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On-Site Customer in an XP Project: Empirical Results from a Case Study

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Abstract. Extreme programming (XP), similar to other agile software development methods, values close collaboration with customers. One of the XP's practices suggests that customer should be 100% available for the development team. Anecdotal evidence suggests that the XP customer role is costly, difficult and demanding. However, very few empirical studies have been published on the customer's role in an XP project. This paper reports empirical results from a controlled XP case study where the customer was present close to 100% of the development time. Both quantitative and qualitative data will be presented. Results are in line with the common belief that the on-site customer's role is demanding and requires a strong ability to resolve issues rapidly but offer contrasting findings in terms of required actual customer involvement in the development project. The empirical case demonstrates that while customer was present close to 100% with the development team, only 21% of his work effort was required to assist the team in the development. However, it is also shown that an on-site customer may create a false sense of confidence in to the system under development. The implications of these findings are discussed.

Keywords

Extreme programming, on-site customer, customer involvement

1 Introduction

Extreme programming (XP), first introduced in [1], is focused on generating early releases of working products and aims to deliver business value immediately from the beginning of the project. The role of customer is important and highly valued in XP for the success of the project [2, 3]. XP's on-site customer -practice suggests that the customer should be 100% available for the development team, for example, to answer questions and resolve problems.

This paper reports empirical results from a controlled extreme programming case study where the customer was present close to 100% of the development time. A team of four developers was acquired to implement a system for managing the research data obtained over years at a Finnish research institute. Both quantitative and qualitative data of XP's on-site customer role is provided. Quantitative data consisted of customer effort usage and effort distribution. Qualitative data included development dia-

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ries maintained by the developers, customer diary, post-mortem analysis session recordings and developer interviews. It has been argued that the XP customer role is demanding and requires lots of involvement [e.g. 4, 5-7]. This study both supports and offers contrasting results regarding these claims. It is shown that the on-site customer offers the team a unique situation to consult him whenever needed. The development team perceives this as a strong demonstration of commitment to their work. The data reveals also that on-site customer is in danger to create a false sense of confidence in the remaining of the customer organization. Results support the common belief that the on-site customer's role is demanding and requires a strong ability to resolve issues rapidly. However, the empirical case demonstrates that while customer was present close to 100% with the development team, only 21% of his work effort was required to assist the team in the development.

The paper is organized as follows. The following section introduces extreme programming. Chapter three presents the related research. This is followed by a description of the research settings, research methods and data collection methods. Section five presents the results and in the section six implications of these findings are discussed. Lastly, section seven concludes the paper.

2 Extreme Programming

Agile methods have gained a significant amount of attention in the field of software engineering in the last few years. Extreme programming (XP) is currently the most well known agile method. Primarily, XP is aimed at object-oriented projects using at most dozen programmers in a one location [3]. Boehm [8] calls this kind of situation as an agile home ground. The XP process can be characterized by short development cycles, incremental planning, continuous feedback, reliance to communication and evolutionary design [2]. The core of XP is made up of a simple set of common-sense practices. These practices are planning game, small releases, metaphor, simple design, testing, refactoring, pair programming, collective ownership, continuous integration, 40-hour week, on-site customer, coding standards, open workspace and just rules. For a more information of XP and an overview of other agile methods readers are referred to [e.g. 9, 10].

3 Related research

From the viewpoint of this study the most interesting XP practice is the on-site customer. It is suggested that the customer should be throughout the project available for the development team, for example, to answer questions and resolve problems. In XP, the customer is the person who sits with the project team, generates and prioritizes stories, provides acceptance tests for each release, and makes the final business decisions [11]. Therefore, the on-site customer delivers the requirements and represents all the knowledge that must be available for the development team. Despite of this important role, there are very little empirically validated studies on the on-site customer available.

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Wallace et al. [12] list three possible locations for customer: On-site customer, off-site customer and remote customer. According to XP literature [e.g. 2, 3, 13], the best situation is if the customer can work in the same room with developers. However, this is not always possible; for example, customer may be too valuable to be on-site [3]. According to Jeffries et al. [3], XP project may survive even without customer presence, but the project will go faster and smoother if the customer can be on-site. If the project team does not include a customer, they have to plan further in advance, which respectively adds the level of risk in the project [2].

But not only the customer on-site make XP project successful. According to XP literature [e.g. 2, 11], it is important to have a customer who plays the role well. According to Beck and Fowler [11, p. 18], a good customer understands the domain, understands how software can provide business value in the domain, can make decisions about what is needed now and what is needed later, and is willing to accept ultimate responsibility for the success or failure of the project. Martin et al. [4] established three research hypotheses covering the characteristics of the customer, the skills of the customer, and the location of the customer. They found XP customer role very demanding requiring among others preparation, skills, attention to detail, and the ability to make critical decisions. Martin et al. [4] report that even the ideal preparation for the customer role may not be sufficient to succeed in the XP customer role.

Farell et al. [5] describe a successful XP implementation from the viewpoint of the customer. According to Farell et al. [5, pp. 4], "it is critical to have a high degree of customer involvement in the process." Also Griffin [6] has come to the same conclusions in their XP implementation and recommends that key customer contact(s) should be moved close to the development team. Lippert et al. [14] have written a book in which they describe their experiences of XP practices. They emphasize the importance of smooth communication between development team and customer. Stephens and Rosenberg [7] provide a critical viewpoint towards XP in their book. According to Stephens and Rosenberg [7, pp. 133], "the trouble with on-site customer done the XP way is that if the on-site customer is a single person, she becomes a single point of failure in an incredibly difficult, stressful, high-profile position of great responsibility". Table 1 summarizes the most critical arguments of related research.

Claim, argument or suggestion	Description	References
High degree of customer involvement is required	It is critical to have a high degree of customer involvement in the process	[5, 6]
The role of on-site customer is very demanding	XP customer role is very demanding requiring among others preparation, skills, attention to detail, and the ability to make critical decisions	[4, 7]
Customer should work in the same room with developers	The best situation for XP project is if the customer can work in the same room with developers	[2-4]

Table 1. Summary of related research.

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4 Research design

This section describes how the research design for the study is laid out.

4.1 Research setting

A team of four developers was acquired to implement an intranet application (called eXpert) for managing the research data obtained over years at a Finnish research institute. The four developers were 5-6th year university students with 1 to 4 years of industrial experience in software development. Team members were well-versed in the Java programming language and object-oriented analysis and design approaches. Two weeks prior to project launch the team performed a self-study by studying two basic books on XP [i.e., 2, 3]. A two day hands-on training on XP practices, the development environment and software configuration management (SCM) was organized to ensure that the team has a basic understanding on XP issues and the technical environment. Development environment was an Eclipse integration framework (<http://www.eclipse.org>), which is an open source initiative, supported by major software engineering tool manufacturers. CVS (Concurrent Versions System) was used as project's SCM tool and JUnit testing framework for unit testing. Both the CVS client and JUnit are integrated as a default in Eclipse environment. The application was written in Java and JSP (JavaServer Pages) and it uses MySQL relational database in storing the data of links. In addition, the Apache Tomcat 4 Servlet/JSP container was used because it implements JSP 1.2 specifications from Java Software.

The team worked in a co-located development environment. The customer (i.e., the first author) shared the same office space with the development team. The office space and workstations were organized according to the suggestions made in the XP literature to support efficient teamwork.

4.2 Research method

A detailed description of the general research method – i.e., the controlled case study approach – utilized in this study can be found in [15]. The controlled case study approach strives for replication (experimentation) and in-depth data collection (case study) and it also has the ability to change the process (action research) in a close-to-industry setting in which also business pressure is present [15]. The first author was in the role of on-site customer and participated in planning game, acceptance testing, post-mortem analysis, project meetings and coaching activities. On average, he spent over 80% of his work time in the same room with the developers. The second author acted in the role of management in the study and mediated the release post-mortem analysis [16] sessions, which were performed after each software release. These post-mortem analysis sessions served as a process change mechanism where the project team proposed changes to the implementation process.

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4.3 Data collection

Both quantitative and qualitative data were collected. Quantitative data consisted of customer effort usage and effort distribution. Qualitative data included development diaries maintained by the developers, customer diary, post-mortem analysis session recordings and developer interviews. Developers and the customer updated their diaries continuously during the project (i.e. tracked time and filled in observations). As indicated by XP principles [2], customer organization placed explicit value on the data collection, thus ensuring the alignment with the agile software development principles (<http://www.agilemanifesto.org>).

5 Results

This section presents the results of the study including both quantitative and qualitative data of XP's on-site customer role. Table 2 provides basic information about the size and schedule of the eXpert project. The system development was done in six iterations, of which the first three were two weeks in calendar time, next two were one week and the sixth iteration was two days long correction release. Developers worked mainly six hours a day for four days a week. Detailed data of eXpert project can be found in [17].

Collected data	R1	R2	R3	R4	R5	R6	Total
Calendar time (weeks)	2	2	2	1	1	0.4	8.4
Total work effort (h)	195	190	192	111	96	36	820
# User stories implemented	5	9	9	4	3	4	34
# Tasks defined	10	30	18	21	19	9	107

Table 2. Background information of eXpert project.

5.1 Customer effort usage and distribution

Figure 1 shows customer presence for each release (i.e. the time the customer spent in the same room with the developers). As it can be seen the customer was present at average of 83%. Figure 1 shows that customer presence was at its highest in the first iteration, but then it was decreasing to iteration three until it increased to average level in the fourth iteration. This change of course can be explained by the change of iteration length from two weeks iteration to one week iteration. The customer saw that everything was happening in faster pace and, therefore, he tried to be present as much as possible. In third iteration the customer presence was as its highest in hours (59 hours), but the lowest in percentage (72%). This results from the developers frag-

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mented presence during the third iteration. Developers worked more at different times compared to first two iterations (for example).

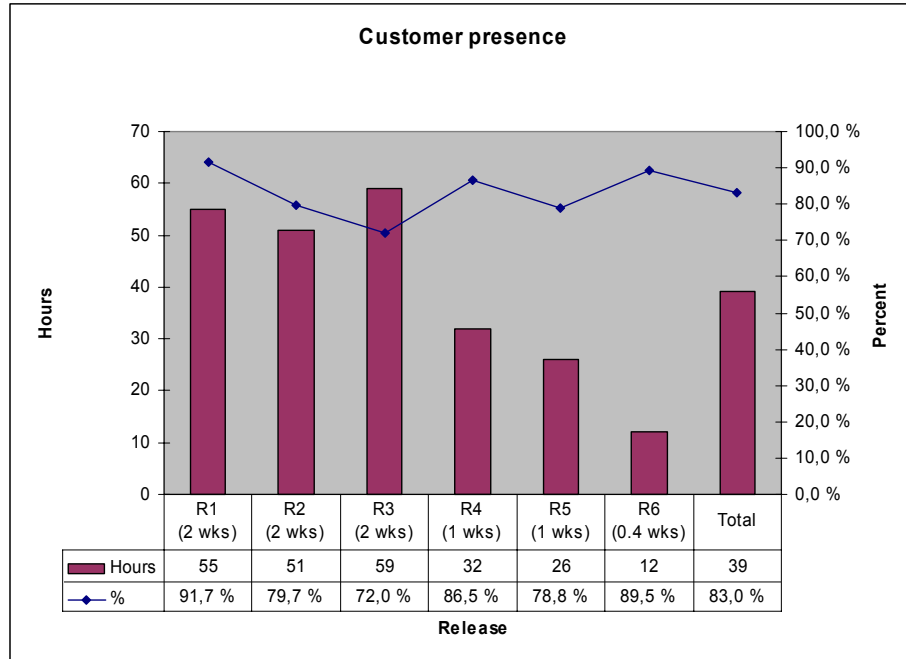


Fig. 1. Customer presence.

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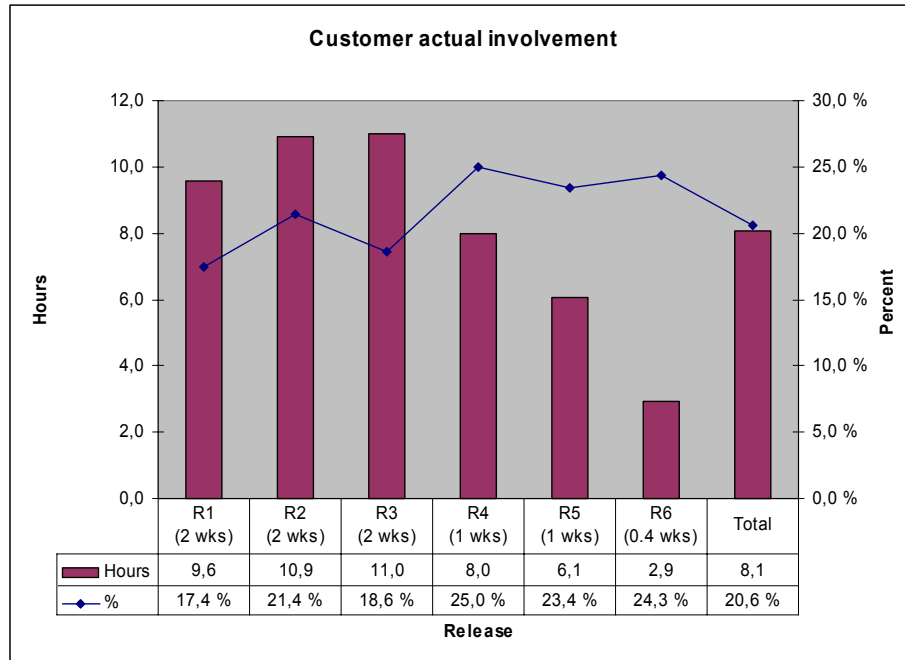


Fig. 2. Actual customer involvement.

Figure 2 shows the actual effort the customer spent for performing project activities in each release (i.e. the time the customer spent doing XP activities). Despite of the high customer presence percentage values, the actual customer involvement during the releases was from 17.4% to 25.0% average of 20.6%. As it can be seen from figure 2, the actual customer involvement was higher in shorter iterations (two week iterations vs. one week iterations). However, near 100% present on-site customer with this low actual involvement is a significant result since on-site customer is one the most controversial topics in extreme programming.

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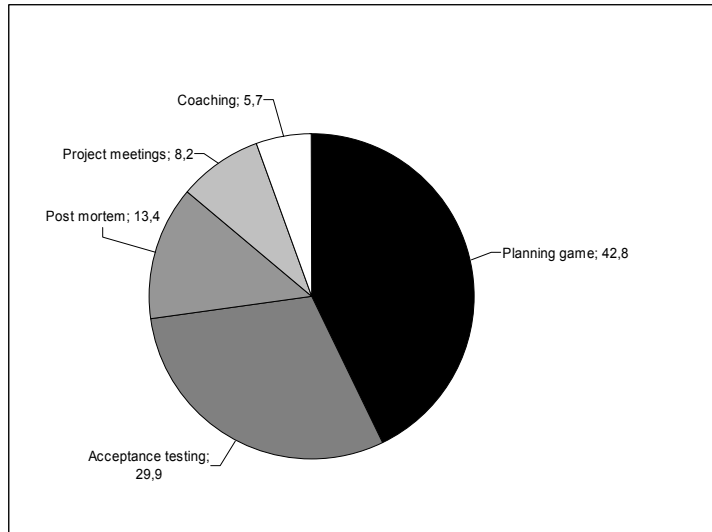


Table 3. Customer effort distribution (%).

From the viewpoint of customer effort distribution, participation in planning game and acceptance testing were two major activities that required customer's effort (table 3). Planning game sessions took 42,8% and acceptance testing 29,9% of the total effort. Post mortem sessions [16] were held at the end of release cycles and they took 13,4% of the customer effort. Project meetings were planning sessions with development team during the iterations and took 8,2% of the total effort. 5,7% was required for team coaching activities, because the customer had the best knowledge of the XP and its practices in the beginning of the project. Coaching was needed during the first two iterations when developers had something to ask, for example, related to continuous integration or unit testing.

5.2 Customer perceptions

The customer did his real work in the same room with the developers according to the suggestions of XP literature. During the project the customer made his observations of this way of working. It was found out that pair programming generates much more noise than solo programming. In the pair programming mode the developers read the code out loud and solve problems actively discussing. In the solo programming, the developer does not share thoughts out loud generally, thus operating in a more silent mode. During the project there were usually two pair programming pairs working at the same time and, therefore, the level of noise was always quite high. This was seen to be a disturbing influence for the customer's real work especially if the customer is accustomed to work alone in a quiet office space. The second finding was that developers had a quite low threshold level to ask questions when the customer was present on-site. This situation had both the good and bad sides. According to XP literature the

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smooth communication between developers and customers are important aspect for the project's success. On the other hand, if developers ask something all the time the customer may have hard to concentrate on his real work. Of course, being as an XP customer should have the highest priority of customer's duties.

The role of an XP customer has been argued to be demanding in the XP literature. The customer in this project agreed to this argument completely. It was found out that the role of XP on-site customer requires a strong ability to resolve issues rapidly. Usually developers asked something and they also expected to get their answers straight away. The most common questions and requests were as follows: *"What do you think of this implementation?"*, *"...but the customer decides how do we do this."*, and *"When you have time, could you test these and these features?"*

5.3 Project team perceptions

In the post-project interview the developers were inquired how important they perceived the on-site customer practice. As the following extracts from the interviews demonstrate, the presence of the customer was highly appreciated:

"Very good. If there is a some problem one can just sing out. There is no need to send email or drop in somewhere."

"Got answers fast, if there was something to ask."

The developers evaluated the on-site customer practice as one of the top-5 positive experiences during the project. For details of other positive findings, see [18]. It was also inspected whether it is necessary for the customer to be in the same room with the developers. One of the developers answered as follows:

"Customer could work, for example, next to project room. However, it should take only at the maximum of couple of minutes to contact the customer."

The daily participation was perceived to be very important. The developers were asked whether, e.g., one day a week would suffice:

"No, [one day a week] is not enough."

"At least once per day the customer should be present."

"Not necessarily a whole day, but he should be present every day."

6 Discussion

The results presented in the previous section pointed some important findings of the XP's on-site customer role. XP literature [e.g. 2, 3, 14] emphasizes the importance of high level customer involvement during an XP project. However, many authors [e.g. 4, 5-7] claim that on-site customer involvement is difficult or even unrealistic due to

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required customer work effort. A contrasting result was that while customer was an average of 83% present with the development team, only 21% of his work effort was required to assist the development team in the development. Customer effort distribution was quite expected, consisting mostly of planning game sessions and acceptance testing. According to XP literature, these are the main activities of the customer in an XP project.

During the project the on-site customer found pair programming quite noisy activity and this may have disturbing influence for the customer's real work especially if the customer is accustomed to work alone in a quiet office. This could be solved by moving the customer's place of work near by XP project room. This solution got also support by the developers. However, developers emphasized that it should take only at the maximum of couple of minutes to contact the customer. Moreover, customer should visit in the project room daily. According to Lippert et al.'s experiences [14], this kind of solution is not a problem if there is an agreement that developers can talk to customers at any time.

Anecdotal evidence suggests that the XP customer role is costly, difficult and demanding. Results of the study support the common belief that the on-site customer's role is demanding and requires a strong ability to resolve issues rapidly. Usually developers asked something and they expected also to get their answers straight away. The data demonstrated that the on-site customer practice offered the team a unique situation to consult him whenever needed. The development team perceived this act as a strong demonstration of organization's commitment to their work. The project was a software engineering success. In fact, the team delivered 250% (i.e., 12 user stories identified initially, 34 delivered) more value for the customer organization than originally planned for. All this was achieved within the defined delivery schedule. Yet, the system has not been used as actively as was intended. The reason for this is the poor usability of the system. Yet, all the related stakeholders were happy with the solution when it was under development. The on-site customer had a lot to say on how the system should function. Thus, while the experiences were mostly positive, the data reveals also that the on-site customer practice is in danger to create a false sense of confidence towards the system under development. Customer e.g., needs to invest to user-centered design (UCD) activities since the team may not require them to be conducted.

Claim, argument or suggestion	eXpert case study findings
High degree of customer involvement is required [5, 6]	This study offers contrasting result to this argument. While customer was near 100% present with the development team, only 21% of his work effort was required to assist the development team in the development.
The role of on-site customer is very demanding [4, 7]	The study supports this argument completely. It was found out that the role of XP on-site customer requires a strong ability to resolve issues rapidly. Usually developers asked something and they also expected to get their answers straight away.
Customer should work in the same	The development team perceived on-site customer as a strong demonstration of organization's commitment to their work.

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room with developers [2-4]	However, the customer found pair programming quite noisy and disturbing activity.
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Table 4. The findings of eXpert case study.

Table 4 presents the main findings of the eXpert case study. Based on these findings, it is suggested that customer could work near to project room, but not necessarily in the same room with the developers. This kind of off-site customer arrangement would take both developers' and customer's viewpoints into account; developers could still contact the customer easily and the customer would be able work in a more silent workplace. The customer should also reserve, for example, a one hour per day at the appointed time to discuss face-to-face with the development team.

7 Conclusions

Agile methods have gained a significant amount of attention in the field of software engineering in the last few years. Extreme programming, similar to other agile software development methods, values close collaboration with customers. XP's on-site customer practice suggests that customer should be 100% available for the development team. Anecdotal evidence suggests that the XP customer role is costly, difficult and demanding. However, very few empirical studies have been published on the customer's role in an XP project. This paper reports empirical results from a controlled extreme programming case study where the customer was present close to 100% of the development time. Results support the common belief that the on-site customer's role is demanding and requires a strong ability to resolve issues rapidly. One of the findings indicate that while customer was near 100% present with the development team, only 21% of his work effort was required to assist the development team in the development. However, it is shown that the on-site customer offers the team a unique situation to consult him whenever needed. The development team perceives this as a strong demonstration of commitment to their work. The data reveals also that on-site customer is in danger to create a false sense of confidence in the remaining of the customer organization. In addition, the customer found pair programming quite noisy activity and this may have disturbing influence for the customer's real work especially if the customer is accustomed to work alone in a quiet office. Based on these findings, it is suggested that customer could work near to project room, but not necessarily in the same room with the developers. This kind of off-site customer arrangement would take both developers' and customer's viewpoints into account; developers could still contact the customer easily and the customer would be able work in a more silent workplace.

One limitation of this study is that the customer was also one of the researchers and, therefore, he may be seen as biased to analyze the results. However, the customer was not an interviewer and developers were free to tell their feelings. Another limitation is that the study was based on the analysis of just a single XP case project. However, very few empirical studies have been published on the customer's role in an XP project and, therefore, we believe that the data presented has its value for practitioners and researchers in the field.

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