

The dissemination of software process improvement innovations: The ESPITI project revisited

Karlheinz Kautz, Even Åby Larsen

Norwegian Computing Center, PoBox 114 Blindern,

N-0314 Oslo, Norway, tel: +47 2285 2500, fax: +47 2269 7600

Email: Karl.Kautz@nr.no, Even.Larsen@nr.no

Abstract

This paper's objective is to analyse an European wide dissemination action which aimed at spreading quality management and software process improvement approaches among IT organisations. We investigate to what extent this mission has been accomplished and what lessons can be learned for similar actions in the future. For our analysis we use Rogers' widely cited model of diffusion. Thus, a secondary outcome of our investigation is an appraisal of the suitability of this model to plan and perform diffusion actions.

Keywords

CEC dissemination actions, diffusion of innovations

1 INTRODUCTION

The development of software is known to be a complex task. Despite the progress made by the introduction of new methods and techniques, unfinished projects, project overruns, and system failures are still the rule. The limited success technology-driven measures has led to a stronger focus on organisational and process-oriented aspects of software development. As a consequence, several innovations in the area of quality management and software process improvement have been developed.

To support and speed up the diffusion of these approaches, the Commission of the European Communities (CEC) launched a project in 1994 in 17 Western European countries called the European Software Process Improvement Training Initiative (ESPITI). The project aimed at spreading knowledge about the innovations to business and IT management and software professionals, especially within

the typical European small and medium-sized enterprises and IT units in all sectors of industry. The project ended after 18 months in summer 1996.

The overall objective of this paper is to analyse this dissemination action which is part of an ongoing diffusion process and to investigate to what extent its aim has been reached and what lessons can be learned for similar actions in the future. We restrict ourselves to an analysis of the project in Norway. For our analysis we use a widely cited and much debated framework for the diffusion of innovations, namely Rogers' model of diffusion (Rogers, 1983). This model has also been used by the CEC for the definition of the support programme of which the project under investigation is a part (Corsi, 1995). A secondary outcome of our investigation is an appraisal of the suitability of this model to understand, plan, and perform diffusion actions.

The paper is structured as follows: we start with by a presentation of the ESPITI project. This is followed by an explanation of Rogers' framework concerning the diffusion of innovations. In the next section the project is revisited and analysed in more detail using the framework. This includes an explication from an organisational perspective which goes beyond Rogers' interpretation. Finally we briefly summarise our findings.

2 THE ESPITI PROJECT IN NORWAY

The events and decisions occurring previous to when the first knowledge about an innovation is consciously spread or to when the first adopters take up an innovation have a considerable influence upon the diffusion process. We will therefore provide some information related to the context and history of quality management, software process improvement, and the ESPITI project.

The project began with the idea for disseminating one particular assessment and improvement approach. This idea was redefined under the influence of the CEC to be a general dissemination action for quality management and software process assessment and improvement approaches. The project started in November 1994 and lasted 18 months.

In all participating countries a regional organiser was appointed who was responsible for the actual diffusion work. In Norway the regional organiser was a research institute with a considerable national reputation. It had, however, little experience with quality management and process improvement.

The following strategy was more or less pre-set in Northern Europe before the Norwegian representative entered the project.¹ As main dissemination mechanism three sets of events were aimed at reaching the target audience of business and IT management, project leaders and software professionals: awareness events were to

¹ In Northern Europe a consortium representing Finland, Island, Norway and Sweden under the management of a Finish organisation had been pre-defined. For the project as a whole, although operating towards the same overall goal and largely applying the same strategy, each regional organiser had on beforehand defined individual dissemination mechanism.

increase knowledge about the initiative itself and about basic concepts of quality management and software process improvement, training courses were to teach people how to make use of improvement approaches and methods - this was the original focus of the initiative - and working group meetings were to support exchange of experiences among practitioners actually involved in the introduction and employment of the presented measures.

We decided not to favour any specific techniques or approaches and offered information events and seminars on individual techniques and more holistic approaches to quality management and software process improvement. The project covered courses on project management, estimation, establishing metrics programmes, reviewing, testing, the ISO 9001/9000-3 standard (ISO9001, 1987) and the TickIT (TickIT, 1992) framework as well the Capability Maturity Model (CMM) (Humphrey, 1989), the Bootstrap method (Kuvaja et al., 1994) and the standardisation project for assessment methodologies SPICE (Benediktson & Nevalainen, 1995).

The project then started with different preparatory actions. First, the regional organiser contacted possible co-operation partners in the country. This resulted in co-operation with 2 other research organisations, 4 professional associations, several commercial companies, and several individuals. They acted as service providers for the project which means they (co-)organised events or contributed to them as lecturers. In addition to local providers, foreign experts were contacted and integrated in the project plans. A press release announcing the project was sent to different IT sector-related newspapers and magazines and was published in 4 journals. Technical journals were later used on a regular basis to invite to project events and on 3 occasions reports concerning the project's progress were disseminated in this form.

In parallel, early in 1995, a survey addressing the software producing units of Norway was carried out to identify the needs of the potential adopters and to adjust the project plans accordingly. Questionnaires were sent to most of the software development organisations, to IT vendors, and to many internal IT-departments in the country. This in itself created a certain awareness. The return rate of the survey was satisfactory. Nearly all respondents indicated interest in further information about the project and included their addresses for invitations to project events. This address list was extended after each event and used for direct mail announcements of further project arrangements.

The survey results showed that most of the responding organisations had various problems with software development and nearly all of them expressed a need for improvement in general. Roughly the following groups were identified: (1) those who used no techniques at all except possibly testing, (2) those who applied some individual quality assurance or process improvement techniques, and (3) those who employed holistic approaches like the ISO/TickIT standard or process-oriented models like the CMM or Bootstrap. Whereas the ISO/TickIT model was already used to a certain extent, knowledge, and consequently use, of the process assessment and improvement methods was generally very low (for more details of the study, see Kautz & Larsen (1996)).

The survey also indicated that there was little interest in training for specific methods; general information and introductions were preferred. The project proceeded therefore as follows: As initially planned, 9 awareness events were performed and over 250 persons attended these meetings. The profile of the planned training courses was changed slightly: 21 training events were conducted, but only a few of them focused on special certification approaches or assessment and improvement methodologies. Emphasis was more broadly on general quality related topics and software process improvement. This part of the project reached nearly 400 persons in over 150 organisations representing the IT-, the service-, and the production sector. With fewer than 50 employees, 66% of them qualified as small or very small enterprises. At the end of each event the participants were asked to evaluate the quality and a huge majority rated it as good or better. The project also supported nearly 20 meetings of 3 working groups of which one resulted in a bigger co-operation project among 8 organisations.

In many of the awareness and general training events several lecturers were used representing a mixture of local experienced practitioners and foreign experts. These events usually lasted between half a day and a full day. A few special topic training courses lasted between 2 and 5 days. All but 5 of the events took place in the metropolitan area of the country's capital.

At the end of the project all participating organisations were asked for further feedback. The questionnaire had a response rate of over 20% of which half stated that they had already put into practice what they had learned. Seven organisations had started implementing a quality system, three were now actively pursuing an ISO certification and another three had started a software process assessment and improvement project, with 10 more considering process improvement steps and the introduction of quality management. Further details of the quantitative dimension of the project can be found in Münch et al. (1996).

The central project management was content with these results. However, the local project group, supported by the feedback from some participants, believes that the project could have been more effective if it had been planned more consciously by, for example, using established findings about diffusion as outlined in Rogers' model. To support our argument we now introduce Rogers' work and then reassess the project carefully.

3 ROGERS' MODEL OF DIFFUSION OF INNOVATIONS

Rogers has developed his framework on the diffusion of innovations over the last 30 years. It has also been the starting point for research on software and information technology innovations (see e.g. Kwon & Zmud, 1987, Prescott & Conger, 1995) and has been successfully used to explain problems concerning the diffusion and introduction of software development methods (see e.g. Raghavn & Chand, 1989, Kautz & McMaster, 1994).

According to Rogers diffusion is the process by which an innovation is communicated through certain communication channels over time among the members of a social system. An innovation is an idea, object or practice which is per-

ceived as new by a potential adopter. The diffusion process is largely a communication process, i.e. an information seeking and processing activity.

The content of the communication, the innovation itself, is of course very important. The following five attributes affect the rate of adoption of an innovation. The degree to which an innovation is perceived as being (1) better than the idea it supersedes (*relative advantage*) (2) consistent with existing values, beliefs, and needs (*compatibility*) (3) difficult to understand and use (*complexity*). *Trialability* (4) is the degree to which an innovation may be experimented with on a limited basis, and the degree to which the results of an innovation are visible is called *observability* (5). The better the perception of these attributes, the higher the chances of a successful adoption of an innovation. We will therefore examine:

How do the quality management and software process improvement innovations appear in public and how are they perceived?

A crucial role for the diffusion of innovations is played by the innovation-decision process, in which a decision-making unit passes from its first *knowledge* of an innovation through a *persuasion* stage at which an attitude towards the innovation is formed to the actual *decision* to adopt or reject it. The innovation-decision process also covers the concrete *implementation* and use of the innovation as well a *confirmation* stage of the adoption decision taken. Different kinds of knowledge are usually of interest to potential adopters in the different stages of this process. *Awareness-knowledge* consists of information concerning the existence of an innovation. It frequently triggers a search for knowledge of principles and how-to knowledge. *Principles knowledge* consists of information dealing with the concepts underlying the functionality of an innovation and *how-to knowledge* comprises information necessary to use an innovation properly. Although this information seeking primarily takes place at the knowledge stage, the latter two types of knowledge are also sought at the persuasion and decision stages. In these stages, however, another kind of knowledge, *innovation-evaluation knowledge*, is mainly asked for. This information is essential for reducing uncertainty about an innovation's consequences; although it might be available from scientific sources, it is more often sought from near-peers. Innovations may appear not just individually, but as closely related yet distinguishable elements of technology. In this case Rogers speaks of *technology clusters*. Clusters often add to the complexity of the diffusion process and demand especially clever devised information strategies. For our further analysis the following questions arise:

In which stage of the innovation-decision process were the potential adopters in our project and were they provided with the appropriate knowledge for their needs?

This leads to the impact the various communication channels have on the innovation-decision process. A distinction can be made between *mass-media* channels, such as radio, television, newspapers, the Internet from *interpersonal* channels which involve face-to-face exchanges between two or more people in informal conversations or formal meetings or seminars. Another dimension is the categorisation of *cosmopolite* channels which provide access to sources outside the given social system and *localite* channels which provide information from inside.

Rogers postulates that mass-media and cosmopolite channels are relatively more important at the knowledge stage and especially more for earlier than for later adopters, whereas interpersonal and localite channels are relatively more important at the persuasion stage. Thus, we have to ask:

Have the different communication channels been used appropriately?

The discussion of the communication channels touches upon another feature of the framework: the role of specific individuals and information providers. The task of *change agents* who often are from outside a given social system is to influence potential adopters' innovation decisions in a direction desired by a change agency. They may or may not be members of the social system. They develop a need for change, diagnose potential adopters' problems, establish information exchange relationships, and support the actual adoption of an innovation. Change agents' success is positively related to the extent of their effort in contacting clients, to their similarity with their clients, and to client orientation as opposed to change agency orientation. They should be supported by *change aides* who are closer to the respective target audience than the 'official' change agents. Change agent success is also related to the extent to which they work through *opinion leaders*. These are members of a social system or an interpersonal network who influence others' attitudes towards an innovation. Opinion leaders usually have greater exposure to mass media, are more cosmopolite, have more change agent contacts, have a higher socio-economic status, and are more socially active than others. For the ESPITI project we pose the query:

Have the change agents fulfilled their mission properly and have the right change aides and opinion leaders been used in a reasonable way?

Another significant element of the framework deals with the socio-economic status of the potential adopters. Rogers presents certain regularities: (1) Potential adopters with high socio-economic status have greater access to information creating awareness about innovations. (2) They have greater access to innovation-evaluation information from peers and (3) they possess greater slack resources for adopting. As a consequence the gap between those with a high status and those with a low status widens. As countermeasures Rogers proposes to tailor messages especially of interest for those with a low status, use communication channels which are appropriate to get through to them, organise them in small groups for information exchange, and direct more change agent contact to them. In addition, actions like identifying change agent aides and opinion leaders among those with low status, giving priority to informing and recommending innovations to them, involving them in planning diffusion programmes and events, granting economic compensations and building organisational units to take special care of the them, might level their disadvantage. Hence, we will inquire:

Have these problems and their countermeasures been taken into account by the dissemination action?

Finally, the concept of *innovativeness* describes adopters related to the point in time when they adopt new ideas. Rogers also provides a normal frequency distribution of these adopter categories. *Innovators*, around 2.5% of a population, are first to take up a new idea and introduce it into a social system. They are followed

by *early* adopters, usually approximately 13.5% of the adopter community . They decrease uncertainty about a new idea by adopting it and by conveying a subjective evaluation to near-peers. After them, an *early majority* develops. These are ca. 34% of a social system. They deliberately follow in adopting an innovation and are important links for the further in a social system. The *late majority* comprises also 34%. They often have scarce resources, so almost all uncertainty about a new idea has to be removed before they adopt. Finally the *laggards* are behind concerning awareness knowledge, they are most localite in their outlook and due to their precarious economic position they are extremely cautious. They constitute roughly 16%. Reflecting on the innovativeness of the population at the beginning of the project might give some indication of the overall chances of the dissemination action. So, we will investigate:

How innovative are the Norwegian software producing units and which effect may this have on the ESPITI project?

To answer this question we have look into the adoption of innovations by organisations. Rogers' emphasis is on individuals and only to small degree on organisations. Ultimately we will therefore ask:

Which other factors do influence the diffusion of innovation in organisations and what consequences may this have for the dissemination action under investigation?

4 CASE ANALYSIS AND DISCUSSION

In the following we analyse and discuss our case in more detail. Before we start to answer the above questions, we will give a short account of our data gathering method. The authors of this article were the main project members directly involved in all of the work performed by the change agency. They participated in most of the dissemination events mentioned, performed two surveys and 12 formal interviews in the potential adopter community, reported regularly to the CEC, and took part in numerous informal discussions throughout the project. This rich body of material is the basis for a thorough presentation and an in-depth explication of the ESPITI dissemination action. We are, however, well aware of the possible shortcomings of case studies and the applied research methods. This has been thoroughly discussed in Kautz & McMaster (1994).

The present investigation has been performed from our perspective as change agents who are interested in improving dissemination actions. This should not be confused with an undifferentiated, positive attitude towards the innovation and the aim to increase the number of adopters regardless of the expense. Such a pro-innovation bias would have blurred the clear sight necessary for a critical appraisal of the diffusion process. Let us now turn to the various questions.

Perception of innovations

The project dealt with a number of innovations. The different elements of this cluster are still controversial in the software development community. Individual techniques have been promoted since quite a while already and little doubt exists about their general benefits (see e.g. McCall et al. (1977), Myers (1979), Freedman & Weinberg (1982)). However, there is also little doubt that using these techniques alone leads to limited improvements. To achieve more, holistic quality management and software process improvement approaches are needed. Here the picture is much less clear.

Traditionally, rules and regulations implementing quality have been seen as inhibiting work routines and restricting creativity. Although this is a misinterpretation of real quality thinking, it has influenced the attitudes of many software developers: quality assurance is not compatible with their understanding of their own work.

One approach which has been closely linked to this perception of quality work is the ISO standard for quality management. It has been widely criticised for being over-bureaucratic, document-driven, inflexible and not geared towards continuous improvement (Braa & Øgrim, 1995). In the ongoing discussion, at least in Norway, much of this critique has been invalidated, but part of the public is nevertheless negatively biased towards the standard.

The other alternative is based on classifying organisations, typically within a five level maturity model. Each level is defined through a number of prescribed processes and activities and indicates the organisations' capability to perform quality development. Assessments of the organisations determine their status and are the foundation of improvement plans which are realised in a stepwise manner. Various methodologies have emerged which differ in the ways maturity levels are defined and determined. A debate has flared up as to which of these methods are appropriate.

The most well-known approach is the capability maturity model (CMM), which originated in the United States. It has been criticised in Europe for having a simplistic way of determining maturity. Like the ISO standard, it can be rather complex, is hard to trial, and the effects of the improvement effort are not easily observable. In addition, employing the methodology can be very costly for small organisational units and convincing evidence of the method's benefits is still quite scarce. This is also true for the European alternative, Bootstrap. It is claimed that this method, in contrast to the CMM, is not only directed towards the development of technical software in large organisations, but also towards the development of commercial software in small enterprises. The Bootstrap approach differs from the CMM in many other details. These few examples show how uncertain the situation concerning process assessment and improvement approaches is, which makes it hard to get a clear, not to speak of a positive, perception of the innovations at all.

To answer the posed question more directly, although the software community experience quality problems, the offered innovations are in general not perceived

very positive. This might well be achievable with a information strategy which underlines the commonalities of the different approaches, namely the basic concepts of quality thinking and management, rather than their differences. The feedback from the awareness and general training events indicated that, although in total highly appreciated, the meetings did not generate the desired effect. Due to their diversity, respectively lack of focus, the seminars only contributed to a certain extent to the clarification of the situation and to a positive perception of the approaches.

Decision process, information needs, and communication channels

A closer look at the target audience shows that the project was confronted with a rather heterogeneous group. The performed survey (Kautz & Larsen, 1996) identified 4 different 'user' groups: (1) 25% of the respondents performed no quality management activities or process improvement measures at all, (2) around 60% stated that they practised some traditional quality assurance measure and/or some singular improvement measures concerning project planning, reviewing, or testing, (3) nearly 20% answered that they were ISO/TickIT certified, with another 30% planning such a certification and (4) 13 organisations claimed to utilise process improvement methods, 4 organisations used the CMM and 2 of those had also been assessed by the Bootstrap method.

This indicates that the audience was in different phases of the innovation decision process concerning the various elements of the innovation cluster and consequently had different levels of knowledge and information requirements. Regarding the need for awareness knowledge, large parts of the first group had a lack of general knowledge about quality management and the possibilities of process assessment and improvement. Those in the second group needed more precise information about the ISO/TickIT approach as well as about the improvement methods. In the third group many members were not aware of the software process improvement movement at all, whereas those in the last group were in search of alternatives to the approach they had already chosen. Depending on their previous knowledge and their status in the decision process, different demands for facts with regards to principles, how-to, and evaluation knowledge could also easily be identified.

This again calls for a differentiated information policy. In the project the main communication channel was interpersonal communication in form of seminar-like meetings. Their character was largely localite, represented by local speakers, and slightly cosmopolite, represented by a few international experts. Thus, the chosen communication channels were not really suitable for the knowledge stage in which most of the audience was. As mentioned above many of the awareness and general training events, provided a mixture of knowledge concerning the different approaches, but hardly no fundamental knowledge about quality management and software process improvement was offered.

This might explain why most of those who came already had some elementary knowledge and experience with quality management. They were basically con-

vinced of the benefits of quality and process management and were not at the beginning of an overall innovation decision process. As a consequence, some participants at several events reported that they had not learned much new, whereas many others declared that they got practical hints of how to implement further improvement activities. A further group stated that they learned about the existence of the advanced approaches first through the project. Unfortunately only a few with no experience of quality measures were reached. This group is nearly identical with the very small and small enterprises. With respect to this group, the dissemination action was not very successful.

Probably, the use of mass media channels as a first step to reach the completely unaware group would have helped. Another possibility would have been to tailor the seminars more deliberately to the information needs of the various segments of the potential adopter set. This might also have helped to reach another target group: management. The seminars - although this decision had not been made intentionally - assumed a certain amount of 'technical' knowledge and, thus did not attract many decision makers.

On the other hand, through their rather open makeup, the seminars had another very positive effect. They gathered people of different innovativeness and levels of knowledge, and many participants stated that they got valuable contacts at the meetings and that they vastly extended their networks in the community. For one region in the country, an awareness event was the first meeting where representatives of nearly all companies in the IT sector showed up.

To sum up, however, not all potential adopters were provided with the right knowledge and not all communication channels have been used appropriately.

Change agents and opinion leaders

The project members representing the regional organiser functioned as change agents. In the beginning of the project they used considerable resources to build up a credibility in the Norwegian IT community concerning quality management and software process improvement. Big effort was also invested in organising the various events to fulfil the contract with the main change agency, the CEC. This led to a change agency orientation which had several consequences.

The change agents decided to concentrate on those potential adopters who were easy to interest or who had already paid attention to the topic. The events were the main point of contact between the change agents and the potential adopters. The change agents acted either as hosts or as lecturers at all seminar meetings. However the spreading of the invitations was limited to a certain audience. Invitations to events hosted by the change agency were only sent to those who either had answered the survey or had participated in an earlier event, and thus explicitly expressed their interest. Invitations to events arranged in co-operation with other organisations, mainly professional associations, reached a wider audience, but often did not strongly emphasise the project. After the initial survey, the participation at a local conference, an early press release, and small announce-

ments of the arrangements, no further attempts were made to reach a broader public.

The change agents also performed the survey which determined the need for quality management and software process improvement, but the results of the survey were only communicated to a limited extent. They were presented at awareness and general training events and a report was sent at the end of the project to everyone who had attended any of the seminars or meetings. The change agents' orientation towards the more educated and cosmopolite segment of the target group is underlined by the fact that one more article about the project was published in a magazine which specialises in quality issues.

Co-operation with chambers of commerce, further associations in the districts, and regular distribution of brochures and news via the established communication channels will certainly have increased attention and participation in events.

An important role that the change agents played was in obtaining appropriate lecturers which were to be used as a kind of change aides. Here a twofold strategy was adopted. With the assistance and recommendation of the professional associations and personal contacts, the project got in touch with international and local experts. A second kind of co-operation involved some commercial providers that either had contacted the project themselves or that were approached by the change agency. This resulted in a mixed success. Whereas the local practitioners were very well received, many of the commercial lectures and courses were perceived as propagandistic. Similar to lectures that were too academic, they were rejected.

The role of the local experts deserves more attention. Retrospectively, most of these people can be classified as innovators or early adopters, and furthermore as opinion leaders. In the project many of these contacts came into being incidentally. This can be illustrated by the portrayal of the leader of a software company with only 6 employees. Members of the project met this woman during a fair and had a couple of informal conversations with her. This led to a close and very successful co-operation. This innovator gave presentations at various events, and furthermore co-organized a number of arrangements. Most of the participants from very small and small companies came to these events due to the influence of this opinion leader.

Although coincidence will always play an important role, it has to be stated that the change agents have only partly fulfilled their mission. A more conscious search and choice of lecturers with innovator/early adopter and/or opinion leader characteristics will have augmented the achievement of the project. Here, however, the scarce resources of personnel, time and financial support provided by the CEC have to be taken into account.

Regular difficulties and their countermeasures

The project was not familiar with the most frequently encountered problems of diffusion actions and thus had no premeditated scheme to counteract them. As a consequence, as mentioned earlier, only a few representatives of the disadvan-

taged segment, software producing units with less than 25 employees, which constitute a large part of the Norwegian software community, were reached.

Some proposals for improving access to awareness and innovation-evaluation information have been made in the preceding sections. These could be extended by electronic services providing regularly updated summaries of research literature, case studies and success stories, and lists of contact addresses.

But these steps do not solve the most severe problem, namely the lack of resources. According to the start-up survey many organisations have a very limited training budget. The project tried to attract these and economical weak companies by special subsidisation of events and courses. Yet, the result was rather unsatisfactory. The feedback gathered at the end of the project indicated that it was actually time that was the main problem. Small firms believe that they cannot afford to send employees to time-consuming seminars or meetings, especially if they are not able to see the short term advantages of this investment. One interested system developer from a small company stated that in this respect he would have appreciated more change agent contact. He missed personal invitations by telephone and explanations of the benefits for him of participating in certain events.

Further possibilities to decrease the gap between the different groups were discussed in the final assessment of the project. Many companies desired in-house seminars for which they would gather their staff for one day. This would give them the opportunity to learn about quality principles and they would have the chance to get help with their specific problems. More individual and practical assistance was proposed by other participants. They would have liked to have experts from less commercial organisations as mentors for a longer time period in their organisations. Their regular but time-limited visits could serve to support an analysis of the current situation and to get started with improvements. Clustering of companies which are interested in mentor programmes was another option that was debated.

Actions like these could be part of future dissemination projects. More importantly, as the final assessment showed, an involvement of the less privileged potential adopters in planning diffusion activities might increase their interest in adopting an innovation, and the measures that are especially tailored to their needs might compensate for their restricted resources.

Reflections on innovativeness and beyond

The survey results allow some thoughts about the innovativeness of the organisations in the sample. We claim that with regard to the different methods, an early majority has been reached concerning the utilisation of the most of the single techniques, whereas for the ISO/TickIT standard an early adopter group can be identified and some innovators have taken into use some software process improvement approaches.

We have argued that a further adoption will be dependant on the success of activities that support the innovation-decision process in a favourable way. So far, the discussion was based in Rogers' framework. Rogers' model emphasises indi-

vidual adoption and only little consideration is given to the adoption of innovations through organisations. Here organisational development and the maturity of the potential adopter population plays an important role.

Mintzberg (1983) postulates that as the age and size of an organisation increases, it usually becomes more structured and formalised. The structure of an organisation also reflects the age of the industry sector. Organisations in older business sectors are generally more structured.

Software development organisations and organisational units typically start small, with little staff and with a small product and service portfolio. Successful companies grow and their need for more co-ordination and structure rises. Standardisation of outputs and standardisation of work processes, which software process improvement approaches, are trying to achieve, are just two possible co-ordination devices. They are characteristic for larger organisations, while smaller organisations tend to use co-ordination mechanisms like direct supervision and mutual adjustment.

Looking at the Norwegian software organisations from this perspective, the larger organisations' use of formalised quality management and improvement methods is a consequence of their inherent need for structure. Accordingly, smaller organisations will not use such measures, in particular not the more structured approaches, until they have grown large enough to experience internal co-ordination problems. This may mean that the number of organisations presently using individual quality and improvement activities, represents already the upper limit of the population of the potential adopters of the more holistic approaches and none of those organisations that remain small will ever take over such methods, regardless of any efforts and dissemination actions undertaken.

But, the lack of structure in younger and smaller software development organisations can also be a consequence of the youth and relative immaturity of the software trade as a whole. As the software industry matures and stabilises with a basic set of best practices, quality management and software process improvement approaches which are perceived as being suitable may also diffuse to the smaller software units.

One possibility to contribute to this process is to put greater emphasis on quality management and software process improvement in the basic education of software developers. This will address another co-ordination device, namely standardisation of skills. Well-educated software developers will provide newly founded organisations with a better starting point in their quest for quality.

5 CONCLUSION

The dissemination action described in this article has been performed in a rather intuitive manner. As a consequence not all potential adopters were provided with the necessary information to enter and carry out an innovation-decision process.

Given the time constraints, guidelines and prerequisites of the central agency, the project was nevertheless a success. Still, the conscious use of Rogers' diffusion

framework could have resulted in a more carefully planned dissemination strategy which might have remedied some of the problems discussed above.

This requires however that a diffusion frameworks like Rogers' which in itself is an innovation are known and adopted by individuals and organisations acting as change agents. The CEC as well as other change agencies should take care of that such knowledge is provided before major dissemination actions are started.

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BIOGRAPHY

Karlheinz Kautz is a senior researcher at the Norwegian Computing Center and has been a lecturer at universities in Germany, England, Denmark and Norway. He holds a MSc in computer science and a doctorate in systems development. He is vice-chair of IFIP TC 8 WG 8.6. His research interests are in technology transfer, organisational impacts of IT, evolutionary systems development, software quality and software process improvement.

Even Åby Larsen is a research scientist at the Norwegian Computing Center. He holds a MSc in computer science and has about 10 years experience in research and development projects. His interests are in the diffusion of IT, Internet services, quality management and software process improvement.