Rob Pooley · Jennifer Coady
Henry Linger · Chris Barry
Michael Lang · Christoph Schneider *Editors*

Information Systems Development

Reflections, Challenges and New Directions

Springer

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Preface

Information Systems Development (ISD) has reached its twentieth anniversary, with the 2011 conference being held at Heriot-Watt University in Edinburgh. As ever, the range of papers and presentations is remarkable, but all have in common the need for higher quality and more reliable information systems to support our increasingly data hungry world.

As well as papers ranging across current issues surrounding the design and implementation of high-performance systems, keynote presentations from Nick Taylor, of Heriot-Watt University, discussing the issues of privacy and personalisation in a world of pervasive systems, and from Ian Somerville of St Andrews University – on the sociotechnical and political factors underpinning successful developments – gave those attending much food for thought. We are lucky that Nick's presentation has been captured in an invited paper.

Thus, we see that ISD remains relevant and challenging. Those attending found much to fuel their imaginations and to spark fresh ideas. Of the 93 papers submitted, 54 were accepted, showing that ISD maintains its high standards.

The selection process was managed using Easy Chair, which lives up to its name. Thanks are also due to all those on the Programme Committee who provided such careful reviews.

The organisers, Professor Rob Pooley, Jenny Coady and Tessa Berg, hope everyone enjoyed and benefitted from all that was offered and pass on their good wishes to next year's team, in Prato, Italy.

Edinburgh, UK

Rob Pooley, Programme Chair
Jennifer Coady, General Chair
Tessa Berg, Local Chair

Contents

Chapter 1
Is There Really a Conflict Between Privacy and Personalisation?

Nicholas K. Taylor, Elizabeth Papadopoulou, Sarah Gallacher, and Howard M. Williams

1 Introduction

In 1991, Mark Weiser described his vision of ubiquitous computing, a world in which technology aids the user unobtrusively in their everyday life (Weiser 1991). Twenty years later, the world is closer to achieving Weiser's dream, but with every innovation comes consequences. For ubiquitous or pervasive system to function effectively and weave itself into the user's everyday life, it needs a wealth of information about that user. Automated systems are generic and offer the same automated functionality for all users, whereas a pervasive system attempts to automate processes on behalf of an individual user. To accomplish such task, a pervasive system requires the possession, processing and inference of knowledge about the user such as the user's preferences, interests, goals, intents, environmental (context information) and personal information. While the benefit of pervasive systems has been defined, the consequences to personal privacy when disclosing large amounts of such information are among the reasons this technology has not taken over our reality. Hence, a divide has been building between those that favour the proliferation of information and those that oppose it for fear of eliminating the right to personal privacy.

In theory, personalisation and privacy are at odds with each other. The more information there is about a user, the better the system can adapt to the user's needs, and if no information exists about a user, all personal privacy is protected beyond any doubt. In reality, people share information everyday with other people, organisations, companies, schools, hospitals and virtually any entity they interact with without worrying about their personal privacy. The people choose what information to disclose and whom to disclose it to, they know the reasons for

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disclosing it, they decide what level of detail to disclose, and they choose when to disclose it. Hence, a pattern can be observed, that people tailor their privacy to suit their own needs. Such practices are analogous to what personalisation provides for services. Personalisation and specifically user preferences can be used to customise how the system discloses information. More significantly, it can relieve the user from the burden of editing privacy settings for every entity they interact with by automating this process based on user preferences.

The next chapter provides an overview of different forms and applications of personalisation. Chapter 3 describes the attitudes of services towards respecting the user's privacy and the attitudes of users with respect to protecting their own privacy. Chapter 4 presents an approach to privacy protection using personalisation, and Chap. 5 illustrates an example of this approach in an implemented prototype. Chapter 6 concludes with a discussion of future work and possible enhancements.

2 Personalisation

Most of the published research papers regarding personalisation refer to the personalisation or customisation of web services or mobile services, specifically addressing personalised service composition (Jørstad et al. 2004). In general, the term personalisation refers to the adaptation of a system according to the needs and preferences of an individual user. In most cases, personalisation systems use rule models and rule engines to represent the user's preferences and evaluate them according to changes in the user's context. User preferences can be used to personalise a system in the following ways.

- Service Ranking and Filtering. The results of a service discovery query can be filtered and ranked based on user preferences and user context. Service filtering can be personalised to discard services that are not preferable to the user, and service ranking can be personalised to sort the list of services-based personalised parameters such as distance, cost, quality and provider preference.
- Service Selection. User preferences can suggest specific services to be selected for particular uses and in certain situations. A simple example of personalised service selection would be using Google Search as the preferred search engine.
- Service Management. User preferences can be used to represent rules for service initialisation, termination and session adaptation. A simple example of personalised service management is to turn on the air-conditioning service when a user enters their office building.
- Service Adaptation. The most common use of user preferences is to personalise the parameters of a service. This can range from setting the wallpaper of a user's desktop to adapting the heating temperature of a room based on activity in the room.
- Proactive Personalisation. Pervasive systems are dependent on the availability of information about the user's context. Context-aware user preferences can be

evaluated during runtime and adapt services and the system to perform differently under specific context conditions. A simple example of proactive personalisation is muting the mobile phone when a user enters a meeting room.

Hence, user preferences can drive a system to function in almost every area according to the user's preferences. However, as the number of used services multiplies over time, it is not reasonable to expect the user to manually enter preferences for every service they use and manage these large structures themselves.

2.1 Degrees of Personalisation

The extent to which a system is adapted by personalisation components depends on the type of user preferences used and the availability of information in the system. The less information that exists, the less impact the personalisation components have on the system. The degrees of personalisation a system can exhibit can be split into three categories.

Static Personalisation. A system that applies static personalisation uses simple static rules or simply static settings to configure the system. This type of user preference is applied once in a service and does not change unless the user manually edits the preference. Many if not all applications today employ some form of static personalisation by providing a graphical user interface in which the user is able to change the settings for the appearance or behaviour of the application.

Dynamic Personalisation. A system that applies dynamic personalisation uses context-dependent user preferences. A context-dependent user preference implies that under different context conditions, the system will behave in a different way. A dynamic personalisation component has to evaluate the user preferences against the current context of the user and apply the corresponding preference outcome. Depending on the complexity of the user preference and the available context sources in the system, a service can be constantly personalised to fit the needs of the user. Context-dependent user preferences can be very useful as they adapt the services and the system based on changes in the environment the user is in and the activities that the user is involved in.

Proactive Personalisation. This is the automated type of personalisation in which the system is constantly monitoring the context of the user and evaluates preferences affected by changes in that context. A system that applies proactive personalisation is automating the behaviour of the system. Services do not need to request preference information explicitly. When the context of the user changes, the system evaluates the preferences and re-personalises the services immediately. Proactive personalisation is the most effective type as the personalisation of the services is instant. In many cases, this is very important. An example of proactive personalisation is turning on and off the heating in a house or an office by monitoring the user's context such as the location and the time of day.

Table 1.1 Respondents' level of concern with respect to privacy

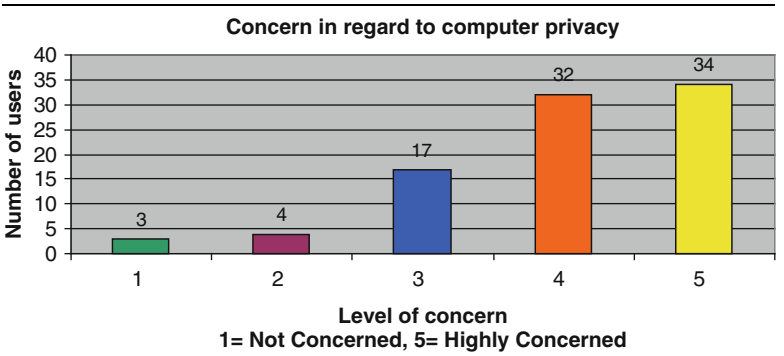
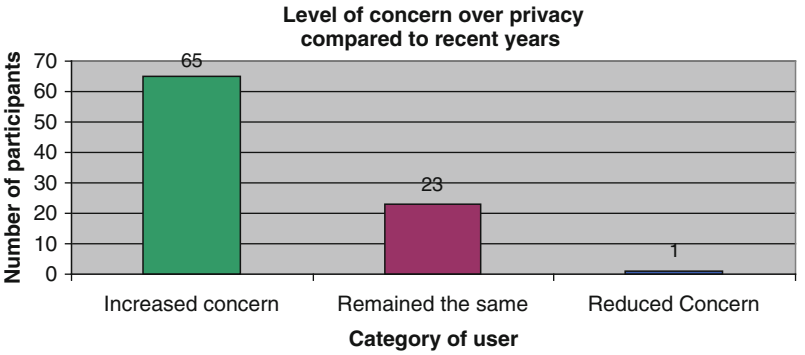


Table 1.2 Respondents' change in level of concern with respect to privacy

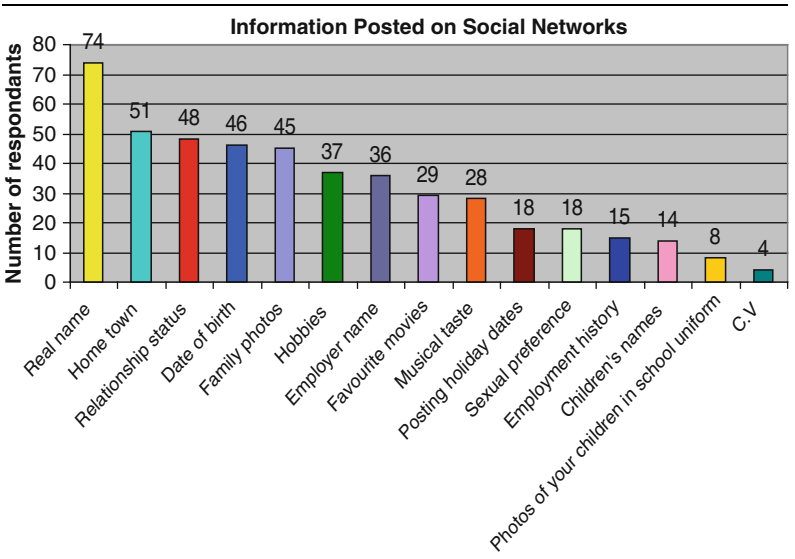


3 Attitudes Towards Privacy

Issues of privacy violation, personal data loss and security attacks often make the news headlines and incur the public's anger towards the practices of large corporations and governments regarding the handling of their personal data. Towards the end of 2010 through to the start of 2011, Simpson (2011) conducted a survey to obtain a snapshot of computer users' current views on data protection and their privacy practices. There were 90 participants and the demographic covered an age range from 16 to 60 and occupations which, while approximately 50 % academic, also included clerical workers, nurses and even a beauty therapist and a bus driver.

The respondents to the survey expressed significant concern about computer privacy, (see Table 1.1) and this concern has been increasing in recent years as a result of the increasing demands for information by websites and social networks (see Table 1.2).

Table 1.3 Respondents' disclosures on social networking sites

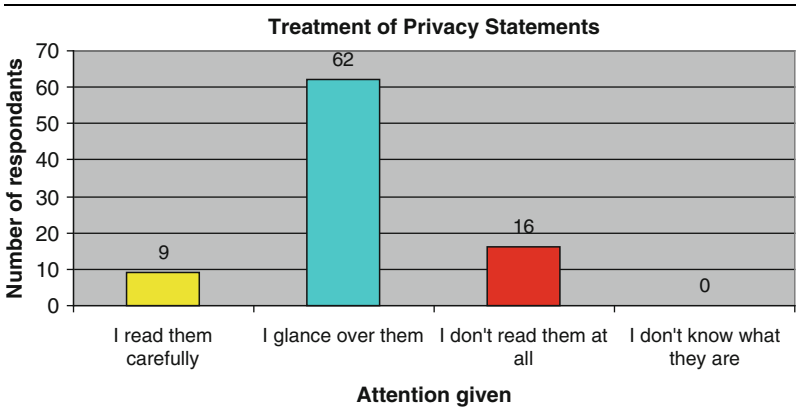


However, when asked what types of information they were prepared to disclose on social networks, Simpson's respondents appear to put their privacy concerns to one side (see Table 1.3).

One of the factors influencing this trend is the lack of privacy protection mechanisms for use by the average user. Current laws, such as the EU Directive 95/46/EC (EU Data Protection Directive 95/46/EC 1995) and the UK Data Protection Act of 1998 (Data Protection Act 1998), have defined the right of users to personal privacy and require service providers (referred to as data controllers) to provide privacy policies that outline among other things, the types of data collected, the kind of processing to be applied to the data and the purpose for which the data is collected. Users must agree to the terms and conditions of a service which implies that they have read and agreed to the privacy policy provided by the service. However, Simpson's, and other, surveys have repeatedly shown that users do not assess privacy policies in a rational manner before agreeing to the terms and conditions of services (see Table 1.4).

Despite the media attention given to privacy violations and security breaches, there appears to be a worrying acceptance on the part of the public that these things are inevitable in the world of digital information. This is probably because users have little choice; if they wish to use a service, such as a popular social network site, then they have no option but to accept the service's privacy policy. Foregoing use of the service because of privacy concerns would not appear to be a realistic option for the vast majority of users.

Table 1.4 Respondents' attitudes to privacy statements



4 Privacy Protection Using Personalisation

It is believed that the more information exists in the system, the better the personalisation. This is true in a generic way. A system can make better decisions if it has all the necessary information, and in order to ensure this in every situation, the only way to do this is to include all the information. However, this does not mean that the personalisation system and the information it uses such as profile information, user preferences and user context has to be controlled by an external entity. Such systems should be centred on the user and any automatic behaviour must be controlled by the user using user preferences as the driver. Advertising and product marketing have caused personalisation to be misunderstood as their purpose is to target users with relevant products by monitoring the users' activity on the Web such as what websites they visit and what products they purchase online. This type of personalisation may be beneficial in some cases since users will see advertisements that they are interested in. However, users are using online services for business use as well as personal use, and it is not always appropriate to link this information together. It will be beneficial to users as well as service providers that the information is disclosed in a controlled manner. The user's privacy is protected viably, and the service providers can offer quality of service as well as receive the reputation of respecting its users' privacy.

The approach presented in this chapter attempts to provide the user with the necessary tools to protect their personal privacy with minimum hassle.

4.1 Personalised Identity Selection

Users employ different personas depending on the situation they are in and the entities with which they interact with. As a simple example, consider a person's behaviour when they are in an office surrounding compared to being in their home

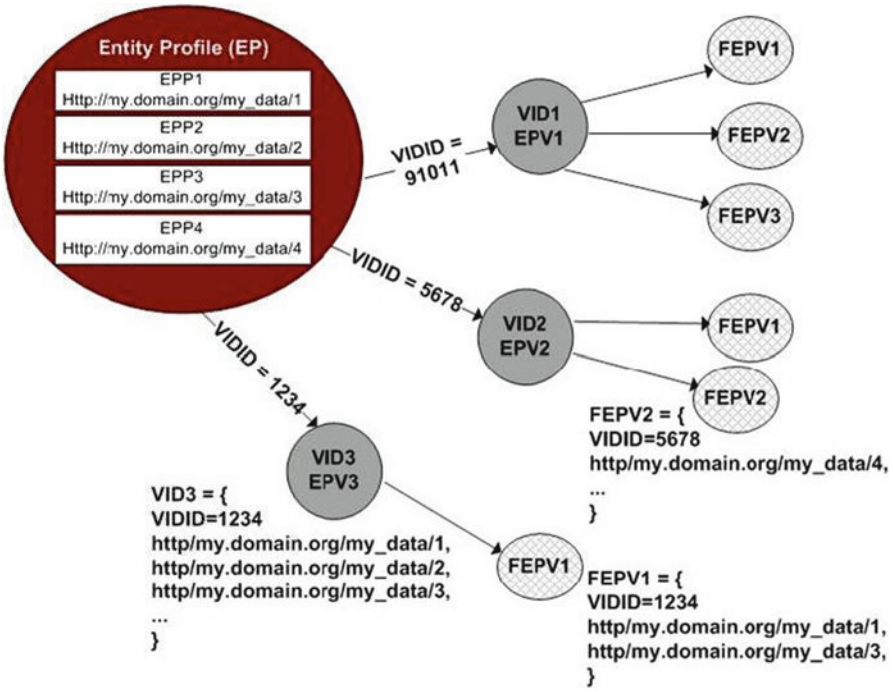


Fig. 1.1 Associating personal data attributes with multiple identities. The Daidalos Virtual model approach

with their family and friends. Supplying the user with mechanisms that support the use of multiple digital identities will have a positive effect on the manner in which personalisation is conducted as well as how privacy is protected. A digital identity can be considered as a digital representation of a user. Identity management is a large research area, and many systems have been implemented such as OpenID (The OpenID Foundation Website), Microsoft's Cardspace (Microsoft Cardspace) and LiveID (Microsoft LiveID), Shibboleth (The Shibboleth System) and the Daidalos Virtual Identities (Girao et al. 2006). All these schemes are centred around the idea of the federated identity. Federated identities can be provided by multiple identity providers and can be used to represent the user when they interact with online services. Using multiple federated identities, the user can link different personal information such as profile information, user preferences and user context to different identities and represent themselves differently to the entities they interact with. The benefit of federated identities is that an identity can be reused in different services and the information collected by one service can be reused by another service.

From the point of view of the user, a tool is required to manage the user's different identities and to suggest to the user which identity should be used in each interaction. The example in Fig. 1.1 shows how multiple identities are linked to

attributes from the user's profile data using the Daidalos Virtual Identity model. Each attribute has a different URI for addressing it. When an attribute is linked to more than one identity, there is a different URI constructed for it for each identity that it is linked to.

User preferences can be used to personalise the use of multiple identities. A graphical user interface must exist for the user to control the use of multiple identities by creating user preferences to drive the identity selection. Also, the system can log every transaction each identity has been used in and automatically create preferences based on the type of transaction and the type of data disclosed during the transaction.

4.2 Personalised Privacy Policy Negotiation and Access Control

The privacy policy negotiation process allows users to negotiate the terms and conditions of a service and choose what data to disclose with each service. Personalisation can play an important part in the automation of this process by allowing the user to create privacy preferences for each data attribute that exists in their profile and equipping the system with the tools necessary to protect the user's privacy in a proactive manner. Current approaches to privacy policy negotiation suggest that the user creates their privacy policy documents manually, and based on these documents, the system is able to negotiate about the privacy policy of the service. It is not reasonable to expect the average user to have the knowledge required to create such documents themselves. The proposed approach attempts to alleviate the user from such burden by suggesting that users only create privacy preferences for specific attributes of data. The system will then evaluate these privacy preferences against the current context and create a privacy policy for the user customised as a response to the privacy policy of the service. Context-aware privacy preferences provide the user with greater flexibility in their choices. Different access control rules can be enforced based on the context of the user and the service or entity that requests access to the data. For example, the user can allow their employer to access their location during office hours and block access outside office hours. Depending on the level intelligence built into the personalisation system, the system can perform certain functions on behalf of the user to aid them. Based on the user's disclosure practices, the system could infer that certain attributes are more sensitive than other attributes. The use of a trust management system that attempts to rate the level of trustworthiness of entities such as service providers can give greater flexibility in a privacy protection framework. As well as context dependence, privacy preferences can include trust conditions for data disclosure. Depending on the level of trust the user has in the ability of a service to honour the privacy policy agreement and respect the personal privacy of its users, the system can assess the level of data access to grant to a service.

5 Conclusion

Personalisation and privacy are always considered as conflicting with each other. Personalisation needs information to function properly while privacy attempts to hide information to protect it from misuse. However, personalisation systems can coexist in harmony with privacy protection systems. Personalisation can aid privacy protection systems to protect the user's privacy in the manner the user wishes to do so. It should be noted that users have different views on how their privacy should be protected and what data they prefer to be disclosed to certain people and what data should remain private. Personalisation can play an important role in enforcing the user's wishes with regard to their privacy.

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References

EU Data Protection Directive 95/46/EC (1995). http://ec.europa.eu/justice/policies/privacy/docs/95-46-ce/dir1995-46_part1_en.pdf

Girao J, Sarma A, Aguiar R (2006) Virtual identities – a cross layer approach to identity and identity management. Presentation, 17th wireless world research forum, Heidelberg, Germany, November 2006

Jørstad I, van Do T, Dustdar S (2004) Personalisation of future mobile services. In: 9th international conference on intelligence in service delivery networks, Bordeaux, France

Microsoft Cardspace. http://msdn.microsoft.com/en-us/library/aa480189.aspx

Microsoft LiveID. https://accountservices.passport.net/ppnetworkhome.srf?lc=2057&mkt=EN-GB

Simpson S (2011) Issues in data protection and individual privacy. B.Sc. Information Systems Honours dissertation, Heriot-Watt University, Edinburgh, UK

The OpenID Foundation Website. http://openid.net/

The Shibboleth System. http://shibboleth.internet2.edu/

UK Data Protection Act (1998). http://www.legislation.gov.uk/ukpga/1998/29

Weiser M (1991) The computer for the twenty-first century. Sci Am 265(3):94–104

Chapter 2
Identify and Classify the Critical Success Factors for a Successful Process Deployment

Bayona Sussy, Calvo Manzano Jose, Cuevas Gonzalo, and San Feliu Tomás

1 Introduction

Nowadays, organizations need to respond to customer' demands with quality products and services. Models and standards have been developed to help organizations to achieve these objectives, such as Capability Maturity Model Integration (CMMI) and IDEAL. This highlights the importance of having an effective process deployment strategy in order that processes can be adopted, used, and institutionalized.

However, the implementation of these models and standards in organizations presents difficulties that include (1) improvement efforts are not aligned with business goals, (2) lack of leadership and visible commitment to improvement efforts, (3) the process does not respond to business needs, and (4) efforts to implement technical aspects ignore strategies based on the social aspects (Messnarz et al. 2008). According to Niazi (Niazi et al. 2005), the problem of process improvement is not the lack of standards or models, but the lack of a strategy to implement them. Not considering the social aspects of a strategy for process deployment threatens the institutionalization of the processes deployed.

Most researchers are focused on improving the technology. However, a few of them mention other important factors such as culture, change management, people, communication, and training. McDermid and Bennet (1999) have argued that human factors for software process improvement have been ignored. According to Zahran (1998), the inadequacy of proposals on the implementation of process improvement is one of the most common reasons for failure of improvement initiatives.

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Some issues are present when processes are deployed such as (1) the difficulty to identify the difference between implementation and deployment; (2) the human factors are ignored or are only focus on technical aspects; (3) the process deployment is a change, but it is not managed to minimize the change resistance; (4) the staff do not participate in the process definitions; (5) the processes are not suitable to the organization's needs, environment, or culture; (6) the processes deployed are not used; (7) the organization does not have a formal deployment methodology; or (8) the method used is not focused on human factors.

These issues are already well known both in academic and industrial context, but they are present in process deployment. The goal of this chapter is to present a procedure to identify the critical success factors of process deployment and also to present a case study about impact of the critical success factors identified in five organizations and a proposal of a process deployment method. This method is focused on the critical success factors for process deployment. The reference model used is CMMI (2006).

This chapter is organized as follows: Section 2 shows the research context. Section 3 presents the critical success factors for process deployment. Section 4 described the case study. Section 5 describes the proposed method "Method for Process Deployment in CMMI level 3 organizations" (MEDEPRO). Finally, the conclusions are presented.

2 The Research Context

The International Process Research Consortium (IPRC) has included the topic of process deployment in a list of research items. A reason is that process deployment is related to the person, and an intensive research into the human factor and change management is needed (Quinn 1999).

The successful implementation of a process instance establishes its basic functionality; its effective deployment establishes its true value to the implementing organization.

The purpose of process deployment is about getting people to use the new processes. It is frequent that an organization uses the term *process implementation* and not *process deployment*. There is a difference between the implementation and deployment concepts.

International Process Research Consortium (IPRC) (2006) indicates that "It is important to recognize the critical difference between process implementation and process deployment. The concept of deployment goes beyond the single instantiation of an implemented process, to address the effective deployment of a process specification to achieve multiple implementations across an organization, each tailored to suit its specific organizational context."

Process deployment is focused on people, and it incorporates topics like:

- Education and training to develop collective competencies and abilities
- Staff motivation

Fig. 2.1 Process deployment elements

- Actual usage of a developed or standardized process into organization's projects and operations
- Metrics of process use and adoption
- Appraisal of the deployed processes to determine their fidelity and capability as well as to evaluate whether the usage has achieved the goals of adding value added by the process or product

According to our research work, process deployment elements are organization, Process Asset Library, processes, people, process deployment methodology, deployment process, reference model, and change management. The organization has a vision defined, values, culture, policies, and business objectives. Figure 2.1 shows the process deployment elements.

Each element is described next.

- *Organization*. IT is the place where the new processes will be deployed (including the organizational and functional structure). Every organization has a vision, mission, business objectives, values, and culture organizational.
- *Process Asset Library (PAL)*. It is a repository for process descriptions and assets, such as process adaptation guide, templates, checklists, and metrics. This repository may be updated using baseline, to have feedback mechanisms and give access to project team.
- *Processes*. A process is a goal-directed, interrelated series of actions, events, mechanisms, or steps that are constituted by (1) purpose, (2) roles and responsibilities of people in order to carry out their work, (3) entry and exit criteria, (4) inputs and outputs, (5) procedures and methods that define how to carry out the tasks and their relationship (activities/steps), and (6) measures. Processes are supported by the tools and equipment that allow them to perform their work.

- *People*. With the required knowledge, skills, and attitudes, tasks can be carried out satisfactorily and thereby ensure that all activities are completed. Aspects like people capacity and competence, teamwork, alignment to the organizational vision, process improvement proposals, participation of those involved (Christiansen and Johansen 2007), training, and communication are all key factors to develop human resources (Constantine 2001).
- *Process Deployment Methodology*. It establishes the guidelines, the procedures, and the rules to deploy the processes. It contains the activities that should be developed for training and motivating people in the new processes and the communication strategies. Also, it establishes deployment roles and responsibilities.
- *Deployment Process*. It consists on selecting a process deployment strategy where information, communication, training, and evaluation are the principal items of this strategy. An important aspect is the people's disposition to continue and apply the processes to their daily work, in such a way to assure that the processes are continued.
- *Reference Model*. It is a model of something that embodies the basic idea of something and can then be looked at as a reference for various purposes. A characteristic of a software process deployment strategy is the selection of an appropriate reference model to base the definition of the processes to be used in software projects.
- *Change Management*. The implementation of a new process in the organization is a change. Deploying the new or modified process is a change that should be managed. An organization that has the aptitude to manage the change minimizes the resistance of the personnel to change.

It is important to know the relationship among process, projects, and people.

Organizations develop software projects in different places. People are involved in software projects. These projects need staff with skills, abilities, and motivation. These projects use the processes that are contained in the organizational Process Asset Library (PAL). The PAL contains the processes, the models, the standards, the procedures and the adaptation guides, the metrics, and the lesson learned that will be used by the projects.

These processes require roles to develop the tasks. To develop the tasks, the people that develop software need to know the processes and the adaptation guides. As a result of process deployment, the lessons learned and the processes improved are documented and included in the PAL. Figure 2.2 shows the relationship among processes, projects, and people.

3 Critical Success Factors for Process Deployment

The critical success factors were obtained by a systematic review of articles and publications related to deploying, improving, and implementing processes.

The method was used in accordance with systematic review guidelines (Kitchenham 2007; Pino et al. 2008; Biolchini et al. 2005).

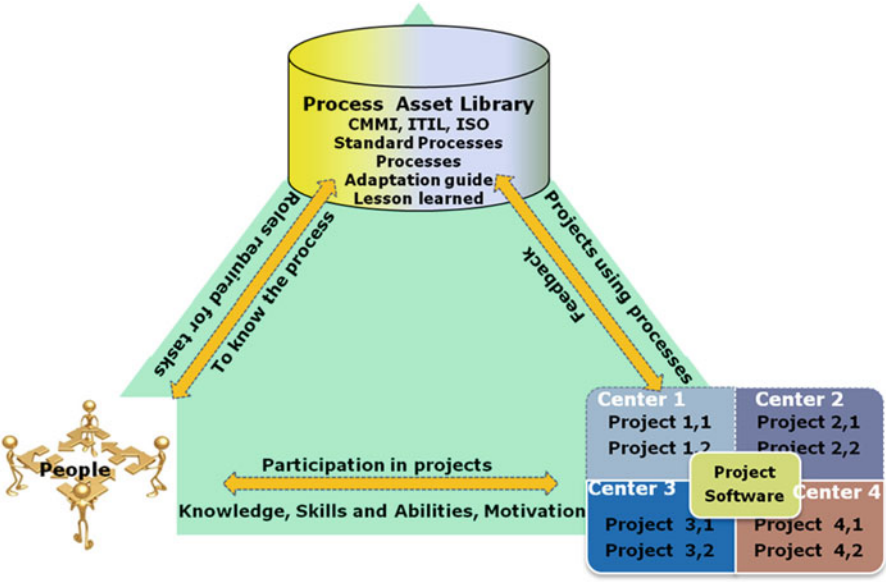

Fig. 2.2 Relationship among process, projects, and people

It has been used in the following: articles, presentations, and technical reports contained in specialized databases such as ScienceDirect, IEEE Computer, ACM Digital Library, SpringerLink, Institute for Scientific Information (ISI) Web Knowledge, and Wiley InterScience and articles and conference presentations specialized as Software Engineering Process Group, European Systems & Software Process Improvement and Innovation (EUROSPI), in addition to reports, articles, and presentations by Software Engineering Institute (SEI), Crosstalk, IT Governance, and Google Scholar.

The systematic review consists of the following stages:

1. *Identify the need for systematic review* to identify these factors that influence process implementation/process deployment in organizations and how they impact on the adoption of the processes.
2. *Review a proposed protocol that allows formulating research questions* is the most important activity of the review to identify the primary studies that respond to questions about the needs. The protocol also indicates how they will locate, exploit, and synthesize the studies.
3. *Conduct the review* to carry out a thorough and comprehensive search of primary studies. The studies identified are evaluated and recorded in the designed formats.
4. *Analyze the results* the data and information as a result of the primary studies are reviewed and analyzed, and the questions are answered.
5. *Report the results of the review*.

The results of the systematic review are (1) an inventory of critical success factors that conditioned the implementation/deployment process of software processes and (2) the categories used by different authors to classify the critical success factors.

The results of the analysis of 31 primary studies related to the models and standards used by the organizations show that the models and standards most used are CMMI and ISO 9000. Most of the primary studies refer to more than one model. The extent review of the literature suggested that there are numerous critical success factors for a successful initiative of process improvement or process deployment. The critical success factors identified by the systematic review were commitment, training, alignment with the goals and business strategy, process definition, roles and responsibilities, staff involvement, organizational culture, methodology for process deployment, change management, communication, and motivation processes (Kaltio and Kinnula 2000; Hantos and Gisbert 2000; Tracy et al. 2002; Guerrero and Eterovic 2004; Wilson et al. 2007; Dybå 2005; Lepasaar et al. 2001; El Emam et al. 1998). Also, the result shows that authors used different terms to denominate a factor.

Next, some examples of the terms used by the authors to communication, commitment, and training factors are presented:

- Communication: encouraging communication and collaboration and providing enhanced understanding (to managers and staff members), communication and collaboration, communication channels, effective communication, and bidirectional communication channels between the workgroups and the software engineering group.
- Commitment: management commitment stakeholders' commitment, senior management commitment, commitment at all levels, commitment at the appropriate management level, high level, management support and commitment, top management support, and top-down commitment.
- Training is planned and made part of the initiative, process-related training, training flexible, training options and training.

Then, it is necessary to standardize and classify the critical success factors in order to use a common language. For this, a basic activity that has been performed is classifying the critical success factors inventory. The purpose of the classification is to enable organizations to identify the factors that may affect the deployment process and include an inventory of the items identified.

The main objectives are:

- Provide support during the preparation of the process deployment method.
- Facilitate the search and grouping of relevant information.

A method for classifying the critical success factors for the process deployment was developed.

Table 2.1 Phases activities to classify the critical success factors

Phase	Definition
Planning	The aim is the planning of the project that will result in the design and implementation of the critical success factors classification
Identification and extraction of information	The aim is to align the work plan with the information needs of the organization. At this stage, we identify the sources of information, the terms to use, and the definitions that will be part of the taxonomy, among others
Design and construction	Design and construction of taxonomy using the inventory of terms. Identify the first level of categorization and other levels to determine the final structure of the taxonomy
Testing and validation	In order to ensure that the taxonomy designed would be useful to users, the necessary tests and validation must be performed
Deployment of the taxonomy	The aim is that the users use the taxonomy, and it must be deployed throughout the organization

The method has been developed in order to serve as a guide for building the taxonomy of critical success factors of the deployment process. The proposed method consists of five phases. Table 2.1 shows the phases. As a result of the implementation of the classification of the critical factors for process deployment, a limited number of categories are identified.

The criteria used to divide and group categories were the categories identified in the systematic review (organization, people, and processes) and according to the context of the study.

Then, applying the top-down technique, a limited number of categories were identified. This taxonomy includes five categories related to the object of study.

The categories are:

1. *Organization*. Many factors which are not covered in the deployment process depend on the organization in which to carry out the deployment process.
2. *People*. The deployment process is based on people at all levels, groups, teams, and organization.
3. *Processes*. Processes are the input of the process deployment.
4. *Product*. Quality product, delivered on time and on budget, and required functionalities.
5. *Others*. This includes other factors not found in the previous categories.

Terminology control is performed by identifying duplication of concepts, synonyms, or terms that designate the same concept. The subcategories identified for people category are shown in Fig. 2.3. The subcategories identified for people category are leadership, communication, knowledge, motivation, values, training, teamwork, participation, change management, and roles and responsibilities.

Fig. 2.3 Critical success factors for subcategory people

4 Case Study

To identify the critical success factors of process deployment in organizations called centers, some research was conducted at five development and maintenance software centers in Spain and South America.

A survey with open questions was carried out in each center with the person in charge of process deployment. The survey consisted of three modules:

- Module 1 was related to the organizational aspects.
- Module 2 was related to use and adoption of the processes deployed.
- Module 3 was related to process deployment.

The survey was carried out in five centers. Each center established its own procedures to carry out the implementation of the processes.

The information analysis was carried out taking into account the following aspects: (1) the Process Asset Library that includes the deployed process, (2) the deployment methodology used, and (3) the impact on the use and adoption of processes.

The metric *process use* aims to analyze the process situation related to process use by the users. The answer types were *"In Use," "Partial Use," "To Modify,"* and *"No Use"* (Module 2). Table 2.2 shows the results of this research. The centers were called C1, C2, C3, C4, and C5.

The first column represents the factors. The second column represents the centers.

Table 2.2 Results of the research by centers

Factors	C1, C4	C2, C3, C5
Creation of the quality and process committee	Yes	Yes
Define and document the procedures with staff participation. Look for a model CMMI	Yes	No
Use of process percentage	>90 %	<50 %
The staff that used the processes participated in their definitions	Yes	No
Had a deployment strategy to decrease the resistance to change	Yes	No
Communication	Yes	Poor
Level of process acceptance (v. high)	>86.5 %	<73.7 %
Resistance to change	No	Yes
Formal training plan	Yes	No

The results of the survey show there are great differences among the centers depending on the process deployment strategy. It shows that the use of process percentage in centers 1 and 4 was greater than 90 % and in the case of centers 2, 3, and 5 was less than 50 %.

In centers 1 and 4, the staff participated in the process definition, whereas in centers 2, 3, and 5, they did not.

Centers 1 and 4 had a deployment strategy to decrease the resistance to change, but the other centers did not.

The level of the process acceptation was above 86 % in centers 1 and 4 which developed a deployment strategy to decrease the resistance to change; this obtained a higher level of acceptation and use of the process deployed in the organizations.

Figure 2.4 shows that at center 1 and center 4, the use of deployed processes percentage is greater than in the other centers.

At center 1, the staff that used the processes participated in their definitions. Center 4 tailored the processes from center 5 in order to get the CMMI certification. Besides, centers 1 and 4 had a deployment strategy to decrease the resistance to change.

At center 5, although they had defined their processes, they did not establish actions to reduce the resistance to change. As centers 2 and 3 had not participated in the process definition, their use was low.

Having identified the critical success factors of the deployment process by systematic review and organizational experiences, we are in a position to propose a method that integrates these factors to ensure the deployment process.

The taxonomy of critical success factors identified by the systematic review has shown the need for bearing not only on technical aspects but to incorporate social aspects in order to achieve the institutionalization of processes.