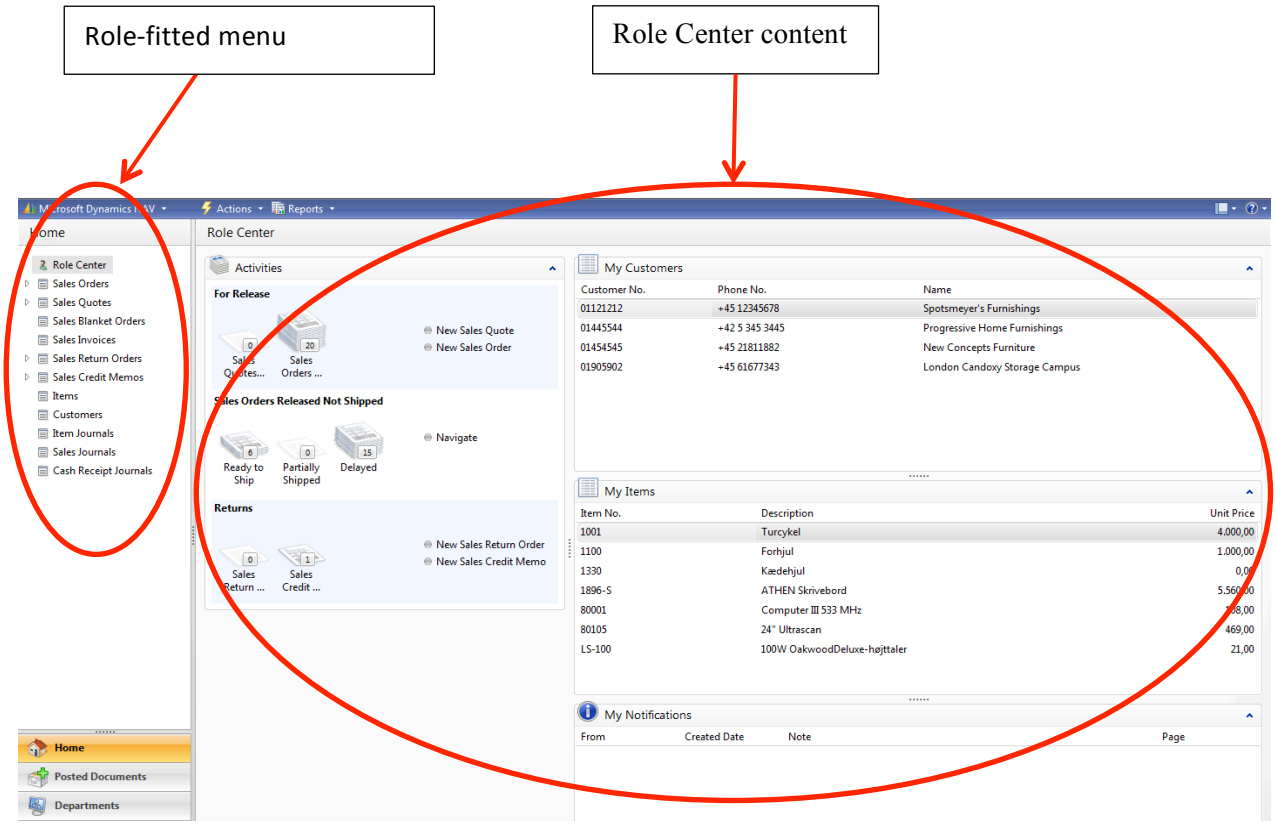

Figure 4. User interface of NAV 2009 RTC. Copyright of Microsoft Corp.

Appendix 2

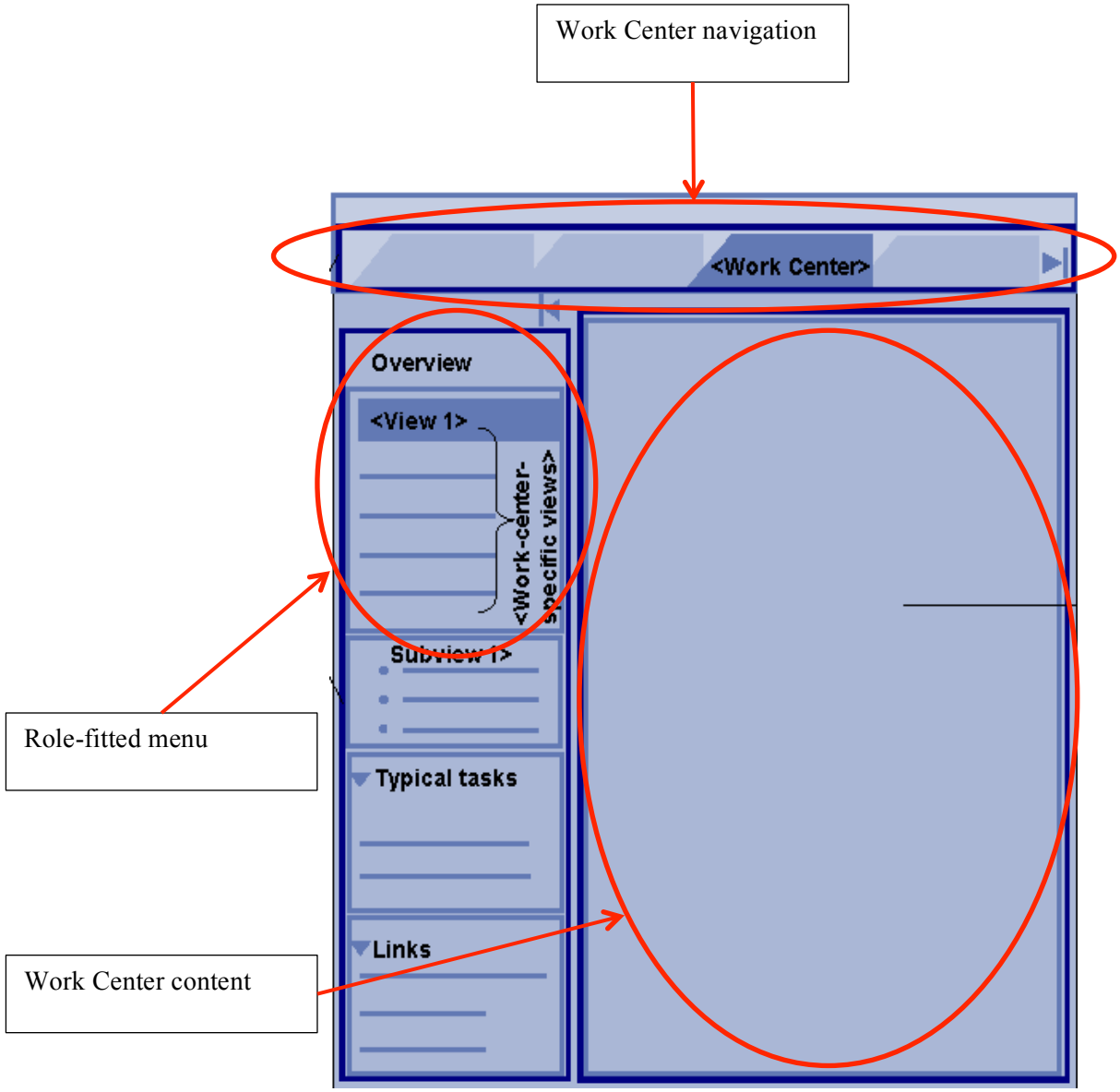

Figure 5. Conceptual illustration of user interface in SAP All-in-One 8.81 with NWBC 3.0. Copyright of SAP AG.