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Implementation of an Information Systems Security Policy: Action Research

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Abstract: Information Systems Security (ISS) is a critical issue for a wide range of organizations. This paper focuses on Small and Medium Sized Enterprises (SMEs) as although all organizations have their own requirements as far as information security is concerned, SMEs offer one of the most interesting cases for studying the issue of information security policies in particular, and information security in general. Within the organizational universe, SMEs assume a unique relevance due to their high number, which makes information security efficiency a crucial issue. There are several measures which can be implemented in order to ensure the effective protection of information assets, among which the adoption of ISS policies stands out. A recent survey concluded that among 307 SMEs, only 15 indicated to have an ISS policy. The conclusion drawn from that study was that the adoption of ISS policies has not become a reality yet. As an attempt to mitigate this fact, an academic-practitioner collaboration effort was established regarding the implementation of ISS policies in three SMEs. These interventions were conceived as Action Research (AR) projects. AR, whose application was originally established in academic milieus in the fields of Social and Medical Sciences, started to be successfully explored from 1990 in the field of IS. The nineties witnessed a development in Research, namely in Educational Sciences, IS research and the learning of Organizations (Baskerville 1999). This article aims to constitute an empirical study on the applicability of the AR method in information systems, more specifically through the implementation of an ISS policy in SMEs where previous attempts to adopt a policy have failed. The research question we intend to answer is to what extent this research method is adequate to reach the proposed goal. The results of the study suggest that AR is a promising means for the institutionalization of ISS policies adoption. It can both act as a research method, improving the understanding among researchers about the issues that hinder such adoption, and as a change method, assisting practitioners to overcome barriers that have prevented the implementation of ISS policies in SMEs.

Keywords: action research, information systems security policies, information security, small and medium sized enterprises

1. Implementation of information systems security policies

Information is one of the present organizations main assets. Therefore, it is natural that the systems supporting information are increasingly exposed to either intentional or accidental threats. These threats put at risk the confidentiality, integrity and availability of information as well as of the systems which manipulate it. Consequently, the people in charge of organizations should consider and implement measures aiming to prevent, detect and respond to such threats. In order to succeed in their Information Systems protection actions, organizations need to adopt several types of measures.

In order to ensure the effective protection of Information Systems, organizations implement several different security measures. Among these measures, ISS policies stand out. These are "documents which guide or regulate people or systems' actions in the domain of information systems security" (de Sá-Soares 2005, p. 56). The importance of ISS Policies is stressed by several authors, such as Peltier (2002, p. 21), who classifies them as the "cornerstone of an effective information security architecture".

In order to implement an ISS policy, an organization must follow a sequence of steps, starting by writing the policy, then implementing it, and later on, at predefined moments or whenever circumstances require it, by reviewing its provisions, which may prompt modifications in the policy. Indeed, this sequence of steps may be viewed as a cycle of formulation – implementation – revision of the policy.

Although there is a considerable agreement in literature regarding the main role played by ISS policies, there is evidence that organizations often fail in the adoption of this security control. When focusing our attention on a specific type of organization, SMEs, a study carried out by Lopes and Oliveira (2013) revealed that among the

307 SMEs surveyed, only 15 stated to have an ISS policy. One of the conclusions drawn from that study was that the implementation and consequent adoption of and ISS policy has not become a reality in SMEs yet.

This state of affairs promptly raised several questions to the researchers, such as the reasons for such a low level of adoption and the obstacles that have prevented the SMEs to successfully apply ISS policies. Shortly after the conclusion of that survey, the heads of the Information Technology departments of several SMEs that had not adopted an ISS policy contacted the first author of this paper requesting assistance for the implementation of an ISS policy. Although the specialized literature provided general guidelines regarding the content of the policy documents as well as several recommendations for drafting, implementing, and reviewing ISS policies, the authors were faced with a methodological decision, i.e., how to do it. After considering several alternatives, such as promoting workshops or just plain consultation work, a decision was made to propose the SMEs an AR intervention.

This paper aims to constitute an empirical study on the applicability of the AR method in the field of Information, more specifically analyzing the implementation of ISS policies in SMEs where previous attempts to adopt a policy had failed, according to the tenets advocated in AR. Hence, the research question that guided this work was to what extent AR methodology is adequate to support the process leading to the adoption of ISS policies.

Structurally, this paper is organized as follows. After this contextualization of the subject, we review the main tenets and characteristics of AR in general and in the field of Information Systems in particular. Then, we describe the collaborative efforts that were promoted to adopt ISS policies in three SMEs, which is followed by a discussion. Finally, we enumerate the papers' main contribution, limitations, and suggestions for future work.

2. Perspectives on action research

Both the description of the application of any research method and the lessons learnt from that application require a previous clarification. Such clarification goes from the way the different practitioners understand the research method to the method's main features and the way it is applied, as well as its areas of applicability.

There are different definitions of AR. In fact, there are probably as many definitions of AR as authors who focus on the matter (Jönsson 1991).
As its name suggests, Action Research is a methodology which has a twofold objective of action and research, as it intends to obtain results in both areas:

- Action – the aim is to reach change within a community, organization or program;
- Research – by increasing understanding by the practitioner, client or community (Dick 2000).

Susman (1983) described AR as intervening in social systems where a systematic method is present within each human activity. This premise was also instrumental in Checkland's (1981) subsequent development of soft systems methodology. Authors in the field of AR define it as interventional, yet inclusive of theory formation, analysis, collaborative alteration of the activity and review (Baskerville and Wood-Harper, 1992; Wuest and Merritt-Gray, 1997).

AR can be described as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. It is characterized by the cyclic revision of action followed by reflection, often culminating in the refinement of understanding using methods such as modelling. The iterative nature of the methodology promotes convergence to a greater understanding (Dick, 1999).

Another researcher, Koshy (2005) considers AR as constructive research, in which the practitioner builds knowledge about specific issues through planning, action, assessment, perfecting and learning from practice. He also highlights the fact that AR implies a continuous learning process in which the practitioner learns and shares the knowledge produced with those who can benefit from it.

Although different authors may have diverse perspectives concerning the usefulness of the AR method, there seem to be broad consensus regarding the method's general architecture. In short, the AR method starts with the detection of a problem, from which some changes are projected aiming to solve the problem. This process

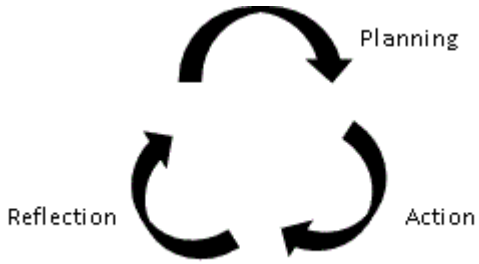
is cyclic as when applied to organizations or other social groups, it is unlikely that a problem is considered permanently solved and will rather suffer alterations and require new intervention. Thus, AR constitutes a methodological approach directed towards change: it is not limited to the understanding of phenomena but it also deliberately aims to change those phenomena.

3. Characterization of action research

AR is ruled by the need to solve real problems and assumes some essential characteristics pointed out by authors such as Dick (2000), Descombe (1999) and Cohen & Manion (1994):

- Participatory and collaborative – as all the participants are involved in the process. They all are co-actors of the research. The practitioner is not an external agent who does research with people, but a co-researcher with and for those who are interested in practical problems and in improving situations.
- Practical and interventional – it is not limited to the theoretical field of describing a certain reality. Action must be linked to change and is always deliberate.
- Cyclic – The research involves a spiral of cycles in which the initial findings generate possibilities of change, which are implemented and assessed as an introduction to the following cycle. The cycle varies according to the author, but it includes at least the following stages: Planning – Action – Reflection.
- Critical – The critical community of participants are not only looking for better practices concerning their work, within certain sociopolitical restrictions, but they also act as agents of change, critics and self-critics regarding possible restrictions. They change their environment and are transformed in the process.
- Self-assessing – Changes are continuously assessed within a perspective of adaptability and production of new knowledge.
- Qualitative – it is predominantly qualitative although some situations may require some quantification.

The method of AR executes an iterative cycle composed of a series of steps, whose numbers and designations vary depending on the authors. Cunha and Figueiredo (2002, p. 21) present a model adapted from Dick (1992) which includes three stages: Planning; Action; and Reflection, as presented in Figure 1.



Source: Cunha and Figueiredo (2002)

Figure 1: Three steps AR cycle

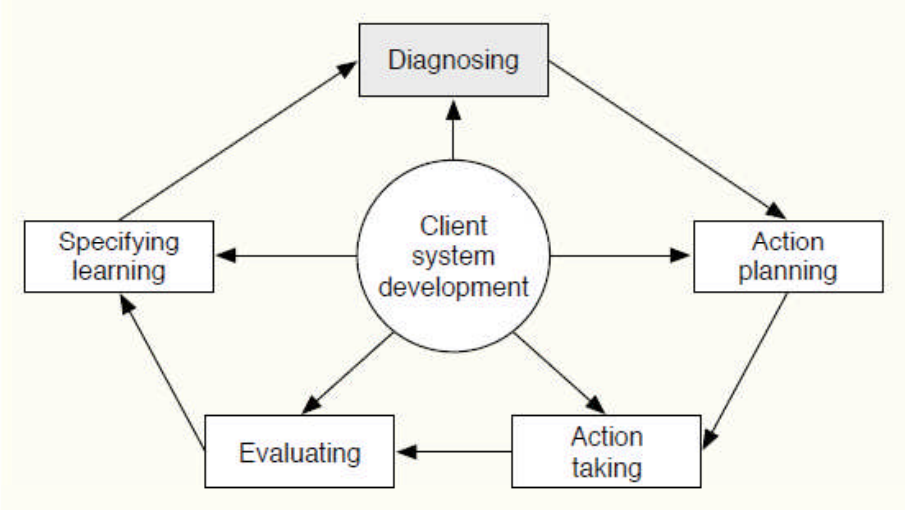
Based on these three building blocks, Cunha and Figueiredo (2002, p.21) summarize the philosophy underlying AR: "You plan an intervention (Planning); you execute the corresponding action (Action), thus inducing a change which will hopefully lead to some development; finally, you do a critical analysis of the results, which supposedly leads to a better knowledge of the situation. This, in turn, enables you to make adjustments leading to new cycles (Reflection)."

Koshy (2005) defines AR as a research conducted with rigor and understanding, aiming to constantly refine practices and allowing the results based on practical evidence to contribute to the researcher's continuous professional development. Also, Kember (2000) characterizes AR as a cyclic and reflexive process of systematic research which aims to improve practice. This author also states that the researcher has a direct influence or participates directly in the research process.

Still according to Kember (2000), the AR cyclic process or spiral comprises four different stages, namely planning; action; observation; and reflection. For this author, it is normal for an AR project to go through two or more iterative cycles. The product resulting from each cycle improves as the cycles are repeated, and each of these cycles includes reflections on the previous ones.

Susman and Evered (1978) view a general AR project as a cyclical process, which is referred to by them as the AR cycle. According to their view, the typical AR cycle is formed by five stages: diagnosing; action planning; action taking; evaluating; and specifying learning. *Diagnosing* is concerned with the identification and definition of a problem to be solved in the client's organization. *Action planning* considers alternative courses of action to solve the problem. *Action taking* includes the selection and execution of one course of action. *Evaluating* comprises the study of the outcomes of the selected course of action. *Specifying learning* is the stage in which the study accomplished in the previous phases will be structured in the form of general findings.

As suggested in Figure 2, the AR cycle takes place just after the Preparation phase. The Diagnosing involves a cooperative work between the researcher and the organization so that a problem to be solved during the research can be clearly identified. This identification has a more limited scope than that of the view expressed in the Preparation phase, and takes into consideration real implementation issues, e.g. the need for pilot projects and the availability of software systems. Following the Diagnosing are the Action Planning, Action Taking and Evaluating stages, all carried out in cooperation between the researcher and the client's organization. The next stage is Specifying Learning, typically carried out only by the researcher. This is the stage in which the researcher will structure results so as to refine the set of open-ended questions, yet with appropriate answers to a number of them, and the preliminary model. Here, the researcher will decide if they will either proceed again in the cycle or go out to the Post-evaluation stage, summarized in the next section.



Source: Susman and Evered (1978)

Figure 2: Five steps AR cycle

Associated with each of the stages included in this model are the following goals:

- Diagnosing – Identification of a problematic situation, related to the need of change of a certain organization;
- Action Planning – Specification of the organizational actions which must be undertaken in order to solve the problems identified in the diagnostic;
- Action Taking – Implementation of the actions previously planned which will supposedly lead to changes;
- Evaluating – Assessment of the intended goals achievement and solution;
- Specifying Learning – Specification of the knowledge acquired with the introduced change. Although this stage appears as the last in the scheme, it represents a permanent process.

4. Action research applied to information systems

Action Research was primarily applied in the academic milieus of Social and Medical Sciences, but in 1990, it started to be successfully explored in the areas of Educational Sciences, organizations learning and Information Systems (Baskerville 1999).

AR is a valid research approach for applied fields (Myers 2004). Baskerville (1999) asserts that the AR approach generates highly relevant research results due to its basis on practical action, aimed at explicit problem solving

while also informing theory. In the 1980s, AR techniques were applied by Peter Checkland in systems analysis, as he developed soft systems methodology, i.e. use in development, rather than in research (Baskerville, 1999).

Information System research has been characterized by a lack of relevance (Keen, 1991; Westfall, 1999; both cited by Baskerville, 1999). In the previous decade, however, Trevor Wood-Harper had already set out to address the tensions between theory and practice and the confusion that existed between traditional scientific research and the more sociological approaches, by introducing AR to the Information System community as a purely research methodology with his landmark paper, *Research Methods in Information Systems: Using AR* (Wood-Harper 1985).

AR is increasingly used for scholarly research in Information System. Baskerville (1999) advocates it to inquire into the complex and multivariate nature of Information Systems social setting, using:

- Joint goals of solving practical computing problems and expanding scientific knowledge.
- Collaborative performance, which enhances the competencies of all participants.
- An emphasis on action and change orientation in social settings.
- Systematic, iterative stages.

Baskerville lists various forms of Information System AR: prototyping, soft systems methodology, action science, participant observation, fieldwork, and process consultation. The present author adds investigation of evolving solutions in their context of use, e.g. e-learning applications and customized interfaces, where the designer conducts research into their own product. AR for producing e-learning solutions is also advocated by Derntl & Motschnig-Pitrik (2004).

One of the main reasons pointed out to justify the use of qualitative research methods in the field of IS is the fact that Information Systems include the human element as a variable or as a determining research factor, whether the study focuses on the individual or on the group, as in the case of organizations or companies (Silva 2002). Thus, AR constitutes "one of the few research approaches which we can legitimately use to study the effects of specific changes in methods of systems development within human organizations." (Baskerville and Wood-Harper 1996).

5. Action research applied to the implementation of information systems security policies

The AR cycle starts with the detection of a problem. In this study, the perception of the problem was clear, resulting from a work carried out by Lopes and Oliveira (2013), in which the authors concluded that the institutionalization of ISS policies in SMEs in Portugal was not a reality. In fact, among the 307 SMEs inquired, only 15 stated to have an ISS policy.

Based on this problem, the present study aimed to project changes with a view to increase the implementation of ISS policies by SMEs. For this intervention project, three SMEs were identified and, with almost permanent on-site monitoring, changes concerning ISS policies implementation were projected. The first author was contacted by those companies' Information Technology departments and asked to assist in the ISS policy implementation process. The time spent in each SME was approximately three weeks and included regular meetings. About two months after implementing the policy, new meetings were held to monitor the process and assess the possible need for new measures.

The whole process was structured according to the AR cycle model proposed by Susman and Evered (1978), which comprises five stages (cf. Figure 2).

In the first stage – Diagnosing – a problematic situation was identified, namely the non adoption of an ISS policy in SMEs. This situation was aggravated by the fact that the problem had been isolated before but the heads of Information Technology had not been able to invert the situation. In other words, although the problem was recognized and assumed, the organizations had not been able to create the conditions to change the situation. Such acknowledgement reinforced the conviction that the AR method might prove to be particularly appropriate to change the current practice.

The researcher was faced with the realities of the three SMEs and started her intervention by meeting with the head of Information Technology. Together, they tried to identify the reasons for the previous inability to implement an ISS.

In one of the cases, the main reason identified was the failure to find an ISS policy model that could be adapted to the Town Council. In the other two cases, a policy had been written and approved by the company executive board but had not been implemented due to the low level of agreement among the companies' IS users.

Also in this phase and besides identifying the problem and the reasons for previous implementation failure, we also analyzed the extent to which ISS policy implementation in SMEs is indispensable or not. There was consensual agreement that SMEs cannot be concerned only with crackers' attacks or firewalls and/or antivirus implementation, but must turn their attention towards the creation of a real ISS policy which may ensure responsibility, integrity, trust and ethics as far as information is concerned.

In the second stage of AR – Action Planning – the organizational actions which must be undertaken in order to solve the problems identified in the diagnostic are specified. In the present study, this process started with the drafting of the ISS policy document, but not before assessing whether one policy would be sufficient or if more than one would be necessary. We discussed the possibility of formulating two policies, one aimed at technicians and another aimed at users. However, bearing in mind that although with different specificities, technicians are also users, we decided to write only one but more comprehensive policy document.

We planned to draft the policy following a model proposed by the researcher, but adapted to the reality of each SME in a joint work with the elements from the Information Technology department.

After drafting the security policy, we planned its implementation, which depended directly on the guidelines incorporated in the document. From the dialogue held with the SME representatives, we isolated two essential factors for the success of the policy implementation. Firstly, the policy would have to be approved by the company executive board in order to have the necessary "authority" before its users. Secondly, it would have to be correctly disseminated among the organization human resources and among all the users of the Information System contemplated in the policy.

The way to disseminate the policy was also taken into account. We planned that, after being approved, the policy would be properly explained to the heads of the various company departments so that they would deliver and disseminate it among all the information system users within each sector.

In the third stage of the AR cycle, called – Action Taking – the planned actions are implemented in the hope that they will lead to some change in the organization. In our study, this stage involved several steps, namely the implementation of the policy; its approval; and its further dissemination.

There is always a chance that ISS policies might not fulfill the requirements of an organization ISS if they become obsolete due to changes either regarding the company business or the threats which the company is exposed to. Therefore, we included some factors such as audit in the implementation method, so that it would be possible to check compliance with what was defined in the ISS policy. The implementation also included incidents management, which not only deals with ISS incidents but also assesses whether the policy can respond to incidents or if on the contrary, it lacks some specific aspect, in which case some measures must be taken, namely a second implementation of the policy or a review of its drafting. Depending on the level of importance or seriousness of the detected incidents or non-conformities, relevant elements will have been provided for a possible reformulation. To a certain extent, we can draw a parallel between the inclusion of these audit and incident management tools and the AR subsequent stages, as they facilitate the assessment of the implemented actions and may, eventually, be used to launch new AR cycles with a view to improve the practice of the implemented ISS policies.

The fourth stage – Evaluating – assesses whether the goals intended with the implementation of the ISS policy were achieved or not. Such evaluation involves the review of the policy, which must take place on a regular basis and particularly whenever significant changes occur within the company, in order to ensure that the policy continues to fulfill the purposes for which it was implemented. In this study, evaluation was carried out

by checking users' compliance with the policy. A review of the policies was not considered necessary at this point.

The last stage – Specifying Learning – takes place in the end, as a conclusion of the whole process. However, this stage is actually present throughout the whole AR cycle. In this study, learning throughout the cycle provided a starting point for a new planning, thus, setting the beginning of a new sequence of the cycle.

The various phases of AR which were explained above are now summarized in Table 1, in which we present the five stages of Susman and Evered (1978) model as well as the main facts developed during each of them.

Table 1: AR stages in the implementation of an ISS policy

Diagnosing	Action Planning	Action Taking	Evaluating	Specifying Learning
-Lack of an ISS policy -Lack of initiative -Lack of an ISS policy model -Importance of a policy -Defining a problem	-Providing an ISS policy model -Drafting an ISS policy document -Planning the policy implementation -Defining ways to approve and disseminate the policy	-Implementing what was defined in the last stage	-Checking compliance with the policy -Checking the policy updating	-Assessing -Stopping if the problem is solved or if not, starting a second cycle.

6. Discussion

AR is an emergent methodology as it provides flexibility, adequate answers and change. Its process is well adjusted to the demands of the situation in all its complexity. AR open attitude towards knowledge enables this method to provide a more effective change, which in turn, stimulates a more effective understanding of the problem. The participatory action methodology in AR is recursive or dialectical and is focused on bringing about change in practices. Thus, at the end of advocacy/participatory studies, researchers advance an action agenda for change. It is focused on helping individuals free themselves from constraints found in the media, in language, in work procedures, and in the relationships of power in educational settings. Advocacy/participatory studies often begin with an important issue or stance about the problems in society, such as the need for empowerment (Creswell 2009).

The implementation of an ISS policy following the AR method was directed towards the creation of a solution to generate new useful knowledge to the participants on how to implement an ISS policy and improve their practice, with successive evaluations and respective changes whenever necessary.

Within the research method under study, the researcher interacts directly with the company, thus basing the research on a collaborative structure. Therefore, one of the main points of criticism is the researcher's inability to manipulate or control certain aspects, namely the articulation between their own goals, often more academic-related, with the company's goals.

During the present application of AR, these aspects were taken into account in an attempt to ensure more rigor and validity as well as less limitations regarding most of the conclusions reached. Whenever possible, an attempt was made not to manipulate or control not only the implementation of the policy, but also the adoption and adaptation of the proposed model to the SME reality.

Within the application cases under study, evidence is found that the implementation of an information protection system must go beyond the plain implementation of hardware or software devices, as they protect what is stored in the company's databases and files but, in most cases, do not provide the necessary or expected security due to functioning, configuration, or installation faults [Peltier 2002]. Besides the technologic aspect, the human element represents the nodal point of ISS. Difficulties in managing this element and in turning it into the main actor in the efficient protection of information assets make many organizations consider ISS one of the most difficult and demanding aspects of their management.

Institutionalizing ISS policies implies that users comply with the policies provisions on a daily basis or, and not less importantly, that they identify the aspects of the policy which lead to a lower protection level of the

Information Systems. AR takes each organization's specificities into account and promotes cooperation between researchers and users with the aim of projecting actions which will affect them. Therefore, it represents a particularly promising research and change method for the adoption of ISS policies. On the one hand, it helps researchers to understand the usefulness and the limitations of the existing knowledge, thus opening new roads to a better understanding of the phenomenon of ISS policies adoption. On the other hand, and as a method of change, it enhances a sense of property and co-responsibility among those who need to permanently put ISS policies into practice or review their content in the performance of their duties.

The strategy that will most effectively allow the necessary changes to take place within SMEs consists of involving all the stakeholders in a dynamic of action – reflection – action. Therefore, AR represents an effective methodology in the implementation of ISS policies.

7. Conclusion

This study involved three SMEs through direct contact with the correspondent IT departments and indirect contact with the executive board as well as with the users of the Information Systems. This work reports on the use and appropriateness of AR applied to the adoption of ISS policies, thus contributing as an empirical study on the application of that method in the field of Information Systems.

This research work presents limitations, namely with respect to the number of SMEs involved. Although we believe that the study carried out in the three SMEs generated enough data to serve the goal of the work, we also believe that a larger number might result in a more sustained set of data. Nevertheless, we highlight that the application of the AR method requires the researcher's direct involvement, thus requiring a substantial amount of time.

Among the works which might be carried out in the future, we highlight the proposal of an ISS policy model, thought up for the Portuguese national reality, and which may work as a starting point to the adoption of ISS policies by SMEs, so as to invert the reduced number of policies existent in these types of company. The provision of that document by the SMEs and the use of AR as a method for planning and promoting change, in which researchers and practitioners project actions, implement them, and evaluate their impacts, may prove to be two important tools for the institutionalization of ISS policies in organizations.

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