

Exploration of difference factors between the public and private domain and their impact on the innovation adoption process

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Distribution possibilities of a brick-laying robot within the Netherlands

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Part 1

Management Summary

This research paper is written in the context of innovation adoption and aims at exploring the impact of difference factors between public and private organizations on perceived innovation characteristics (IC) and the innovation adoption process. The main question, this research paper seeks to answer, is:

What are relevant adopter characteristic differences between the public and private domain within the roadmaking sector in the Netherlands, in how far are they influencing the way innovation characteristics are perceived and what impact do they have on the adoption decision process?

Hence, this paper stresses three main parts: characteristic differences' relevance; the impact on perceived innovations characteristics; impact on adoption decision process. By means of interviews conducted within the public and private domain, data on the issues was collected, analyzed and thus, the following conclusions have been drawn:

1. Organizational structure, competitive pressure and financial budget might be characterized as clearly distinct difference factors between the public and private domain; educational level has not been found a relevant difference factor.
2. Despite the differences identified between the public and private domain was the impact on the perceived IC somewhat uniform: mainly relative advantage has been influenced. This has also been identified as the most important perceived IC.
3. Difference factors fostering risk have been found for the public domain as not influencing how the ICs are experienced, but as enhancing the degree of importance of the perceived IC. For the private domain organizational size was weakening the degree of importance. With the presence/absence of the sub-factor risk the perceived ICs become more/less important.
4. For organizations within the private domain holds that the difference factor's impact on both, the consideration stage and the adoption decision stage is the same because they are treated as being closely related to each other, even equal.
5. For organizations within the public domain holds that the difference factors used are first of all influencing the consideration stage before influencing the adoption decision stage.

Part 2

Management Summary

Mr. van Herpt innovated a brick-laying robot (BRL), which is operating in a state-of-the-art manner. This research paper attempts to derive distribution possibilities of the BLR. In more detail, it answers how many brick-laying robot can be sold annually within the Netherlands at what price?

In order to answer this question most accurate an analysis of the environment was conducted, technician's opinion and financial aspects were taken into consideration. Moreover, interviews were conducted with 7 potential customers.

The major results were:

1. An estimated quantity of 5-10 BLR for the first year is expected to be sold to the Dutch market.
2. When the BLR is starting to profile itself and is pushed to the market, the following years a pull market could be a logical scenario.
3. The BLR's price can be 160.000€ initially and can be increased subsequently.

The following recommendations should be taken into consideration in order to make the distribution of the BLR more likely:

1. Learn from the faults and benefits of previous machines and robots, particularly the Streetwise 1200 and translate those to BLR features.
2. Create and develop a robot that is more accurate and productive compared to the machine/solution it supersedes.
3. Consider USP for further improvements of the BLR, especially re-paving features are of importance.
4. Develop a robot that stresses firstly economic issues, then social issues and last but not least ease of use issues.
5. Do not stand still by details, proof that the BLR is accurate and faultlessly operating.

Acknowledgment

The research paper at hand is my final step to get my bachelors degree. This bachelor thesis is in a way special, because firstly it enabled me to do research on innovation adoption theory and secondly it let me do marketing research for an organization. Hence, I had two stakeholders: the University of Twente and the organization VHTech.

I would like to thank Mr. van Herpt, founder of VHTech, for giving me an insight into his job as a technician and for his flexibility that made the combination of both, research on innovation adoption theory and marketing research, possible.

Secondly, I would like to thank Mr. Heuven for supporting me to do research on both issues and for challenging me for making me not just applying given theory but to look critical and setting up a sort of own model. By following this approach I am convinced I learned the most.

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Introduction

This research paper is my bachelor thesis written in the context of my bachelor study business administration at the University of Twente, Netherlands.

It includes two parts: the first part has a more scientific nature and approach, whereby the second part is following a semi-scientific approach. Basically, the scientific part discusses the differences between public and private organization and its impact on the way the innovation is perceived and on the innovation adoption process. Therefore, this part attempts to answer the following main research question: *what are relevant adopter characteristic differences between the public and private domain within the roadmaking sector in the Netherlands and in how far are they influencing the way innovation characteristics are perceived and what impact do they have on the adoption decision process?*

In contrast the second part is about an innovation, a brick-laying robot. By means of this paper, in general the distribution possibilities of the brick-laying robot within the Netherlands are discussed. In more detail, the following question will be answered: *how many brick-laying robots can be sold annually at what price within the Netherlands?*

Both parts are integrated into this paper because the scientific part is making use of the innovation stressed in part 2. Although, both parts can be treated and read independently, sometimes, though, they are referring to each other.

Part 1

1. Introduction

1.1 Research Motive and Relevance

The last decennia many scientific articles on innovation and on organizational innovation adoption have been published, which all stress the significance of a good understanding of the adoption decision process in order to come to successful innovation implementation (Rogers, 1995; Frambach and Schillewaert, 2002). The construction sector's reputation regarding adopting new technologies is poor due to for instance reluctance in patent applications or poor R&D investments (Habets et al., 2007). Less research has been conducted, though, regarding non-adoption of innovations because the phenomenon is complex and therefore it may be argued that the reason for the reluctance could be found at earlier stages of the adoption decision process (Frambach and Schillewaert, 2002). Hence, basically many innovations are rejected due to a lack of understanding of factors influencing the innovation adoption process. In the case of the brick-laying robot these understanding is crucial since it firstly helps to understand why innovations are rejected or adopted and thus secondly can be used as a marketing instrument to come to successful innovation sales. With other words, understanding the innovation adoption process and the factors influencing the adopter's decision to purchase an innovation will provide the innovator with relevant information needed to affect the adoption decision process in a way the innovation purchase is finally more likely.

In order to get a better understanding of the innovation adoption process, the following section will represent a discussion of innovation adoption process models.

1.1.1 Innovation Adoption Process

Rogers (1995, p.161) defines the innovation adoption process as "the process through which an individual or other decision-making unit passes from the first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision." This makes clear that before coming to the final decision to adopt or reject an innovation precedent stages have to be passed. In Rogers' (1995) model this is first of all knowledge, which occurs when an individual or other decision-making unit gets exposure to the existence of an innovation and gains an understanding of its functions. The second stage is persuasion, which can be defined as the stage responsible for forming a favorable or unfavorable attitude towards the innovation (Rogers, 1995, p.162). Frambach and Schillewaert (2002) define those stages before the adoption

decision as awareness, consideration and intention and label them as sub-stages (compare figure 1).

Figure 1: Adoption Decision Process Model



Sources: Rogers (1995); Frambach and Schillewaert (2002)

Whereas awareness is a synonym for the knowledge stage, consideration and intention are comprised in Rogers' persuasion stage that encompasses not only gaining information for taking the innovation into consideration but also innovation-evaluation (intention) information that will form a perception towards an innovation (Rogers, 1995; Frambach and Schillerwaert, 2002).

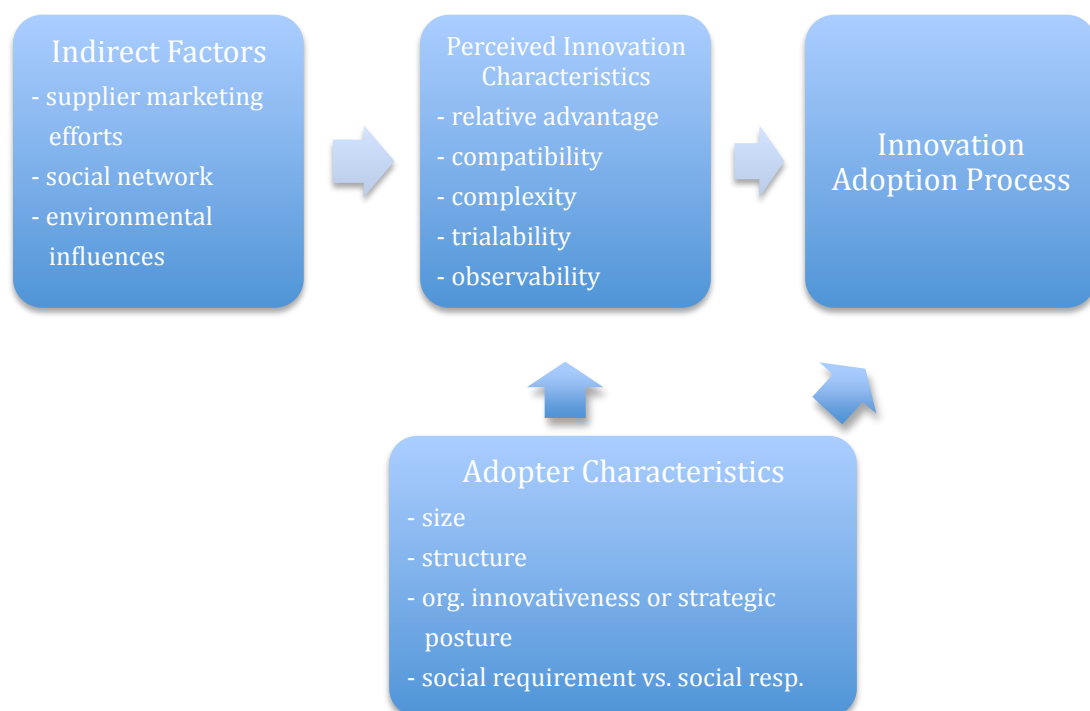
In research on innovation adoption the above-mentioned sub-stages always gained less ascription ability of being relevant factors in the adoption decision process. Thus, researchers have always paid the most attention regarding effects of different factors on the adoption decision stage (Frambach and Schillewaert, 2002). Without having any knowledge of the factors affecting the adoption decision it can be stated that the affection of the individual or other decision-making unit by those factors takes place *before* the actual adoption decision and not *during* the adoption decision stage. Most studies, though, as Frambach and Schillewaert (p. 164, 2002) pointed out, "(...) focus on the dichotomous adoption/non-adoption decision." And hence the sub-stages are perceived as one entity affecting the innovation decision stage. Almost no study is stressing the sub-stages (awareness, consideration and intention) and focus on each stage's relevance of affecting the innovation decision stage.

1.1.2 Determinant Factors

Extensive research has been conducted to identify factors that influence the adoption decision of both individuals and organizations. A general model that clearly reveals the interrelations between the adoption decision process and the factors influencing this process, is proposed by Frambach and Schillewaert (2002). As can be seen in the overview, do direct as well as indirect factors exist. Direct factors, such as perceived innovation characteristics and adopter characteristics, are those factors, which hold a direct effect on the innovation adoption process. In turn, indirect factors, such as

supplier marketing efforts, social network and environmental influences, are those factors which are not holding a direct influence on the innovation adoption process. In our overview their indirectness comes forth from their direct influence on perceived IC first, before influencing the innovation adoption process. Adopter characteristics' impact, though, is twofold: on the one hand it is directly influencing the innovation adoption process and on the other hand its impact on the innovation adoption process is mediated by the perceived IC (see figure 2). Again, relevant direct factors are the perceived innovation characteristics and the adopter characteristics. This is since extensive studies have validated the significance of those factors of being key influencers in the adoption process: commonly used adopter characteristics for research purposes are organizational size (Kennedy, 1983), organizational structure (Damanpour, 1991), organizational innovativeness/ strategic posture (Srinivasan, 1999) and the perceived innovation characteristics such as relative advantage or compatibility (Rogers, 1995; see figure 2).

Figure 2: Overall Literature Overview



Source: Frambach and Schillewaert (2002), Hartmann et al. (2008)

In addition to the direct influence of adopter characteristics on the innovation adoption process, it can also be argued that they are shaping the way innovations are perceived. For example, Hartmann et al., (2008) identified factors (social requirement, social responsibility, project-independent knowledge and project-dependent uncertainty) that

have an influence on the innovation adoption but are mediated by the perceived innovation characteristics. This is why in figure 2 the adopter characteristics box has two arrows and its affection is twofold.

1.1.3 Public and Private Domain

The last two decades' research conducted was primarily focused on finding determinants, which would hopefully have a positive effect on the adoption decision process. Less emphasis has been placed, though, on the different sectors organizations are settled in. For example in the construction sector the effectiveness of common factors such as age, education of individuals, organizational size and structure on the adoption process are only indicatively analyzed (Hartmann et al., 2008).

In addition to this shortcoming, research has less stressed the specific domain organizations are embedded in.¹ The domain an organization is placed in is either public or private. Research has unconsciously been conducted in both domains. In general the common distinction between those two groups lies in the ownership; whereas entrepreneurs or stakeholders predominantly own private organizations, public organizations are owned by the collective of political communities (Boyne, 2002).

This conscious distinction is in so far relevant that it indicates more precisely, which factors are influencing the perceived innovation characteristics and the adoption decision process of each domain since it has been found that public organizations show significant differences regarding structure and values compared to private organizations (Boyne, 2002). This gives direction to investigate whether there are other relevant adopter characteristics that differ between the public and private domain, which affect how innovation characteristics are perceived and the innovation adoption process. These can also be potential factors, not applied to either one or other domain yet, as represented in the research of Hartmann et al. (2008).

1.2 Research Questions

The preceding discussion reveals that this research is about addressing shortcomings, research has not stressed yet. No hypotheses have been clearly formulated on the issues and therefore this research will follow a more explorative approach to get a clearer view of relevant adopter characteristics and their impact on perceived innovation characteristics and the innovation adoption process. The above-discussion reveals the main research question:

¹ A domain is actually a synonym for sector but is used in this context to make a clear distinction from it.

What are relevant adopter characteristic differences between the public and private domain within the roadmaking sector in the Netherlands and in how far are they influencing the way innovation characteristics are perceived and what impact do they have on the innovation adoption process?

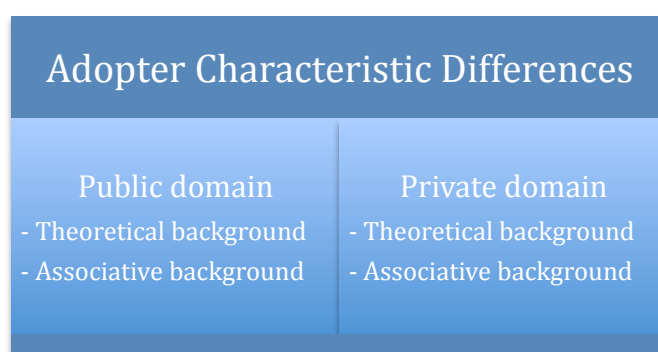
In order to answer this main research question, it is segmented in several sub-questions:

1. What are relevant adopter characteristic differences between the public and private domain that might affect the perceived innovation characteristics?

From a theoretical background adopter characteristic differences between the public and private domain can clearly be distinguished. In addition, this research question aims at exploring adopter characteristics not stemming from a theoretically discussed background but have a more associative origin.

Since little is known about adopter characteristic differences between the public and private domain within the roadmaking sector in the Netherlands, it is assumed that not only general differences, such as Boyne (2002) stressed, or particular differences within the construction sector, should be of relevance but also differences that are closely related to the specific conditions and specific (organizational) characteristics of the roadmaking branch (see figure 3).

Figure 3: Adopter Characteristic Differences

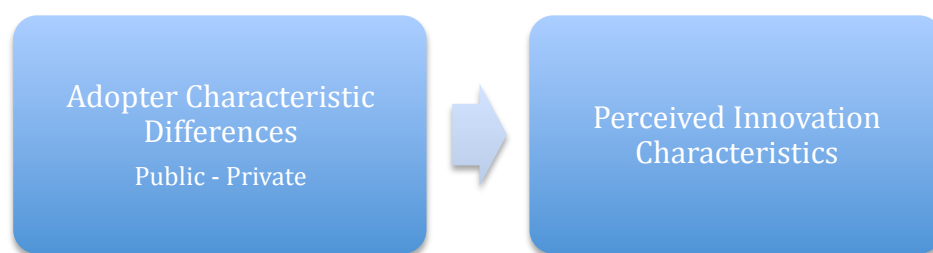


2. What might be the impact of the adopter characteristic differences on the perceived innovation characteristics?

It was argued earlier that adopter characteristics' impact would be twofold; on the adoption decision process as well as on the perceived innovation characteristics (see

figure 2). Within the borders of this research question the affection of the adopter characteristic differences on the perceived innovation characteristics are emphasized and the direct impact of the adopter characteristic differences on the innovation adoption process are left without consideration. Moreover, also indirect factors (see figure 2) have been identified; these are not taken into consideration, either since this would exceed the limits of this research. Another issue this research question attempts to explore is whether there are perceived innovation characteristics, which are more affected than others (see figure 4).

Figure 4: Adopter Differences on Perceived IC



3. Might adopter characteristic differences and perceived innovation characteristics have an influence on the adoption decision stage or is the impact mediated by the consideration sub-stage?

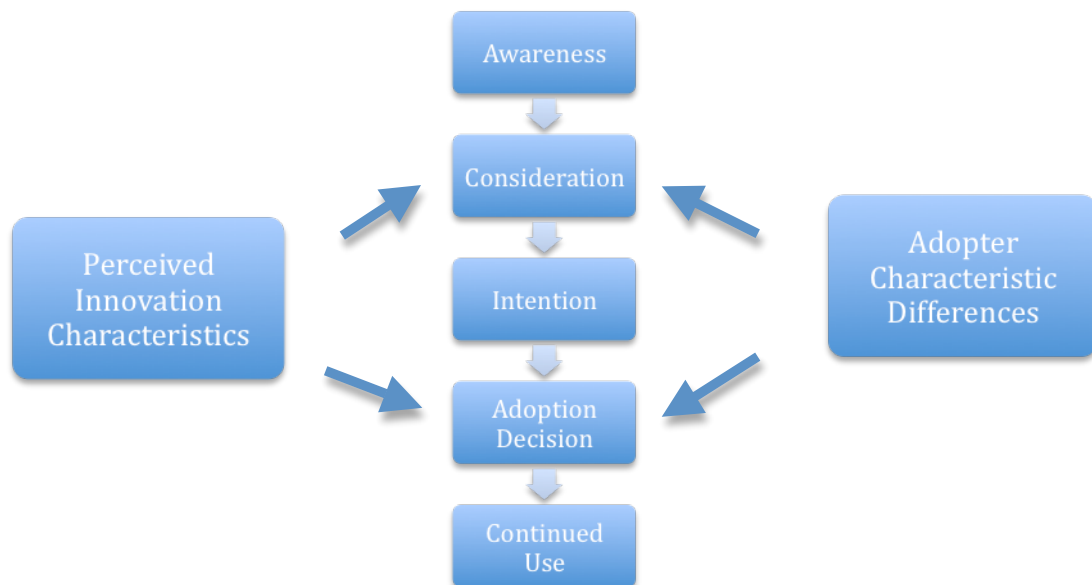
The affection on the innovation adoption process has been stressed earlier in the discussion as lacking of being precise about which part of the innovation adoption process is actually influenced. Therefore, this research paper takes a closer look at the affection possibility on the consideration sub-stage and on the innovation adoption decision stage.

Both, the direct influence of perceived innovation characteristics on the adoption decision stage and the direct influence of adopter characteristics on the adoption decision stage have already been stressed in literature (Frambach and Schillewaert, 2002). Accordingly, relevant factors influencing the adoption decision stage or the consideration sub-stage are either stemming from the adopter characteristics or the perceived innovation characteristics (see figure 5).

Within the borders of this research question, both aspects are assumed as being distinct and only the direct influence on the innovation adoption process plays a key role. This is important to state since the adopter characteristics could also have an impact, mediated by the perceived innovation characteristics, on the innovation adoption process.

Therefore, the influence of the adopter characteristics on perceived innovation characteristics as depicted in figure 4 are left without consideration.

Figure 5: Influence on the Innovation Adoption Process



2. Theoretical Framework

The section above gives a clear direction for the theory that will be used within this research. Firstly, the difference between the public and private organizations will be discussed, to come up with adopter characteristics differences, which can be used in this paper. Secondly, the perceived innovation characteristics will be described. Finally, more light will be shed on the consideration sub-stage within the innovation adoption process. In sum, the following discussion will elicit a theoretical framework, which will be used to answer the research questions. Figure 6 depicts the theoretical framework used within this research.

2.1 Differences between Public and Private Organizations

The differences distinguished between public and private organizations are stemming from different sources; they hold a relevant character since the factors have been extensively tested within research on innovation adoption (compare Frambach and Schillewaert, 2002); they are of general character (not explicitly used in innovation adoption research) but found significant by a lot of research conducted (compare Boyne, 2002; Nutt, 2000); they hold a potential difference character due to partial testing on public organizations only (compare Hartmann et al., 2008); they hold a total potential

difference character because they have not been tested yet within the field of innovation adoption at all. The latter factors are chosen based on an associative approach, which mainly holds that they are not stemming from a theoretical foundation but from logical argumentation.

Figure 6: Theoretical Framework Model

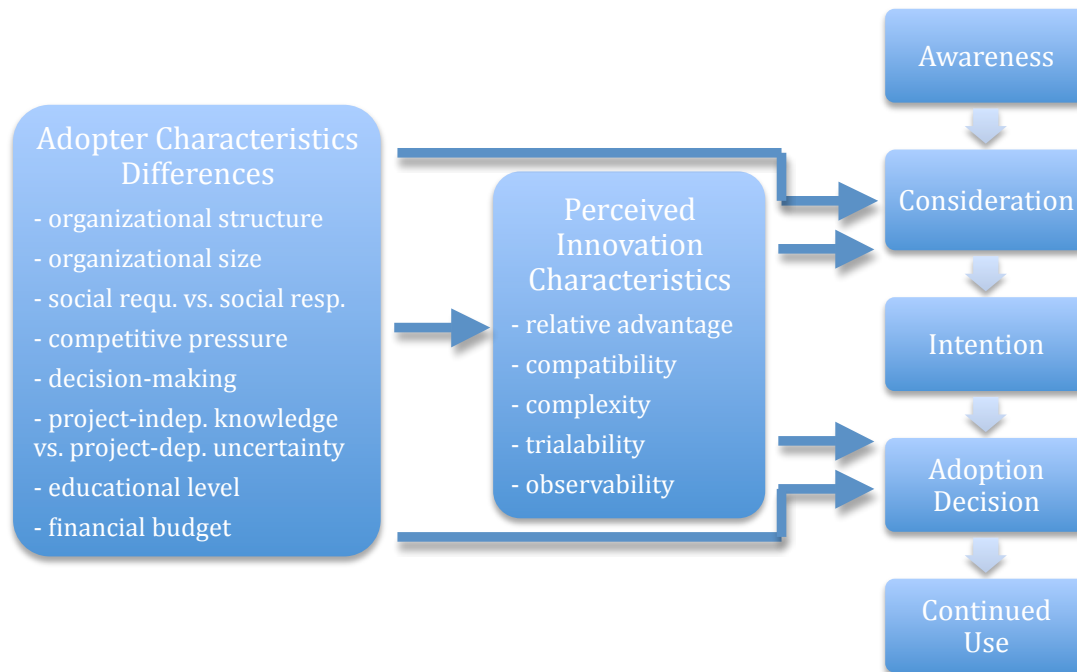


Table 1 reveals more precisely what the above mentioned actually means. It depicts three different categories: difference factors, potential difference factors and total potential difference factors. Difference factors are those factors, which theory has already found as relevant difference factors between the public and private domain. Secondly, potential difference factors are defined as those factors, which are found relevant determinants influencing the perceived IC and the innovation adoption process but are tested on within one domain (here public) only. Finally, total potential difference factors might be defined as those factors, which have not been tested yet within the realm of innovation adoption and their origin is based on logical argumentation.

Table 1: Difference Factors and Impact on Perceived IC and the Innovation A. Process

Difference Factor	Domain	Sub-factor	Impact on Perceived IC	Impact on Innovation Adoption Process
Organizational Structure	Public	Bureaucratic, Less flexible, Risk-aversion, Formal	x	Negative: less likely to initiate innovation adoption decisions

	Private	Less bureaucratic and formal, less risk-aversion, more flexible	x	Positive: more likely to initiate innovation adoption decisions
Organizational Size	Public	Large, less flexible	x	Positive: innovate for support performances
	Private	Small, flexible	x	Positive: enhanced receptiveness towards innovations
Competitive Pressure	Public	Political context, no competition	x	Negative: no competition, no need to innovate
	Private	Market context, competition between organizations	x	Positive: to stay alive
Decision-Making	Public	Turbulent, Interrupts and Conflict	x	x
	Private	Smooth, Less bumpy	x	x
Potential Difference Factors				
Social Requirement vs. Social Responsibility	Public	Services benefiting society as a whole; responsible for organizations and employees	Relative advantage, compatibility, observability	Positive: when innovation better in meeting social requirements while not compromising social respon.
	Private	x	x	x
Project-independent Knowledge vs. Project-dependent Uncertainty	Public	Past experiences, Networks	Relative advantage, compatibility, observability	Positive: when project-dependent knowledge is used to overcome project-independent uncertainty
	Private	x	x	x
Total Potential Difference Factors				
Educational Level	Public	Higher than private	x	x
	Private	Lower than public	x	x
Financial Budget	Public	"Public" money	x	x
	Private	"Personal" money	x	x

Legend: x= literature does not provide tested findings

2.1.1 Difference Factors

Within the roadmaking branch and within the private domain organizations make use of roadmaking work for profit reasons, whereas public clients are institutions demanding the roadmaking work not-for-profit reasons. Three main differences between the public and the private domain have been indentified; these are (1) public organizations are more bureaucratic, (2) motivation to serve the public interest is higher in the public domain, and (3) public managers have weaker organizational commitment (Boyne, 2002, p. 116). Results from research reveal that public organizations tend to be more bureaucratic than private organizations. Major characteristics of bureaucratic organizations are less flexibility, more risk-aversion and more formal procedures for decision-making. Accordingly, for private organizations hold, which are considered as being less bureaucratic that they are more open and flexible towards their environment and they are taking risks for achieving even greater benefits (Boyne, 2002; Frambach and Schillewaert, 2002). Hence, the first difference factor has been identified: organizational structure.

Another factor extensive research found significant with respect to innovation adoption is organizational size. Larger organizations are considered as being less flexible compared to smaller organizations (Kennedy, 1983). This sub-factor identified is the same as for organizational structure. With respect to this research, we try to ascribe a factor to either the public or the private domain. In this case, it is generally not possible because it is not known yet, how large the organizations within both domains will be.

Anyway, research already conducted for part 2 of this paper reveals that private organizations within the roadmaking branch are in general smaller than public organizations. In our case private organizations are SMEs and thus have up to 100 employees only. In contrast, we expect that public organizations tend to have more and are hence considered to fit the category 'large organizations'. Therefore, another difference factor can be distinguished.

Another difference factor, the absence of competitive pressure has been identified in research conducted by Boyne (2002). Although results on this topic are unclear and indicate ambiguity, the absence of competitive pressure will be used as a difference-factor because it indicates a potential difference. The potential is derived from Hartmann et al. (2008); they state that in comparison to organizations within the private domain "(...) public-sector organizations are monopolies lacking competitive

pressure to innovate (...)”. In contrast, private organizations are embedded in a market situation facing competition from other private organizations (Hartmann et al., 2008).

Research conducted by Nutt (2000) indicates that decision-making is different within public and private organizations. In more detail, the decision-making within public organizations is characterized by more turbulence, interrupts and conflicts compared to the private domain. This is, as Nutt (2000) argues, due to the political context, in particular the frequent elections and high level of scrutiny and disclosure. On the contrary, within private organizations decision-making is considered as being smooth and less bumpy. Hence, the difference factor decision-making is perceived a relevant factor in this research.

2.1.2 Potential Difference Factors

The motivation to serve the public interest is higher in the private domain, has been found another general difference factor between the public and private domain (Boyne, 2002). This difference refers to the term social requirement, Hartmann et al. (2008) identified as a factor inciting the innovation adoption decision. They argue that because public organizations are put into the political domain, they are thus confronted by requirements “(...) that are manifested in governmental policies”, and therefore serve the public interest. In different words, public organizations are in contrast to their private counterparts embedded in a political context rather than a market context. Thus their services aim at benefiting society as a whole. Issues related to this approach are considered as social requirements (Hartmann et al., 2008). For example, such social requirements could be related to traffic, environment or health issues. Since this factor has only been tested within the public domain it is considered a potential difference factor.

In addition, major findings of Hartmann et al.’s (2008) research were that social requirement is in conflict with another factor identified: social responsibility. Social responsibility is associated with concerns organizations could hold towards the innovation. Mainly concerns were related to safety and financial issues. This potential difference factor has not been tested within the borders of the private domain at all (see table 1).

Decision-makers are not only reliable on knowledge that is dependent on the respective decision but also consult, what Hartmann et al. (2008) named project-independent knowledge. This knowledge, stemming from internal or external sources is (mostly)

related to previous applications and experts. This makes clear that knowledge and expertise that cannot be directly attributed to the current decision to come, is used to reduce risk. Anyhow, consulting experts and experiences of previous applications, a certain project-dependent uncertainty remains. Public organizations tend to make expectations regarding the performance of the innovation but it cannot be guaranteed that the expectations will be fulfilled with the adoption of the innovation. Hence the remaining uncertainty is replaced by a trust-based relationship over time. This trust can mainly be build by experts or an expert network (Hartmann et al., 2008). The interplay of the conflicting factors project-independent knowledge and project-dependent uncertainty is influencing how the innovation is perceived and hence, it is added to the category potential difference factors of this research. This potential difference factor has not been tested within the private domain (see table 1).

2.1.3 Total Potential Difference Factors

The following factors were identified while conducting research for part 2 of this paper. The educational level within the public and private domain tends to differ. Employees working in public organization have in general a higher educational level compared to their private counterparts in the roadmaking branch. This is mainly due to the fact that many SMEs emphasized within the roadmaking branch are run by the workers itself instead of specialized management.

Another difference, which emerges from the ownership of public and private organizations, is the financial budget. Whereas private organizations hold a budget consisting of money that has generally been accumulated by making profit and which can be spent for organizational purposes only, public organizations hold a budget consisting of money accumulated through taxes and should be spent for both organizational and public purposes. Hence, public organizations have a budget consisting of “public money” whereas private organizations have a budget consisting of “personal money”. Another difference factor has been identified: financial budget.

2.2 Perceived Innovation Characteristics

Rogers (1995) distinguished five characteristic of innovation to determine the rate of adoption. These are:

- Relative advantage is the degree to which an innovation is perceived better than the idea it supersedes.

- Compatibility is the degree to which an innovation is perceived as consistent with existing values, past experience, and needs of potential adopters.
- Complexity is the degree to which an innovation is perceived as difficult to understand the use.
- Trialability is the degree to which an innovation may be experimented with on a limited base.
- Observability is the degree to which the results of an innovation are visible to others.

When the user's perception of an innovation holds a relative advantage, compatibility, observability, trialability and less complexity, the innovation is more rapidly and likely adopted than other innovations (Rogers, 1995, Habets et al., 2007). The speed of adoption is what Rogers (1995, p.206) defined as the rate of adoption.

2.3 Consideration within the Innovation Adoption Process

Here is the basis of departure that consideration is defined as the stage where an individual or other decision-making unit is forming a favorable or unfavorable attitude towards the innovation. This is in accordance with what Rogers (1995) defined as his persuasion stage. The main difference lies in its distinction from the intention to use, which is integrated in Rogers (1995) framework. Taking an innovation into consideration will in this research be made operational by deriving whether the individual is interested in such a product since being interested would be the outcome of forming a favorable or unfavorable attitude towards the innovation.

2.4 Impacts on Perceived IC and the Innovation Adoption Process

After having identified difference factors between the public and private domain and after having outlined the theory on perceived IC and what status the consideration sub-stage has within the innovation adoption process, this section will discuss what the difference factors' impact on the perceived IC and the innovation adoption process is.² As stressed earlier are the difference factors stemming from different sources, which are depicted in table 1. This table also reveals the difference factors' impact on perceived IC as well as on the innovation adoption process.

² Keep in mind that here the notion innovation adoption process is used to integrate both parts, the consideration sub-stage and the adoption decision stage into one concept.

2.4.1 Impact on Perceived IC

As table 1 reveals do the potential difference factors only have an impact on the perceived IC, which has been tested yet.

2.4.1.1 Potential Difference Factors

For the potential difference factors hold that they are partially tested, including the impact on perceived IC and on the adoption process. Here, partially tested means that the public domain was emphasized only.

Social Requirement versus Social Responsibility

While having an impact on the innovation adoption process, this factor is mediated by the perceived innovation characteristics relative advantage, compatibility and observability; the innovation must contribute better than traditional ideas with respect to political public issues (relative advantage), these are conform the organizations mission and goals (compatibility); by means of observability the innovation's relative advantage and risks were evaluated more accurately (Hartmann et al., 2008).

This potential difference factor has not been tested within the realm of the private domain at all (see table 1).

Project-independent Knowledge versus Project-dependent Uncertainty

This potential difference factor is, while influencing the innovation adoption process, mediated by the perceived innovation characteristics relative advantage, compatibility and observability (Hartmann et al., 2008). When public organizations make use of project-independent knowledge to overcome project-dependent uncertainty, they would see how other solutions work for different organizations. They would see whether the solutions would have a relative advantage, are compatible with their strategic orientation, and to what degree those are observable.

2.4.2 Impact on the Innovation Adoption Process

2.4.2.1 Difference Factors

In general, for the category 'difference factors' sub-factors as well as the impact on the innovation adoption process are presented. Decision-making, though, is found only as a significant difference factor between the public and private domain but has not been stressed in research on innovation adoption yet. Therefore, no impact on the adoption process has been found. Moreover, literature suggests that the perceived IC are not

mediating the following factors belonging to the category 'difference factors' while influencing the adoption decision (Frambach and Schillewaert, 2002; Rogers, 1995).

Organizational Structure

Organizational structure's impact on the adoption decision has been found to vary: the more formalized and centralized organizations are, the less likely is the initiation of the innovation adoption decision. In contrast, the less bureaucratic and hence risk-averse organizations are, the more likely is the initiation of the innovation adoption decision (Boyne, 2002; Frambach and Schillewaert, 2002).

Organizational Size

Moreover, organizational size has repeatedly been found a determinant factor positively influencing the adoption decision (Kennedy, 1983). Larger organizations, it is argued, attach more importance to adopt innovations for supporting and improving performances. Smaller organizations, in turn, hold an enhanced receptiveness towards innovations due to their more flexible and innovative character (Frambach and Schillewaert, 2002).

Competitive Pressure

The consequence that public organizations lack competitive pressure is an impact of the adoption decision with a negative outcome: they are less likely to initiate innovation adoption decisions because they don't feel the need to innovate. In contrast, private organizations are embedded in a competitive environment, which is an important driver for innovation (Hartmann et al., 2008).

Decision-Making

For this difference factor no influences on the perceived IC and on the innovation adoption process have been stressed and thus identified yet.

2.4.2.2 Potential Difference Factors

Social Requirement versus Social Responsibility

Hartmann et al. (2008) argue that PPCs (Professional Private Clients) will adopt an innovation if they hold the perception that "(...) the new idea performs better in meeting social requirements than traditional solutions while not compromising the client's social responsibility." This means that the benefiting of the public interest is most important by adopting innovation but in case the innovation does not meet safety or financial

issues related to the implementation of the innovation, public interest is less important than directly related project implementation issues.

Project-independent Knowledge versus Project-dependent Uncertainty

This mediated potential difference factor is positively influencing the innovation adoption decision when project-independent is endorsed by the organization to cover the project-dependent uncertainties.

2.4.2.3 Total Potential Difference Factors

The category 'total potential difference factors' comprises factors, which impact is neither tested on perceived IC nor on the innovation adoption process. In addition, their difference did not emerge from literature.

3. Research Design

3.1 Interview Approach

This research attempts to find results on issues that are yet relatively less emphasized scientifically. This means that no hypotheses have been formulated or even tested to which this research could be connected. Anyway, suggestions for further research (Frambach and Schillewaert, 2002) and expectations (Hartmann et al., 2008) have been formulated, used as starting point in this research. Thus, the knowledge that could be applied to the cases is highly limited. This indicates that an explorative approach would be the most appropriate for this research. Applied to this research it means that difference factors have been identified or explored by means of a theoretical discussion. The further research comprises the exploration of relevance of such difference factors on perceived IC and the innovations adoption process.

Hence, by means of semi-constructed interviews the impact of difference factors can accurately be explored (Babbie, 2004). For this research a total of six interviews were conducted: one research within the public domain and five interviews within the private domain. All organizations relevant for this research were selected on basis of the general criterion of being potential customers for an innovation, a brick-laying robot. This criterion is used because the brick-laying robot would be something tangible, easily imaginable and of highly importance to them, which is expected to elicit more accurate

data. Therefore, the Dutch register of commerce³ was used to get a list of potential customers of a brick-laying robot. The relevant list received was based on the criteria: roadmaking branch, economic active, with contact person and between 10-100 full-time working employees. About 76 (see appendix 1) organizations were found of which the innovator of the brick-laying robot selected 15 organizations as highly relevant to him based on their location: 'the closer the better'. Those 15 organizations left were approached in order to make an appointment regarding an interview. With five organizations an interview appointment could be made. For the public domain, one public organization, the local authorities Rotterdam, could be identified as a potential customer of a brick-laying robot.⁴ Making use of only one public organization is weakening the external validity of this research. Therefore, the outcomes regarding the public domain might give a false perception of how the reality looks like. No variety of the outcomes is also the result of using one public organization only and hence it is difficult to generalize to the whole public domain. The outcomes will, thus, only present potential issues further research has to stress more to make generalization possible. Finally, the local authorities Rotterdam appears to be the best representative found for all public organizations within the construction sector. This is mainly because the local authorities Rotterdam are one of the biggest local authorities within the Netherlands and have therefore the financial potential and ability to purchase innovations. Therefore, the outcomes of this research might be relevant for those who see local authorities or large public organizations as potential clients.

3.2 Data Gathering

As stated above, semi-constructed interview design was used to obtain relevant data. This holds, that firstly a set of general questions were generated and secondly that the interviews would also be based on an unconstructed part to be able to obtain in-depth data. In addition, quantitative data was gathered to obtain data on IC importance to the individual. The units of analysis' status in the organizations were twofold and comprised general managers and CEOs. A total of six interviews were conducted, which lasted in total about 1.5 hours. The first 30 minutes were dedicated to the constructed part and the rest was needed for the unconstructed part. Only the constructed part of the data collected was recorded and transcribed. The other part was recorded in written form. The transcribed interviews can be found in the appendix 6.

³ www.kvk.nl

⁴ As found by this interview, they are the only local authorities, which is actually purchasing such innovations.

3.3 Data Analysis

The interview outcomes were analyzed firstly to find information on difference factors' relevance, secondly to investigate their impact in perceived IC and finally to obtain information on the impact on the innovation adoption process.

This research is not about testing explicit hypotheses but has a more explorative character. Therefore, the data analysis approach is more like fishing in a big pot of data than exactly testing on given hypotheses. This also means that we cannot apply strict criteria over and over again for the data analysis. Anyway, the following guideline will be used to provide the data analysis with a framework not to let the outcomes being affected only by subjectivity and the free will.

In general, the difference factors' are considered as relevant for the public and private domain when the interview outcomes are in accordance to the theory or expectations (expectations in case of the total potential difference factors). For the private domain holds that a different factor is relevant when (1) a common consensus among the respondents persists on one given issue, (2) when the favoring findings on an issue outweigh the disfavoring findings. We do not make use of statistics to come to our findings. Therefore it can be sufficient that only one respondent agrees upon an issue, preconditioned that the others are not disproving it.

For the public domain, we only have one case, which means that we consider these findings as the only contributor to our research for the public domain. Hence, different factors are relevant when the interview outcomes suggest that.

When we come to the impact on the perceived IC the same approach as for the difference factors' relevance can be applied. Here, though, except for the potential difference factors, no theory on how different factors affect perceived IC has been formulated yet. This means that the data analysis is here even more like fishing in big pot of data, exploring for relevant findings because no basis can be used to start from.

The same approach holds for the analysis regarding the consideration sub-stage versus the adoption decision stage.

4. Data Analysis

The means of this section is to present the findings gained from the interviews conducted with organizations within the public and private domain. The following discussion will firstly stress aspects concerning research question 1, than research question 2 and finally research question 3.

4.1 Difference Factors' Relevance

4.1.1 Difference Factors

With respect to the first category 'difference factors', which is comprised almost of only theoretical relevant factors within the realm of innovation adoption, it can be stated that the interviews conducted within the roadmaking branch reveal many similarities with the theory. However, there have also been found differences.

The organizational structure of the local authorities Rotterdam can be characterized as highly bureaucratic. This is because the hierarchy has many levels as well as many departments such as the 'community work Rotterdam'. In addition to this, the interviewee stated that within their public organization procedures are all written down. This means that the degree of formalization is relatively high (Interview local authorities Rotterdam, 2008). This bureaucratic structure would lead, according to Boyne (2002), to risk-aversion and less flexibility. This is actually what the interviewee was stating; they are not taking any risks.

The local authorities Rotterdam are one of the largest public organizations within the Netherlands. Moreover it is, according to Mr. Dooremalen, an advisor of the local authorities Rotterdam, the only public organization engaged in road-making activities. Moreover, the data of the interviews suggest that they are embedded in a political context, and are thus not affected by competitive pressure. In sum, these two factors, organizational size and competitive pressure are in accordance to theory.

Regarding the difference factor decision-making interviewees within the local authorities Rotterdam claim that decisions are made smoothly with less meetings and conversations. Furthermore the employees are not deliberate in decision-making; they provide the necessary information and pro & contra arguments only, but other employees, higher in the hierarchy, make the actual adoption decision. Striking is that decisions are made very rapidly, preconditioned that no risks are related to the innovation. On the first glance, this is in sharp contrast to what Nutt's (2000) research on differences in decision-making between the public and private domain, had found. Striking was that rather than making the actual (adoption) decision themselves they provide information and try to convince third people, who are higher in the hierarchy, to increase the likeliness of a favorable decision. Since the decision goes to a different department it might be stated that the actual decision maker is not even concerned about the issue or engaged with the work of the other department. Basically, when it comes to convincing people, a conflict or turbulences could be the cause. Since this is not further investigated during the interviews it is speculative. Anyway, this logical

argumentation makes clear that the decision-making with the local authorities Rotterdam might not be as smooth and less bumpy as indicated by themselves.

Concerning the organizations within the private domain, the interviews support what already, considering the mainly small organizational size, has been exposed. The organizational structure is simple comprising less hierarchies and formalization. The size varies from 20 to 150 employees. This makes clear that the organizational size does not provide a good soil for bureaucracy to flourish. The organizational structure and size found are in accordance to the theory (see Frambach and Schillewaert, 2002). Regarding risk-aversion, which comes with bureaucracy, it might be stated that compared to public organizations, the private organizations investigated are more willing to take risks, which expresses itself for example in high innovation investments (Interview, NTP Infra, 2008). With respect to the organizational size, the size itself is a difference factor, but the interviews suggest that the sub-factor, being more receptive towards innovations, cannot be found for all small organizations emphasized. Rather, these stress more the better performances and higher productivity rates of the innovation, which indicates that the innovation should contribute to improve their performances (i.e. Interview, GMB LBS, 2008). One respondent argued that they were, due to their organizational size, more receptive towards innovations than larger organizations (Interview, NTP Infra, 2008). In sum, organizational structure might be seen as difference factor when it comes to the structure. Nevertheless, both sub-factors, 'improve performances' and 'receptiveness towards innovations', are of relevance and therefore organizational size cannot clearly be distinguished as a difference factor.

In contrast to the public domain, which was characterized by no competition at all, within the private domain, interviewees as well as facts (see part 2 section 2.1.5) indicate that competition is fierce. All interviewees said that the highly competitive situation they face pressures the price per square meter. The net profit is decreasing and as a consequence the budget for investments is becoming less. Nevertheless it has not been an argument yet not to invest. This is in accordance to theory (Hartmann et al., 2008) and therefore considered a difference factor.

With respect to decision-making within the private organizations investigated, interviewees claimed that decision-making would be smooth and rapid. Mr. Slot, CEO of NTP Infra, argues that this is 'inherent to the organizational structure: a flat firm' (Interview, NTP Infra, 2008). His employees are to a certain degree (the amount of money to be spent) deliberate to decide by themselves whether or not to invest. Striking

is here that the decision-maker, the CEO, is due to the small organizational size highly attached and involved to anything that is going on within his organization. Therefore, compared to the public organization for instance less time is wasted to provide information. In addition, one could argue that due to the decision-maker's involvement into the whole decision-making process, decision-making itself might be characterized as less bumpy, less time-consuming and with less conflicts. Hence this is in accordance to the theory regarding difference factors (Nutt, 2000). In sum though, the difference factor decision-making cannot be considered as a difference factor based on the data found for the public domain. Anyway, another striking issue has been identified: it is not only important how decisions are made but also who makes the decision. In our case either direct involved individuals as in the private domain, or no involvement at all as argued for the public domain.

4.1.2 Potential Difference Factors

The analysis of the interview revealed a strong accordance with Hartmann et al.'s (2008) research. For example, when adopting an innovation, the local authorities Rotterdam attach utmost relevance regarding the benefits of society, especially its citizens, and not of the organization itself. The benefits were mainly related to health issues because a brick-laying robot contributes from a societal perspective to a general healthier branch and therefore to a healthier society. Accordingly, it might be argued that this societal perspective reflects the organizations strategic orientation. The whole issue is known as social requirement, private organizations, as we will stress later, lack. On the other hand, social responsibility has also been investigated by the interview with the local authorities Rotterdam (2008). There were two important aspects; firstly employee health aspects and secondly financial aspects. Regarding the health aspect, the interviewee stated that they are concerned about the health conditions of their employees and that they would help them getting less physically strained work. The brick-laying robot would be one possible solution. With respect to the financial aspects they want to make efficient use of the public budget. This expresses itself in the fact of being highly reluctant when it comes to purchasing decision. They argue that they are not jeopardizing the public budget in order to possibly gain the benefits of the innovation. The risks must be close to zero to them.

It was discussed earlier that these two concepts could be conflicting; and they are. On the one hand the innovation would contribute to a healthier society (social requirement) but on the other hand the (financial) risks are high so that public money could be at stake (social responsibility). This is one possible reason for the non-

adoption. These two factors and their conflicting character are in accordance to the Hartmann et al.'s (2008) findings.

For the private domain no theoretical reference point exists (see table 1). The reason is that Hartmann et al.'s (2008) focus was on public instead of private clients. Therefore, the theory applied to the public domain will be used.

Our data gathered indicates that social requirement is not applicable for the private organizations stressed. They might not need to take the benefit of society into consideration when making any kind of decisions. Of course, there are rules, government imposed on them. But for instance in the case of the brick-laying robot its contribution is not achieving a healthier society. In contrast, the brick-laying robot should contribute to fulfill the social responsibilities they have towards their organization and their employees. There are differences, though, in the degree of importance. For example the CEO of NTP Infra found all responsibilities of equal importance. Those include for instance legal aspects related to work circumstances, finance, or safety issues (Interview, NTP Infra, 2008). For the private organization GMB LBS is the social responsibility, financial aspects, of most importance. Striking was that the interviewee found financial aspects more important than safety aspects. This is, as he argues, because "nobody will be charged for working safely but for working unproductively" (Interview, GMB LBS, 2008). This means, before taking the decision to purchase a brick-laying robot, the robot's performance is of utmost importance since it will affect the financial performance of the organization and will weight much more when taking the adoption decision than the safety aspects.

Regarding the possible conflicting character of the two concepts, it can be stated that, since no social requirement has been discovered, there is no conflict at all. Nevertheless, there is a conflict within the social responsibility between financial and health aspects. Private organizations are not including the 'benefit of society' into their mission but are willing to improve safe work circumstances and therefore the overall health conditions of their employees. It might be argued that what for Hartmann et al. (2008) is the conflict between the social requirement and social responsibility within the public domain, is the conflict between the health responsibility towards the employees and the financial responsibility towards the overall organization.

Project-independent knowledge was needed to cover the project-dependent uncertainties of the innovation. For Hartmann et al. (2008) project-dependent uncertainties were such, which are related to the implementation of an innovation and

which had not been thought of in prior to the adoption decision. This is in contrast to our case because the implementation is yet to come. Hence, project-dependent uncertainties are mainly related to the future performance of the brick-laying robot. This holds for both domains. With respect to the performances it was very important to the interviewees how many bricks the robot could lay in a specific time. But in general holds that almost all respondents want a faultlessly working robot. These are uncertainties, since only estimations and speculations can be presented. In Hartmann et al.'s (2008) research the project-independent knowledge was used to cover the uncertainties. Whereas the public organization's interview reveals that they made use of mainly past experiences and networks engaged with road-making activities, private organizations make mostly use of own past experiences only. It seems that many don't look beyond their organizational borders and thus knowledge and experiences from external sources strongly related to the innovation are not taken into consideration. For example the interviewee of GMB LBS stated that they are convinced of their own products and don't need to rely on external products (Interview, GMB LBS, 2008). In contrast, for the public domain the interview showed that they had past experiences with a similar innovation; the adoption decision was already been made but the firm went bankrupt. Therefore, it seems that the past experiences are not used to cover the uncertainties but are in a way nurturing them and making the decision-makers even more skeptic.

In sum, the project-dependent uncertainties could be identified within both domains as well as the project-independent knowledge but the above discussion suggests that the uncertainties cannot be covered by the knowledge. It seems that this is due to the hypothetical character of the uncertainty. In Hartmann et al.'s (2008) research, the uncertainties were exposed. Finally, the overall discussion leads to the conclusion that for both domains, public and private, the Hartmann et al.'s (2008) interplay found between the project-dependent uncertainty and project-independent knowledge cannot be proven true to our case. However, it appears that the public organizations make more use of independent knowledge than their counterparts and thus it appears to be a potential difference factor.

4.1.3 Total Potential Difference Factors

The educational level of decision-makers within local authorities of Rotterdam is in general equal to the decision-makers within the private domain. The interviews indicate that the majority has attended, after finishing basic education, an apprenticeship within the roadmaking branch. The CEO of NTP Infra is an exception, though; he has an

academic background. Compared to the other private organizations, NTP Infra has the most employees (Interview, NTP Infra, 2008). One of the public respondents firstly worked as a bricklayer and then became with this background an employee of the local authorities Rotterdam (Interview, local authorities Rotterdam, 2008). The overall impression suggests that the educational level between the public and private domain is not different. This could be due to the fact that the small private organizations have a handicraft character where everyone is on the job itself and for example less administrative and accounting tasks have to be done compared to larger organizations such as NTP Infra.

With respect to financial budget the interviews proved what was expected by logical argumentation: the public organizations have a public budget whereas the private organizations have a private budget. The interviews reveal that the budgets are treated, regardless their origin of either stemming from taxpaying citizens or from the organizations' profit gained - with respect. For the public domain this respect is rooted in the fact that the money to be spent is not theirs, so they have to be very careful. Striking was that on the one hand no risks are allowed to be related to the innovation but on the other hand it would not matter, of course relatively, how much the innovation would cost. This is in sharp contrast to the private domain, where an efficient use of the own budget is a necessity because the budget is in most cases tight and restricted. Therefore, as the interviews show, are investment decision instruments, such as the payback time, or innovation's performances, in our case mainly costs per square meter, crucial to the decision-makers. A market conform working innovation with no risks at all was for the local authorities Rotterdam highly important (Interview, local authorities Rotterdam, 2008). A market conform working robot, for instance would be a robot, though, which performs at least as good as the market on average. This would mean that the gains and benefits of adopting an innovation would not be derived from the economical sphere of relative advantage. Thus, other factors would be of more relevance. In sum, the interview suggests that the financial budget is a total potential difference factor.

4.2 Difference Factors' Impact on Perceived IC

As discussed earlier in this research and as table 1 reveals did the adopter characteristics have an affect on the innovation adoption without being mediated by the perceived IC. This holds for the adopter characteristics within the categories 'difference factors' and 'total potential difference factors'. In contrast, the potential difference

factors, as identified by Hartmann et al. (2008) are while influencing the innovation adoption process mediated by the perceived IC. The following will on the one hand explore the impact on the perceived IC of those difference factors, the perceived IC has not played a major role yet. On the other hand, the findings on the potential difference factors will be compared to the already identified outcomes of Hartmann et al.'s (2008) work. Finally, it will be presented what relevance each perceived IC might have to the organizations emphasized in both domains.

4.2.1 Difference Factors

Organizational Structure

Firstly, the most important sub-factor derived from the organizational structure was risk-aversion, which is inherent to a more bureaucratic structure found applicable for the public domain. Risk-aversion did influence how decision-makers experienced the perceived innovation characteristics. Being risk-averse would only be an issue when risks are persistent. Imagine, no risks could be identified to the innovation than one could argue that risk-aversion is not nurtured at all. Regarding the brick-laying robot, risks have been identified: these were mainly about performance issues; that it wasn't certain whether the estimated performances could be achieved. With different words, it wasn't certain whether the brick-laying robot would perform better compared to the solution it supersedes. This is known as relative advantage. Therefore, the impact of being risk-averse is here that the innovation would most likely not be adopted when the relative advantage of the innovation is not given. This is in accordance to what the respondents of the local authorities Rotterdam stated only when no risks at all are related to the innovation it would be adopted (Interview, local authorities Rotterdam, 2008).

Organizations within the private domain, in turn, were characterized of being more risk-taking due to their less bureaucratic structure (see section 4.1.1). This was found by the interviews conducted. For them, the relative advantage was also important, but they are not as strict as the public organizations, which would only adopt an innovation when no risks at all are related to the innovation. It might be argued that risk-taking influences the way how innovation characteristics are experienced; when for example the risk exists that the innovation is not having a strong relative advantage, they would still be willing to adopt the innovation.

Organizational Size

For the local authorities Rotterdam it was said that they have a large organizational size. According to the theory, this means that they strive for improving their performances

and processes. The respondents indicated that this would influence how they perceive the innovation characteristics: the new solution should be more effective and efficient compared to the old solution (Interview, local authorities Rotterdam, 2008). Thus, the organizational size has a direct impact on the relative advantage of the innovation.

On the contrary, it was argued earlier that organizations within the private domain would both, be more receptive towards innovations and adopt innovations to improve performances (see section 4.1.1). This has been identified by the interviews conducted. For example in the interview of GMB LBS (2008) the respondent stated that they had invested and would invest in innovations to improve their performances. Again, this is the relative advantage of the innovation to be adopted. Thus, it might be argued that the innovation should better perform, for instance by means of higher productivity rates, compared to the innovation it supersedes. On the contrast, being more receptive towards innovation is not influencing how the innovation is experienced or what requirements it should have. Neither can be stated that by being more receptive towards the innovation would call for a better performance of the innovation or a higher compatibility with the strategic orientation; nor would it demand the innovation to be less complex or more observable. In sum, the sub-factor 'improve performances', which has also been identified for private and small organizations, is influencing the relative advantage of the perceived innovation characteristics; the sub-factor 'receptiveness towards innovations' was not affecting the perceived IC.

Competitive Pressure

The difference factor 'competitive pressure' did not hold for the public domain due to their political context, they are embedded in. Striking was, according to the interview that the absence of competition was in a way enabling the public organization of being risk-averse. This is because they do not need to innovate, basically to stay alive, and as a consequence they are not taking any risks. In our case the risks were related to estimated performance issues, and as discussed above, the impact would be on the perceived innovation characteristics, particularly, in our case, on relative advantage. Hence, it can be argued that the absence of competitive pressure is enabling risk-aversion within the public domain and it would have the same impact on perceived IC as for the organizational structure, which has the same sub-factor: risk-aversion.

Private organizations are in a highly competitive situation, which will basically force organizations towards innovation adoption (see section 4.1.1). Due to the fact of competition the innovation to be adopted should be competitive. The respondent of NTP Infra (2008) stated that the brick-laying robot should be competitive regarding the

quantity of bricks, the robot can lay within a specific period of time. The competitive pressure forces the organizations to think more competitive and therefore influences how the relative advantage of the innovation is experienced.

Decision-making

As argued earlier was the decision-making for public organizations characterized in general by smoothness and less conflicts. What could the decision-making have for an impact on the perceived IC? The interview indicates that there is an impact: interviewees stated that they only provide information to a third-party who is actually taking the adoption decision. Therefore, they attempt to provide such information that is reasonable and would actually convince the decision-maker. This would mean that the innovation should meet a lot of criteria and therefore decision-making is influencing how the innovation is experienced. Mainly relative advantage and compatibility as well as complexity would be of most relevance.

For the private domain, in turn, a weak influence of decision-making has been identified on the perceived IC. Actually, the impact differs between small and large organizations. For the latter, managers make the adoption decision, after consulting the CEO and therefore, they try to provide information, which would make the decision more likely (Interview, NTP Infra, 2008). Therefore, decision-making is influencing how the innovation is perceived. Any issue is important, as long as it is providing positive information, which makes the adoption decision more likely. For small organizations hold, though, that managers do not provide information to the CEO or other decision-making unit; rather the CEO itself seeks the information and therefore decision-making, in particular the issue of providing information, is not influencing how the innovation is perceived.

4.2.2 Potential Difference Factors

Social Requirement vs. Social Responsibility

According to Hartmann et al. (2008) the interplay of the conflicting factors social requirement versus social responsibility is mediated by the relative advantage, compatibility and observability. They state that the innovation to be adopted should be "(...) better able to contribute to politically and publicly important issues and objectives (relative advantage) which are expressed in the overall strategic orientation of the organization (compatibility)." The observability of the innovation was relevant since it enables to evaluate the relative advantage of the innovation. The social requirements and the social responsibility of the local authorities Rotterdam demands exactly for the

above mentioned: the innovation should have a relative advantage, which includes that it should stress better work circumstances and better productivity rates to ensure a healthier society and an efficient use of the public budget, that is a main part of their strategic orientation (compatibility). The observability has not been identified by the interview conducted for the public domain (Interview, local authorities Rotterdam, 2008).

For the private domain was said that they don't have a social requirement and that their social responsibility was mainly related to financial aspects, and then to safety-aspects. In order to fulfill their responsibilities they have requirements concerning the innovation. Hence, their requirements are influencing how they experience the innovation: mainly the relative advantage was affected since the innovation should from a financial point of view better perform than the traditional solution. Secondly, it should better stress the safety aspects compared to the solution it supersedes.

Project-independent Knowledge vs. Project-dependent Uncertainty

With respect to the project-dependent uncertainties and the project-independent knowledge it might be stated that the project-independent knowledge could not be used to cover the project-dependent uncertainties. This holds for the private organizations emphasized because they make use of internal past experiences knowledge only. This is not enough knowledge to overcome the uncertainties related to the innovation since the past knowledge has less in common with the innovation to be adopted. For the public domain was found that the knowledge was insufficient due to the hypothetical character of the uncertainty (see section 4.1.2). The impact project-independent knowledge on the perceived IC would be for both domains. For private organizations would be the impact on those factors, which the traditional solution lacks. This could be any perceived IC; according to the interviews, though, again the impact would be most on relative advantage. In contrast, the impact for public organizations would be stronger, because they made use of networks as well as past experiences from which many requirements regarding the innovation could emerge. Moreover would the requirements be more in detail and hence harder to meet in contrast to the private domain. Thus, the use of project-independent knowledge is influencing how the innovation is experienced; let it be the relative advantage, complexity, trialability, compatibility or the observability. In addition, by making use of project-independent knowledge the probability might be higher within the public domain that more perceived IC are affected and that that the perceived innovation characteristics are specified in more detail, which makes it harder to meet these requirements, compared to the private domain. For example, whereas

within the private domain one would argue that the innovation should be able to lay more bricks each day compared to the traditional solution, within the public domain one would require the innovation to be 75% more productive.

4.2.3 Total Potential Difference Factors

Educational Level

For the total potential difference factor educational level no impact on the perceived IC has been found for both domains. Not only had the decision-makers an equal background, but also had the users of the innovation. Therefore, the impact of the educational level of the users might be that the innovation should be less complex. However, this does not emerge from the low or high educational level of the decision-makers. The interviews did not reveal better insights into this issue but generally it cannot be stated that it has no impact on the perceived IC.

Financial Budget

From the discussion of the difference factors relevance it could be stated regarding the total potential difference factor that although private organizations have a private budget and public organizations have a public budget the impact on perceived IC would generally be the same: the innovation should economically perform better than the solution it supersedes. For the public domain, though, was said earlier that they want a robot that is working at least as good as the market. The market is getting more productive by means of the introduction of new solutions but therefore, it cannot be argued from the interview that this is the most important issue for them. Thus, it seems that the benefits and gains of adopting an innovation would not only be derived from the economical sphere (i.e. productivity rates etc.) of relative advantage. This means that other issues are of (more) relevance. This could be for example the risks, which are related to the innovation. In contrast, for the private organizations was found a direct influence of the strict and tight budget on how they perceive IC: the innovation should perform better concerning for example productivity rates to gain even more profits compared to the traditional situation.

Another striking impact has been identified. The interviews conducted within both domains indicate that the private organizations attached a lot of importance to the payback time. Whereas the private organizations found a payback time of 2-5 years appropriate, the local authorities Rotterdam did not find a short payback time of relevance. Rather, the payback time did not matter at all; it could be 8 years or even 10 years. A payback time of 2-5 years would mean that after this period of time the results

of the innovation should not only be hypothetical but perceived facts. This is actually different from what Rogers (1995) identifies as observability because in our case the degree in how far the results are visible to others does not matter but that they *are* visible by means of facts. Therefore, for the private domain the strict and tight budget would mean that this is influencing how they experience observability: a shorter payback time, or with different words a shorter period of uncertainties and risks. Hence, not the more the results are visible to others, but the shorter the period of time that the results are only hypothetically visible, might be positively related to the likeliness of adoption. With respect to the public domain, one might argue that the public budget is affecting how they perceive the observability of the innovation, too. Thus, it might be argued that a longer payback time and therefore less observability, is related to a public budget.

4.2.4 Innovation Characteristics' Relevance

In addition, the interviews were used to gain an understanding of the responder's importance of the innovation characteristics, as defined by Rogers (1995). The following table shows the outcomes for the public and the private domain.

Table 2: Results on Innovation Characteristics' Relevance

	Public Domain (n=1)	Private Domain (n=4)
Relative advantage (economic sphere)	1	1
Relative advantage (social sphere)	2	2
Compatibility	5	6
Trialability	3	5
Observability	4	4
Complexity	6	3

Within both domains respondents stated that relative advantage is of most importance to them. Complexity and observability are perceived as the third important IC for the private respectively the public domain. Striking is that both respondents in both domains find observability as fourth most important. Striking is that compatibility is in both domains not very important.

4.3 Impact on Consideration Sub-stage vs. Adoption Decision Stage

When the respondents were asked repetitively throughout the interviews whether their specific perception of the innovation are relevant for affecting their interest in the innovation or affecting their adoption decision, all 'private' respondents agreed upon

that getting interested in an innovation and taking the actual adoption decision are closely related to each other. For public organizations, though, it is different: here respondents make a distinct difference between getting interested into an innovation and actually purchasing it. They state that the reason is that they are not investing risk-bearing capital since the capital owes society. Furthermore, they would only invest in an innovation when it has proven faultless and steady performances for a period of about 3-6 months. With different words, one could say that they are not, according to Rogers (1995, p.262), belonging to the category innovators or early adopters, which are the first and the second to adopt innovations. A period of 3-6 months would fit the category early majority or late majority. This is in accordance to what has already been stressed in the previous discussion on difference factors' relevance and their impact on the perceived IC.

Such difference factors are affecting the individual's investment decision, which are highly related to risks. For example when comparing the organizational structure of both domains with each other it might be concluded from the earlier discussion of the difference factors' relevance that being risk-averse is slowing down the innovation adoption process. Until, as the data suggests, the risks are reduced or abandoned at all, the decision-makers persist at the consideration sub-stage. In contrast, being willing to take risks, which comes with a less bureaucratic structure, as identified for the private domain, is fostering or even speeding up the adoption decision process. This might be one reason for not persisting at the consideration sub-stage or even for not perceiving any difference between this stage and the adoption decision stage.

The lack of competitive pressure has also been found as enabling the local authorities Rotterdam of being more risk-averse and thus this can be seen as an obstacle with a smooth adoption decision process and only getting interested into an innovation.

The financial aspect of social responsibility, in our case, bears financial risks, and finally the project-independent knowledge used by the local authorities Rotterdam enabled them to discover more potential risks. Thus, both aspects might be considered as being obstacles within the adoption decision process and might let the decision-maker persist at the consideration sub-stage.

For the private domain the discussion suggests that organizational structure, as said above, might speed up the decision-making process and might be the reason for perceiving the consideration sub-stage closely related to the adoption decision stage. The same holds for competitive pressure and the project-independent knowledge used. Competitive pressure might force the decision-maker to take more risks and the project-

independent knowledge, which has not been used extensively, hinders the exploration of potential risks related to the innovation to be adopted.

6. Conclusion

The main research question this research attempted to answer and at least shed more light on was: *what are relevant adopter characteristic differences between the public and private domain within the roadmaking sector in the Netherlands and in how far are they influencing the way innovation characteristics are perceived and what impact do they have on the adoption decision process?*

The main research will be stressed by answering the three sub questions.

Sub-research question 1: What are relevant adopter characteristic differences between the public and private domain that might affect the perceived innovation characteristics?

This data analysis suggests that three difference factors have been identified as holding a clear distinction from the other domain (organizational structure, competitive pressure and financial budget), four difference factors are holding a semi distinction from the other domain (organizational size, social requirement versus social responsibility, project-independent knowledge versus project-dependent uncertainty and decision-making) and one factor has been identified as a not relevant difference factor between the public and private domain (educational level).

A clear distinction means that the difference factors have been found by means of the interviews for both domains. It might be indicated that risk plays a major role within the public domain. Two of the key difference factors identified foster that risk becomes an issue within the organization. The general risk aversion is stemming from the bureaucratic organizational structure. Furthermore, a lack of competitive pressure has found as a factor that might enable the organization of being risk-averse, since innovation adoption is not compelling (to stay alive).

We ascribed the factors organizational size, social requirement versus social responsibility, project-independent knowledge versus project-dependent uncertainty, and decision-making to the semi distinction category because they are not clear difference factors but hold a high potential of being so.

With respect to the organizational size the discussion suggests that a large organizational size has been found for the public domain, a small size for the private

domain. This cannot be generalized because in different sectors the private organizations might be much bigger than their counterparts and vice versa. Moreover, for the private domain both sub-factors 'receptiveness towards innovation' and 'enhance performances' were applicable. This means that the size could not clearly be ascribed to either domain.

Social requirement has not been identified at all within the private domain, which means that theory as Hartmann et al. (2008) found for the public domain, cannot be applied to the private domain. Since it is not applicable to the private domain it suggests that this is a difference factor, but with a semi distinction because social responsibility has been identified within the private domain.

Project-independent knowledge versus project-dependent uncertainty might on the first glance not hold a difference between the public and private domain, since this factor might be applied to the private domain, too. However, the outcome is actually different: the use of project-independent knowledge was different and has led to differences. For the public domain independent knowledge was a risk enabler, because by consulting different sources about the innovation to be adopted, this might enhance the possibility that more risks are discovered. Private organizations, in turn, make less use of independent knowledge, and therefore is the likeliness of exploring risks also less.

Finally decision-making holds semi distinction; for the public domain the theory could not be applied. Due to that the private domain was in accordance to the theory it holds a semi distinction.

Educational level has been identified as a not relevant difference factor, because no clear distinction could be made between the public and private domain. The discussion suggests a variety of educational background among decision-makers within any organization. Due to the variety within many organizations, one would have to polarize, in order to come to the conclusion that for example the public domain has in general a higher educational level than their private counterparts. By means of this research this cannot be argued.

Sub-research question 2: What might be the impact of the adopter characteristic differences on the perceived innovation characteristics?

The discussion of this research topic reveals different impact issues. On the one hand a direct influence on one, more or all perceived ICs had been identified. On the other hand, though, the difference factors' impact was affecting *the degree in how far the perceived ICs are relevant to them*. Table 3 reveals the major findings.

In total it can be stated that the relative advantage of the innovation is crucial for the decision-makers of both domains. This comes forth from the fact that 3 of 8 difference factors emphasized hold an influence on relative advantage within the public domain. For the private domain 4 of 8 are influencing relative advantage. In addition, within both domains 2 of 8 difference factors have an influence on all perceived IC. It has also been found that relative advantage is the most important factor for both domains. Therefore, it might be argued that when all ICs are affected, relative advantage plays a key role for both domains (see table 3).

The public domain has been identified as being bureaucratically structured, which enables risk-aversion. It might be argued that the risk-aversion has a general impact on perceived IC: it is enhancing the degree of importance of the perceived ICs. This means that in case the innovation should have exact and higher productivity rates than the traditional solution, these requirements are highly important. So important that it might be impossible to convince them of adopting the innovation when the risk persists that it does not meet the specific requirements formulated. In different words, risk is making the IC experienced more important. In contrast, for the private domain holds, due to a more flexible structure that they are risk-takers and therefore, this is weakening the degree of importance of the perceived ICs. Even when the innovation bears risks, it might be more likely that it will be adopted.

In addition, the data collected and the followed discussion reveal distinct difference factors and their distinct impact on the perceived ICs. It should be kept in mind that to come to a successful innovation adoption all factors and their impact should be taken into consideration since many factors are interdependent.

Table 3: Impact on Perceived Innovation Characteristics

Domain → Difference Factor ↓	Public	Private
Organizational Structure	Enhancing perceived IC's degree of importance	Weakening perceived IC's degree of importance
Organizational Size	Relative Advantage	Relative Advantage
Competitive Pressure	Enhancing perceived IC's degree of importance	Relative Advantage
Decision-Making	On all perceived IC	Large org: on all perceived IC Small org: no impact
Social Requirement vs. Social Responsibility	Relative Advantage, Compatibility	Relative Advantage

Project-independent Knowledge vs. Project-dependent Uncertainty	On all perceived IC	On all perceived IC
Educational Level	Complexity	Complexity
Financial Budget	Relative Advantage, Observability	Relative Advantage, Observability

Sub-research question 3: Might adopter characteristic differences and perceived innovation characteristics have an influence on the adoption decision stage or is the impact mediated by the consideration sub-stage?

First of all, no relevant data has been found by means of the interviews regarding the perceived innovation characteristics' impact on the innovation adoption process. Therefore, emphasize is placed on the adopter characteristics' impact. Nevertheless, it was argued that the adopter characteristics' impact is mediated by the perceived ICs, which means that they have a certain impact.

With respect to the difference between the consideration sub-stage and the adoption decision stage the discussion of this research suggests that the impact between the public and private domain is different.

For the private domain holds that the difference factor's impact on both, the consideration sub-stage and the adoption decision stage is the same because the private organizations stressed perceived them as closely related to each other. In contrast, for the public domain might be argued that the difference factors are firstly influencing the consideration sub-stage before influencing the adoption decision stage.

Again, whereas this research suggests that for the private domain the consideration sub-stage is not relevant and a dichotomous view of adoption/non-adoption can be used, for the public organizations the consideration sub-stage might gain a right to exist. The most striking finding is that risk-enabling factors might be a determinant for persisting at the consideration sub-stage and not progressing to the adoption decision stage. As already stated are the organizational size, competitive pressure and the use of project-dependent knowledge risk-enablers and might therefore bear possible obstacles not letting the innovation adoption process progress smoothly to the adoption decision stage. Only when no risks are related to the innovation, the way is clear to come to the adoption decision stage.

In sum, potential determinants have been identified that might let the decision to adopt an innovation persist at the consideration sub-stage. They might persist there as long as

risks are related to the innovation. Of course, there might always be a tiny but distinct degree of risks, which cannot be abandoned. The interviews conducted suggest, though, that no risks at all should be related to the innovation. Therefore, the innovation had to prove steady performances over a certain period of time in order to be perceived as riskless. This holds for public organizations only.

For the private domain might be argued that they don't persist at the consideration sub-stage because they are not characterized by factors enabling risk. Rather, the organizational structure might be seen as speeding up the innovation adoption process, which might be a plausible explanation for treating the consideration sub-stage and the adoption decision stage the same.

Future Research

This research provides many opportunities for future research. In general this research attempted to make a clear distinction between the public and private domain, and their adopter characteristics differences' impact on the perceived IC and the innovation adoption process. Only one public organization has been used to come up with findings for the public domain. Therefore, more public organizations have to be stressed. The main fields of future research are:

With respect to sub-research question 1 future research should verify the difference factors found; research should focus on whether the semi distinction is justified or whether can be considered as clear difference factors; although educational level has been abandoned of being a difference factor, future research should stress this more.

With respect to sub-research question 2 future researches should more emphasize in how far organizational structure is enhancing and weakening the degree of perceived ICs' importance. Furthermore, it was found that relative advantage is mostly influenced. Maybe other innovation characteristics can be identified by other research. Finally, it appears that risk is playing a high role within the public domain and is moreover an important issue within the perceived IC's realm. Future research might stress the importance of risk more and methods to reduce their perceived risks.

Regarding sub-research question 3 future research should of course verify the findings of this research and in addition should mainly place emphasize on further determinants that are hindering or speeding up the adoption decision process. It would be very interesting to find out whether other determinant factors exist that let the decision-maker persist at a stage.

Part 2

1. Introduction

1.1 The Brick-laying Robot (BLR)

In brief is VHTech's BLR innovated for the application within the roadmaking branch⁵ aiming at the automation of work processes. It is a mobile device with an onboard computer allowing it to fully operate on its own. Equipped with a hydraulic robot arm and a vacuum based gripper it is able to grip a number of bricks, which are loaded onto the robot in advance, and lays the bricks precisely stone by stone in any pattern desired. Furthermore, it is uncertain by now, where the robot will operate, either on the sand or on the just laid bricks. In case the BLR is operating on the sand, it is the idea to pull the sand, on which the rubber tracks can be seen after the BLR rood over, even again. This is why the BLR is equipped with a flexible plank in front of the vehicle. When the BLR is operating on the just laid bricks, though, the plank would be redundant and the robot has to be constructed in a way, when displacing it, the heavy weight of the BLR combined with its rubber tracks are not causing the just laid bricks to sway. This, for instance, is an issue that has to be tested be means of a prototype.

However, to realize such a fully automated robot, highly innovative but still existing technologies are bundled into one entity. To get a better understanding of what the BLR is, the following table shows basic features of the robot.

Table 4: Basic BLR Features

Category	BLR
Machine form	Robot on rubber tracks
Application	Paving
Work mode	Automation
<i>Machine dependence</i>	
Dependence on other machines	Independent
Dependence on workforce	1 man (operator)
<i>Machine functions</i>	
Features	Paving bricks automatically in pattern required
Pallet requirements	Bricks can be loaded onto robot unsorted but piled
Patterns	Herringbone or other bond required

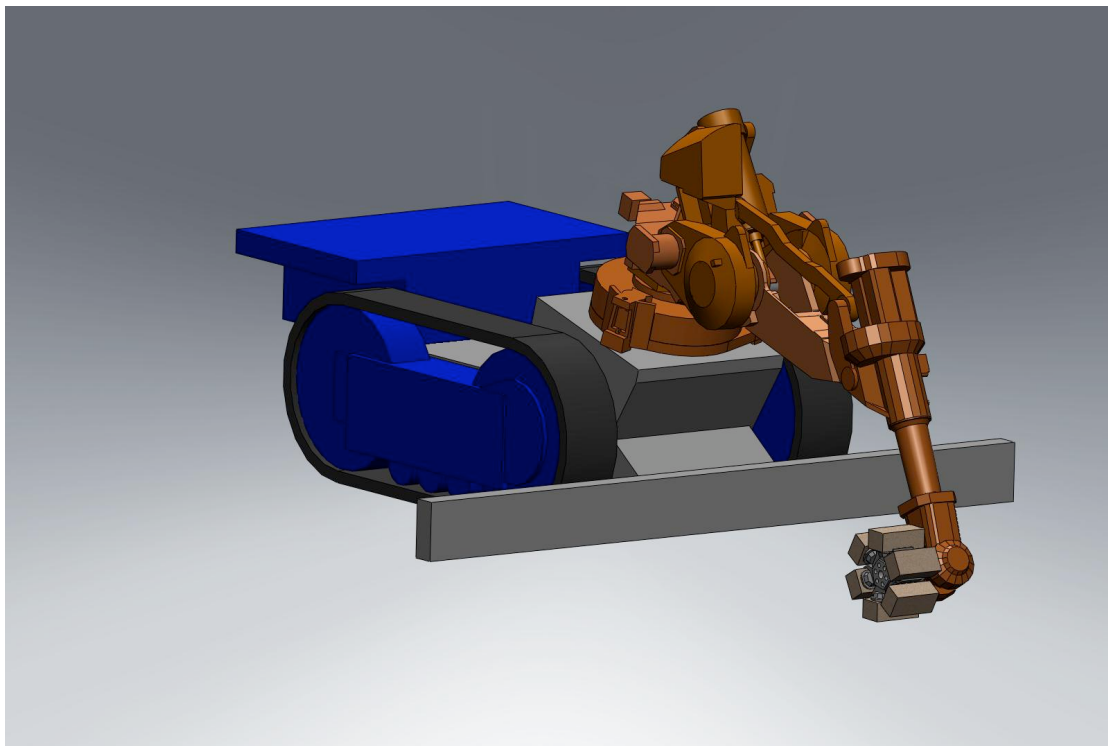
⁵ Roadmaking is used which suggests different kind of fields, such as asphaltting or paving. With roadmaking, which will be used throughout the report only paving is suggested.

<i>Capacity (brick dimension 210x70x80)</i>	
Load capacity (bricks)	720
Lay capacity (bricks)	1 (6 on gripper)
m ² /hour	18,75
m ² /day (8h)	150
Costs (€)	160.000

Source: VHTech

Visually, the BLR only exists on a picture by now, made by means of the engineering program 'autocat'. This means that the final development of the robot is still in progress and that desired specifications can be applied any time. The following picture reflects how the BLR should look like in the near future.

Picture 1: VHTech's BLR



Source: VHTech

2. Analysis

2.1 VHTech's Environment

The organization's environment plays a key role in determining the likeliness of the distribution possibilities of the BLR since it comprises factors, which are affecting the organization, the BLR and the thus the distribution itself. Following the external environment model, according to Draft (2006), the organization's environment can be distinguished into three aspects: the internal environment, the task environment and the general environment. Whereas the internal environment includes elements within the organization's boundaries, the task environment and the general environment affects the organization indirectly respectively directly. In addition, from the organization's perspective both the task and the general environment hold in general uncontrollable forces; whereby the forces within the task environment are more open to affection. The most relevant factors constitute for the general and task environment will be stressed.

2.1.1 The Roadmaking Branch in Digits

In the Netherlands the general code for the construction sector is 45; in particular the code for the roadmaking branch is 45232. Throughout the last years this branch underwent a heavy increase of new start-ups. Whereas in 2004 organizations engaged in roadmaking activities accounted for almost 2.200 (van der Valk, 2005), in 2007 3.295⁶ were registered in the Dutch commercial register and in 2008 the registrations of economic active organizations amounts 3.654⁷.

Of this total amount autonomous companies without employees (Dutch: ZZP-ers) have the biggest fraction; they constitute for about 2.500 registrations in 2008. Companies with 2-9 employees have a total stake of 958. The small and middle enterprises (SME), consisting of 10-100 employees, constitute for 142 of the total amount and companies above 100 employees are not registered in 2008⁸. The heavy increase is mainly due to stimuli of governmental policies aiming at fostering entrepreneurship since 2004 (EIM, 2008, p.54) and hence many ZZP-ers started business.

Estimated revenues gained accounted for about 556 million, exclusive VAT, in 2004. Half of the organizations gained revenues less than 50.000€ and 11% gained revenues of 500.000€ and more (van der Valk, 2005). Again, this can be traced back to the fact of

⁶ http://www.kvk.nl:80/Branches//branche_stats.asp?bik=45232&brBranche=Statenmaken&Type=Cijfers

⁷ http://www.kvk.nl:80/Branches//branche_stats.asp?bik=45232&brBranche=Statenmaken&Type=Cijfers

⁸ <http://www.kvk.nl:80/handelsregister/zoekenframeset.asp?url=https://server.db.kvk.nl/ia&zk=0>

the huge fraction of ZZP-ers within this branch. Although no specific digits on revenues for the roadmaking branch exist for 2005 and the years to come it can be argued, due to its integration and strong relation to the ground, road and water construction segment, that the segment is representative for making estimations about the revenues gained within the roadmaking branch until 2008. From 2004 onwards the revenues made in the ground, road and water construction segment annually increased as table 5 reveals by 8,2% in 2005; 11,5% in 2006; 6,9% in 2007 and an estimated 6,9% for the third quarter of 2008. In sum, the roadmaking branch is still growing by more than 7% in revenues annually. Striking is that about 90% of the revenues produced can be ascribed to organizations with more than 10 employees.

But not only revenues have increased during the years; with respect to new organizations and mainly ZZP-ers, which started business competition has become fierce.

Table 5: Revenue Development within Ground, Road and Water Construction Segment

Periods	Organizational Size	Revenue	Revenue development
2004	Total organizations	102	4,90%
2004	More than 10 employees	100	4,90%
2005	Total organizations	111	8,20%
2005	More than 10 employees	108	8,10%
2006	Total organizations	123	11,50%
2006	More than 10 employees	120	10,70%
2007	Total organizations	132	6,90%
2007	More than 10 employees	127	6,20%
2008 3 rd quarter*	Total organizations	133	6,90%
2008 3 rd quarter*	More than 10 employees	128	6,50%
* estimated		2000=100	

Source: Dutch institute for statistics (www.cbs.nl)

2.1.2 Socio-cultural

The first striking issue is that the roadmaking branch is aging to a huge extent, which inherently means a continuous lost of craftsmanship (Crow, 2007). This fact combined with above averaged outfall percentage (Arbouw journaal, 2008), which are mainly

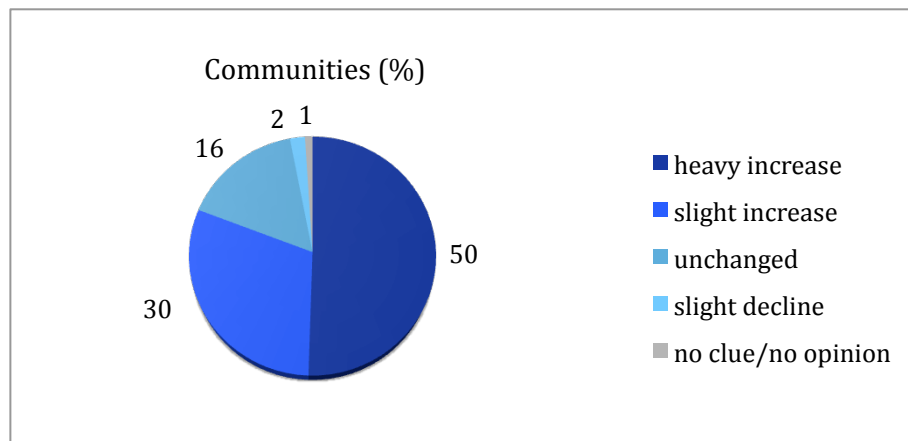
caused by hard physical work circumstances, lets us assume that the branch is shrinking.

With respect to mechanical roadmaking recent research reveals that about 3% of the roadmaking work is carried out by means of machines. The reasons are sought in the diversity of the branch: many employers; a lot of roadmaking elements that are processed by many thousand road makers, employed at a couple of hundred, in general small, organizations (Crow, 2007). Alternative research argues that 10-15% of the projects in the roadmaking branch are carried out with the support of machines (Busker and Ridderhof, 2008). Despite this reason of diversity the percentages elicit indication of the reluctance of this branch when it comes to investment decisions regarding innovations.

In general the investment climate can be characterized by 'if necessary'. ZZP-ers made fewer investments in new machines and products compared to other organizations within the branch. This may simply be explained by lesser revenues, which provide organizations with a financial precondition in order to wave investment costs of couple of thousands Euros. Many of those who are financially able to make such investments in innovations are reluctant to do so. The reason is that the roadmaking branch is a traditional handicraft and any investments in innovations would mean a change in work processes and the way issues are handled or executed. In sum, the traditional handicraft is deeply anchored into this branch and this causes reluctance of investments in innovations.

Another social-cultural issue is, according to a poll conducted on a symposium in 2006 that the need for automation machines within the roadmaking branch is highly increasing. In total 84% of the respondents wanted to put automation on their agenda (Straategie Techniek, 2006). A much clearer view is presented by research conducted among communities who commission projects and their clients in 2008. The results were that about 80% of the communities estimate an increase of automation projects for the upcoming three years; for clients the percentage is even higher, 87% think so (Busker and Ridderhof, 2008). In figure 7 and figure 8 the findings are presented in more detail.

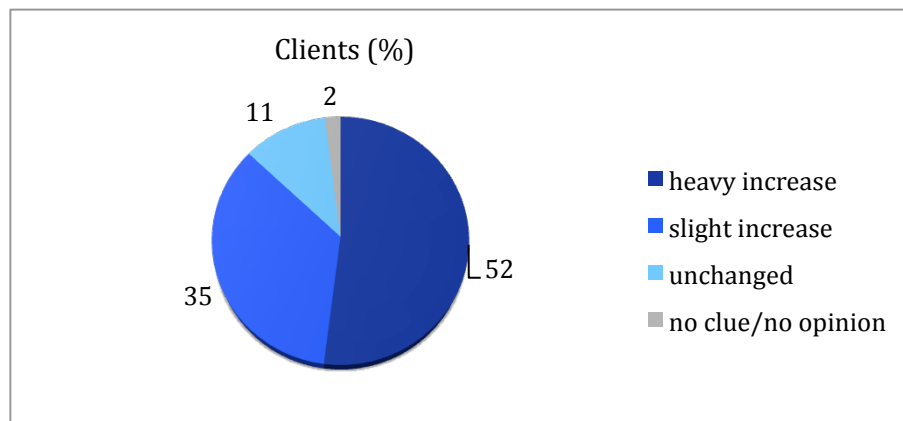
Figure 7: Development Fraction of Automation for Upcoming 3 Years



Source: Busker and Ridderhof, 2008

In spite of the persisting traditional perception of many craftsmen, the branch moves on, a bunch of innovations have been introduced and hence automation has been made possible. Therefore politicians postulate securer work circumstances based on the emergence of innovations and introduced a new agreement between the Dutch labor inspection, branch organizations and associations.

Figure 8: Development Fraction of Automation for Upcoming 3 Years II



Source: Busker and Ridderhof, 2008

2.1.3 Legal/Political

Due to traditional work methods in the roadmaking branch the work of roadworkers have always been characterized by hard physical work. This expresses itself in work related risks comprising complaints of posture and body movement. In particular roadworkers suffer from backaches, injuries at arm, neck and shoulders, which inevitably entails absence of illness and long-term stoppages. The Dutch labor inspection defined the most relevant work related risks within the roadmaking branch

on basis of accident facts, facts regarding complaints caused by the particular work, influx into the Dutch Disablement of Insurance Act (WAO) and labor inspection's estimations of risks. The five most relevant work related risks are:

- Physical overload
- Vibrations
- Exposure to quartz materials
- Sound
- Collide threat

Physical overload is articulated as the most relevant to prevent. These work related risks accompanied by the emergence of innovations aiming at the relief of the roadworker in the first place created the basis for an agreement between the Dutch labor inspection, branch organizations and associations (Arbeidsinspectie, 2007). The agreement was about the constitution of norms used as reference point (for inspections) and starting point for initializing automation in the still conservative roadmaking branch.

The lift norm

In the manual situation it is not allowed to process road materials (bricks) that are heavier than 4kg. In case the road material is heavier than this norm mechanic support is required. Moreover it is not allowed to lift 'burdens' that are heavier than 25kg per person and 50kg twosome. Finally mechanic support is required in the case tiles lifted by one road worker is heavier than 9,5kg.

The surface norm

This holds that new projects commissioned with a *connected* surface of 1500m² or bigger have always to be processed mechanically. An exception is only possible if it can be proofed that application of machines is impossible for the specific project.

Whereas the lift norm is apparently established to prevent direct injuries related to repetitive physical heavy work, the surface norm not only holds the prevention aspect but also pushes the branch towards mechanical roadmaking. At this point it is unclear in how far the Dutch labor inspection will tighten the lift and surface norm, which will mainly be affected by compliance with the norms agreed upon.

2.1.4 Economics

Europe's economies are running into a recession in 2008, which is strongly enforced by the credit crisis. This means that business activities are declining and few projects will be commissioned due to stagnating and decreasing revenues; a lack of investment power is the cause. The roadmaking branch is highly dependent on the construction sector since only when new constructions are completed, new roads are needed. The contracts for the construction sector are still going and thus there will be enough work for the upcoming year for the roadmaking branch. After projects are completed the recession is hitting the construction sector and similarly the roadmaking branch. The cause would be fewer revenues, reluctant investment decisions and an increase in unemployment.

2.1.5 Competition

Another relevant aspect of the environment VHTech is embedded in is competition. Competition in this sense is not meant as competition among potential customers (i.e. roadmakers) of VHTech but as organizations that have introduced similar products, which are potential competitors of the BLR. By means of Porter's 5 Competitive Forces Model (Porter, 1979) the competitive situation of VHTech and the BLR will be analyzed in order to get a clearer view about the likeliness of distribution possibilities within the roadmaking branch. Besides, direct competitors' products and its competitiveness will be stressed in more detail.

Force 1: Threat of New Entrants

Generally speaking new entrants have easy access to the roadmaking branch with innovations emphasizing mechanical roadmaking and automation since first of all there are only a couple of organizations serving the branch. In addition, the roadmaking activities that can be processed mechanically are divers. This comes mainly forth from the fact that there are different kinds of bricks, which differ in size and weight, and work tasks, mainly paving and re-paving. Hence many solutions can be innovated to serve the right field. As indicated earlier a tiny fraction of 10-15% within the roadmaking branch are making use of machines. Accordingly the rest of the branch, 85-90%, has not been served yet with mechanical support. This is mainly due to the conservative attitude of the branch and due to the existence of many ZZP-ers, which are unable to make big investments. One could argue as well that an appropriate machine that meets the needs of the customers precisely has not been innovated yet.

Speaking about 'supporting machines' different kinds can be distinguished. First of all there are whole machines, such as the Sijnja Street Designer⁹ and there are mechanic tools, such as divers clamps¹⁰ used for different kind of bricks. The Sijnja Street Designer is moreover applicable for re-paving projects since old bricks can easily be bashed in the back of the machine, which sorts them precisely in an intended pattern that they can be used again. In contrast, clamps require a given pattern delivered in pallets. Both products substitute (sub-) processes of the paver. In both cases an equivalent amount of two workers are needed to process the bricks compared to the manual situation. Anyway, both solutions can be considered as competitive products of VHTech's BLR.

The diversity of application possibilities of supporting machines and the fact that a small fraction has been served yet, give direction to assume that the roadmaking branch can easily be penetrated.

Another factor enforcing the easy access is less economies of scale. Actually, economies of scale are only evident for clamps, which are manufactured by different kind of, mainly internationally operating, organizations such as Hunklinger¹¹. With respect to the whole machines, though, they are at a very early development stage; only prototypes, such as the Sijnja Street Designer¹² have reached the market so far and competitors attempt to push those towards economies of scale. Less economies of scale – by the way in products not directly comparable to VHTech's BLR – are easing the market access; the pure presence of machines directly related to VHTech's BLR can be seen as an obstacle for penetrating the branch.

The roadmaking branch is so sensitive and conservative towards innovations that new machines can hardly profile themselves. ROBOSTREET B.V. is the most recent example of a failure that missed to meet the needs of the pavers. The paving machine Streetwise 1200 was focused of being accurate, safe, fast and cost- effective¹³, but was to most of the relevant organizations (even excluding ZZP-ers) not affordable. The inventors missed to take a closer look at the primary work process and thus did not encounter problems prior to the prototype, which were so devastating that the Streetwise 1200 did not reach the assembly line and could not be introduced to the market. The accompanied bankruptcy of ROBOSTREET B.V.¹⁴ makes clear that fundamental research

⁹ www.kramp.com/info/uploads/media/KIT_03_2008NLweb_02.pdf

¹⁰ http://www.hunklinger.com/cms/front_content.php?changelang=3

¹¹ <http://www.hunklinger.com/>

¹² www.kramp.com/info/uploads/media/KIT_03_2008NLweb_02.pdf

¹³ <http://www.controltechniques.com/CTcom/pdf/RoboStreet.pdf>

¹⁴ http://www.curatoren.nl/fo/verslag_faillprofiel.php?id=98115

of the branch and primary work processes of pavers are of utmost importance to come to a good working prototype and to meet the needs of the potential customers.

In sum, when VHTech is taking these issues into consideration for the manufacturing and creation of the BLR, it can be argued that the barriers to entry the market are less.

Force 2: Threat of Substitutes

When talking about potential substitutes it can be stated that due to the specific characteristics of the BLR, mainly automating the work process of paving and therefore displacing the work of two pavers, no direct threat of substitutes exists. This is enforced by the fact that with VHTech's BLR the paver's work process is completely automated (like Streetwise 1200), which means that the costs can be reduced. This is in contrast to other solutions discovered so far where work tasks are changed instead of displaced and costs are equal.

Estimated costs of potential substitutes range from 20.000€ for a clamp, which can only be used in combination with an expensive vehicle, to 150.000 - 200.000€ for a whole machine such as the Streetwise 1200 or Sijnja Street Designer. The estimated costs of VHTech's BLR are 160.000€, exclusive VAT (see section 3.3 for more detailed information about the costs). The performance of competitor's products is outlined in table 6. It reveals that the performances of the different products in terms of m²/hour are similar. Compared to VHTech's BLR the competitor's m²/hour indicate a slightly better performance (see section 3.2 and 1.1 for BLR's performance). Nota bene that the information are stemming from journals and websites, where the machines are promoted and perhaps are not kept in perspective. Both, the Sijnja Street Designer and the Hunklinger (P01) have a huge disadvantage compared to VHTech's BLR: dependence on 2 men, which drives costs high instead of down. The products attempt to balance this shortcoming by claiming higher productivity rates (both Sijnja Street Designer and Hunklinger (P01)) and low investment costs (only Hunklinger (P01)). What both products are incapable of, which was the starting point of the Streetwise 1200, is to go one leap further and to automate the work process instead of supporting it. Fully automated robots give direction for the future and VHTech's BLR meets this criterion and is hence capable of substituting two men, being more productive than in the traditional situation and additionally investments costs are less compared to similar products, particularly Streetwise 1200 and Sijnja Street Designer.

Hence, when comparing the investment costs and performances of the different products, and by taking the work nature into consideration, VHTech's BLR is accurately positioned when it comes to whole machines and the threat of substitutes is little.

Table 6: Benchmark of Competitor's Products

Category	Sijnja Street Designer	Hunklinger (P01)	Streetwise 1200
Machine form	Machine on rubber tracks	Clamp	Machine on rubber tracks
Application	Paving and re-paving	Paving	Paving
Work nature	Semi-automation	Manual	Automation
<i>Machine dependence</i>			
Dependence on other machines	Independent	Only in combination with a shovel	Independent
Dependence on workforce	2 men (bricklayer and assistant)	2 men (bricklayer and assistant)	1 man (operator)
<i>Machine functions</i>			
Features	Sorting bricks in patterns, paving bricks with clamp	Laying bricks with clamp	Paving bricks automatically in pattern required
Pallet requirements	Bricks can be put into machine unsorted	Pallets with pre-formed bricks	Bricks can be put into machine unsorted
Patterns	Running bond, herringbone	Running bond, herringbone	Herringbone or other bond required
<i>Capacity (brick dimension 200/225x100x60/120)</i>			
Load capacity	Continuous load possible	42	240
Lay capacity	42	42	2
m ² /hour	20/30	30*	30
m ² /day (8h)	160/240	240*	240
Costs (€)	180.000€*	20.000€*	200.000€*

*estimated

Source: www.controltechniques.com/CTcom/pdf/RoboStreet.pdf; www.hunklinger.com; www.sijnjakonstruktie.nl;

Force 3: Bargaining Power of Suppliers

Again, within the roadmaking branch (semi-) automating products are absolutely new. This means that potential customers have to be persuaded and addressed sensitively since the investment in such innovations does not only mean that the old work traditions have to be changed, but also that a purchase of about 160.000€ has to be made.

Until now the roadmaking branch does not have many suppliers of mechanic instruments, let alone suppliers of automated robots. Streetwise 1200 had been the first fully automated robot so far. The percentage, 10-15%, indicating how many projects are

processed mechanically, speaks its own language. This is mainly due to the young age of application of mechanic tools within the branch. Accordingly, no dominant supplier was able to consolidate his position. This is also enforced by the diverse application possibilities of mechanic tool and the less recent abilities of existing products.

In sum, these facts give direction to assume that existing suppliers hold less bargaining power.

Force 4: Bargaining Power of Buyers

In general a total of 3.654 organizations constitute for the roadmaking branch. Of those, 2500 organizations are ZZP-ers, companies with 2-9 employees have a total stake of 958 and companies with 10-100 employees account for 142 of the total amount in 2008. The dominant buyers are those who have the most money to spend and therefore organizations holding 2 and more employees are considered so. Thus, dominant buyers have a fraction of 1100 of the total branch.

As outlined earlier did revenues increase, which let's us assume that the financial ability to invest in innovations is given. Buyers have only a few investment possibilities due to the few products launched in the branch, which means that buyers can relatively easily be convinced for investment decisions. Another relevant factor here is that the pavers are pushed towards working mechanically. Hence, sooner or later pavers are forced towards a purchasing decision of a machine or robot.

What was striking about the interviews conducted with several potential customers was that basically, they were not interested in a specific product most, let alone that they were more interested in having a high-end fully automated product instead of a supporting machine. Mostly relevant was that the machine must do his work accurately and more productively compared to the previous situation/machine. A general awareness of the new (ARBO) policies and plans exist among the potential customers and most of them find it important that a physical relief can be achieved by means of a machine. The purchasing costs are not left without any considerations but hold less importance when comparing them with the above-mentioned issues.

In sum, the bargaining power of buyers can be considered as being less so far. The annex 'so far' is in this case of most importance. This is because few products are available to the pavers; the products have not really taken root within the branch, which can be perceived by less economies of scale. This means that the upcoming period of about 5 years these issues will change and the barriers of entering the branch are increasing.

Force 5: Rivalry among the existing players

As indicated earlier is the fraction of the projects commissioned and processed mechanically about 10-15%. According to Mr. Zwinkels and Mr. Dooremalen of the local authorities of Rotterdam 4 brick-laying machines share this fraction: the Eagle, Optimas, Stratenlegger and the Sijnja. In addition to those machines different clamps as Hunklinger's (P01) share the fraction as well. Assuming that 10-15% of the projects commissioned are processed mechanically equals the percentage of companies engaged in automation activities would mean that around 110-165¹⁵ companies own at least one of the products mentioned above; whereby we assume that most of the companies have a 'supporting machine' such as a clamp (Hunklinger's (P01)) or a vehicle with a clamp (Optimas+Eagle). Semi-automated products such as Sijnja are considered as having the smallest fraction. Hence rivalry among existing players is fierce, but taking all potential customers into consideration competition is weakening. Moreover, semi-automation machines such as the Sijnja have a clear advantage: ease of re-paving.

Conclusion

With respect to the discussion of the 5 competitive forces it may finally be concluded that the barriers for entering the branch are low to medium in the short run. This is mainly due to less economies of scale, that the main fraction of potential customers has not been served yet and that competitor's products offer little differentiation: either clamp (with vehicle) or semi-automation. Hence for the introduction of a new brick-laying robot the roadmaking branch offers enough possibilities in the short run. Because of the fact that the branch is moving due to policy pressure and increasing awareness of automation applications, the long run does not appear very bright. The branch will become more and more saturated, competition will increase and economies of scale will be applied to gain more profits.

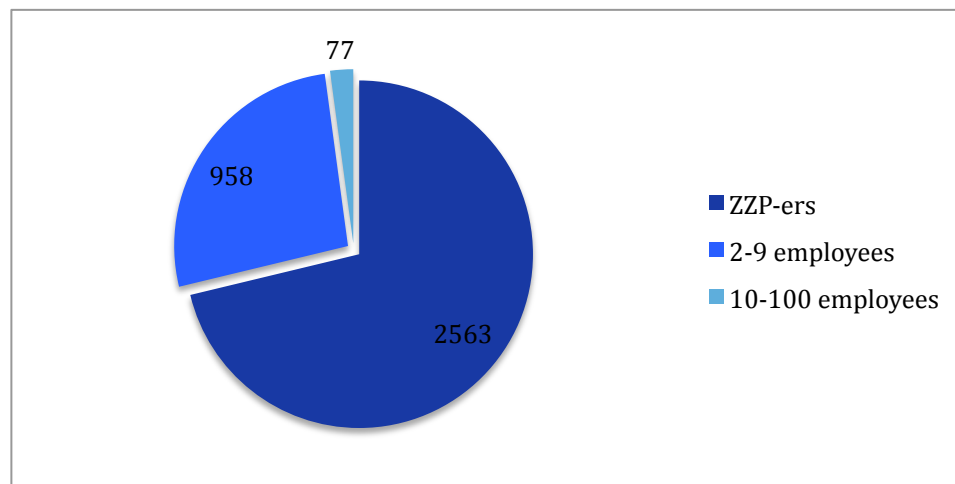
2.2 Potential Customers

Where does the potential customer for a brick laying robot hide? As indicated earlier has the roadmaking branch been increasing each year. Actually, this does not mean that the branch is growing with respect to its workforce. What is going on, though, is a re-allocation of workforce, stimulated by governmental policies, which explains the huge amount of new start-ups the recent year. ZZP-ers accounted for about 2.500 in 2008 and most of them gained revenues less than 50.000€. For making an initial investment, this

¹⁵ 10-15% of 1100 (companies indentified as being engaged in automation activities and additionally potential customers)

group is generally unable to wave the costs of about 160.000€ for the brick-laying robot (see section 3.3 for costs). This does not hold a general exclusion of this group because in case the BLR is introduced to the market and could profile itself, economies of scale are thinkable, which makes the robot more affordable to revenue-weak companies, such as ZZP-ers. In addition, a BLR could be made affordable by means of for example leasing or the establishment of networks to get a higher investment power.

Figure 9: Company Fractions of Total Branch



Source: www.kvk.nl; www.obn.nl

Hence for the introduction of an innovation potential customers regarding financial abilities have to be sought within the 1.000 organizations enrolled in the Dutch register of commerce in 2008. By means of discussion with Mr. van Herpt and his son, who is a ZZP-er within the roadmaking branch, turned out that many companies employing more than 30 people are outsourcing their projects gained to smaller companies, especially to ZZP-ers. Accordingly, the potential customer's size is slightly decreasing by 11 companies¹⁶. The impact on the total size of potential customers is insignificant.

In order to get a broad overview of issues related to the potential of a brick-laying robot and paver's needs within the roadmaking branch in the Netherlands, all companies could have been taken into consideration. The discussion above, though, gave direction to exclude ZZP-ers. Due to the insignificant size of 11 companies, we decided to include those in the overview. We assumed that for a purchasing decision, organizations with 10 or more employees would be of most relevance to derive first-hand information on the potential of a BLR, their needs regarding BLR specifications and market settings.

¹⁶<http://www.kvk.nl:80/handelsregister/zoekenframeset.asp?url=https://server.db.kvk.nl/ia&zk=0>

Target Group

Finally, the organization category of 10-100 employees can be defined as the target group of this research, which is used for interview purposes. The target group was selected as if it would be potential customers. Therefore organizational size was important as well as location; the customers should be close-by that rapid maintenance could be guaranteed. The Dutch register of commerce maintains a database, which delivered a list of the target group. Search settings were in general organizations employing 10-100 people, which are economically active (see appendix 1). By taking the location into consideration the total target group amounts a total of 15 organizations.

Moreover, to this target group the local authorities of Rotterdam were annexed because they were found to fit the categories size and location and could probably provide us with relevant information, since they ordered two Robostreet 1200. By the way, the local authorities of Rotterdam are the only public institution, which are engaged in roadmaking activities themselves. All of the Dutch local authorities outsource their roadmaking related work.

Pre-selection

These 15 organizations were contacted by phone to make a pre-scan of the interest in a BLR. 7 organizations revealed to have interest in a BLR and with all of them interview appointments could be made. 2 out of 15 organizations could not be reached and significantly all of the organizations were quiet hesitating in showing interest and reluctance when it came to making appointments. However, later during the interviews, after talking to them personally in more detail, interviewees got rid of those attitudes. In sum, the pre-selection shows that a little more than 50 percent are basically interested in a BLR.

3. Analysis Findings

3.1 The User Specifications Requirements of the BLR

The following will stress the user specifications requirements (USP) and wishes regarding VHTech's BLR. To come up with reliable results mainly three sources were used: field research, technician's opinion and interviews. With each of these sources an above-mentioned issue was attempted to identify. Field research comprised taking a closer look at the primary work process to derive potential bottlenecks and difficulties. The main aim though was to derive relevant information about cycle times, which were compared to the cycle times of the robot. Technician's opinion means that Mr. van Herpt

came up with a list with specific features, he himself regards as the best solutions. Finally, interviews were conducted to identify general trends in the roadmaking market and to elicit specifications, wishes and requirements regarding the BLR, which can be compared to technician's opinion.

The primary work process

The standard work to pave a street requires 2 persons: the bricklayer and his assistant who delivers the bricks to the bricklayer. Prior to the primary work process of bricklaying some tasks have to be done. These comprise for example the delivery of the bricks in piled pallets or the preparation of the street so that the bricks only have to be laid. Since those tasks have also to be done in the robot situation, it was unnecessary to measure them. Hence only the work task regarding the primary work process of bricklaying was measured (see appendix 2). Within the branch a general consensus prevails about how many square meters a bricklayer and his assistant are making on average each day: 50m²/day each. Results reveal after extrapolation of measures that the bricklayer and his assistant are working 3,24 hours respectively 3,8 hours for 100m². This time needed for 100m² is significantly low compared to the consensus. Keep in mind that the results are extrapolations of measuring about 30min of the primary work process. However, this would mean that both workers are doing different tasks during the day. Whether these tasks are relevant to the primary work process could not be derived.

For the new fully automated situation we expect the BLR to have cycle times as indicated in appendix 3. Although the robot operates the primary work process fully automated, it requires another worker, called operator, to let the robot's work be processed very smoothly (see appendix 4). Hence, he has to conduct issues like bringing the robot to the starting point, inserting a digital map into the robot and delivering the brick pallets. The robot and the operator have cycle times of 5,08 hours respectively 1,47 hours for 100m².

When comparing this two situations with each other it is striking that the robot inclusive operator are much more productive. Hence, the robot and operator could work, since the regular workday consists of 8 hours, about 1/2 more productive (100m² towards 150m²). Estimated cycle times for 150m² would be 7,62 hours for the robot and 2,21 hours for the operator. This equals, compared to the current situation, three fulltime bricklayers (inclusive assistant). This led us conclude that the BLR is able to substitute 2 fulltime employees.

3.2 Technician's Opinion

When it comes to the technician's opinion we talk about the opinion of the innovator, Mr. van Herpt. He set up a list with requirements the robot has to fulfill (see appendix 5). Surprisingly, the interviews with different kind of people revealed that most of the specifications and functions of the BLR were only of inferior interest. The most important issue, all of the interviewees had in common, was that they would like to see a robot that is working faultlessly. Actually, a IST-SOLL list with specifications should have been applied to reconcile the IST-values with the SOLL-values to come up with a list of user specifications requirements. Reality shows, though, that the reconciliation is redundant. Some general specifications and wishes of the BLR could be derived from the interviews conducted and will be discussed hereafter.

Results from Interviews

Again, what was of most relevance to all the interviewees was a robot that was working faultlessly. More precisely the interviewees had stated some wishes they found the BLR necessary to be equipped with. The findings are represented in the table 7.

Table 7: BLR related Wishes of Interviews

Wishes	
1	Round plate to make the street even
2	Mobile device; easy to transport
3	Herringbone pattern
4	Broadly applicable
5	More productive
6	Must make quality work
7	Re-paving feature; robot piles bricks
8	Substitute 3 men
9	Weatherproof
10	Compact

Source: Interviews

Strikingly, almost all interviewees expressed different kind of wishes but all tended towards the same direction: a simply working machine, which is able to operate faultlessly. By taking a closer look at the wishes expressed, 4 out of 10 wishes are already thought of and included in the list of specification (see appendix 5). These are the wishes 2, 3, 9 and 10. Wishes number 1 and 7 have not been thought of yet and could be value adding features. Number 4 cannot be realized in the short run because the first aim is to build a simple product working, under normal conditions with only one sort of

bricks. For the long run this wish can be considered. Wishes number 5 and 6 are not features that can easily be equipped to the robot and hence tougher to accomplish in advance. The testing phase of the BLR would provide more evidence on such issues. Finally, we indicated earlier that the BLR is able to substitute 2 men and in the short run this is the objective. Though, after the BLR proofed to work smoothly and faultlessly, the productivity could be improved so that wish number 8 may eventually be fulfilled.

General interesting interview results are that all interviewees indicated in the first place that an innovation should be better from an economic point of view (i.e. more productive, cheaper, profitable) than the product it supersedes. Secondly, social issues (i.e. better for the workers' health condition) would play a key role in the purchasing decision. Another striking point is that interviewees regarded an ease of use of the robot as important. These three issues are part of Rogers' (1995) innovation characteristics of which in most cases the first issue (economic point of view) is perceived as affecting the purchasing decision most. Hence, when the BLR is able to meet this issue the ultimate purchase is theoretically most likely.

Conclusion

The discussion above, which elicits results from three different sources, covers a lot of relevant issues related to productivity, specifications, wishes and first-hand information.

Firstly, field research resulted in cycle times and compared to the estimated cycle times of the BLR revealed that the BLR can improve productivity by 50% by substituting 2 fulltime workers.

Secondly, specific, definitive and distinctive user specifications requirements could not be retrieved from research. Only general wishes could be elicited. Among those, interviewees stated that a faultlessly working machine would be the most important requirement. Hence, the specifications compiled by Mr. van Herpt are considered as sufficient and reasonable user specifications requirements.

Thirdly, some wishes add value to the list of specifications and others are already included. This gives indication for the fact that specific specifications play a key role when purchasing a robot. But since every interviewee expressed different wishes, the BLR would have to be customized to a huge extent.

Finally, the BLR matches Rogers' (1995) innovation characteristic in all issues. It is more productive, cheaper (after return on investment) and more profitable. This case is affecting the likeliness of purchasing the BLR to a huge extent.

3.3 Financial Issues of the BLR

In this section we are taking a closer look at the financial issues related to the BLR. In more detail this means that we attempt to outline the costs and benefits of the robot to give an overview in the end whether the benefits outweigh the costs. If this is can be accomplished the BLR is from on financial point of view attractable and worth purchasing.

The following table shows the parameters used for the upcoming calculations.

Table 8: Parameters used for Calculation

parameter	1 man	robot		1 man	1 man	cumulative
days/year	200	200		200	200	
h/year	1600	1600		1600	1600	
h/day	8	8		8	8	
m2/day	x	150		50	50	100
m2/year	x	30000		10000	10000	20000

Costs of maintaining the current situation

In this situation roads are paved as they always have been: traditionally without any easing support of machines. The general consensus within the branch, as mentioned earlier, was that each full-time worker accounts for an average of 50m²/day. We assume that each full-time worker works on average 200 days a year; this is mainly due to the winter pause (compare table 9).

Table 9: Costs of Current Situation

parameter	1 man	1 man	cumulative
€/jaar	40000	40000	80000
€/m2	2	2	4
€/h	25	25	50
€/day	200	200	400

With a work day of 8 hours and an annual employment of 200 days, the cumulative fix costs for two men are 80.000€ per year, while making around 100m² a day, which equals 20.000m² on annually basis (see table 9).

In order to be able to compare the current to the new situation better the square meters per day are perceived as basis and hence the following figure shows the costs per year of maintaining the current situation.

Figure 10: Costs per Year of Maintaining Current Situation

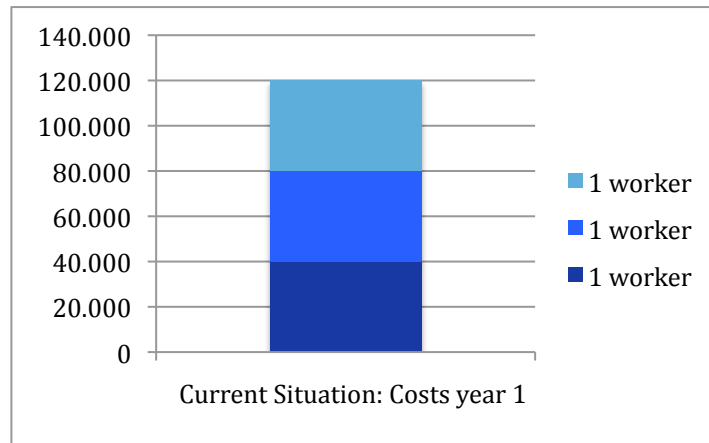
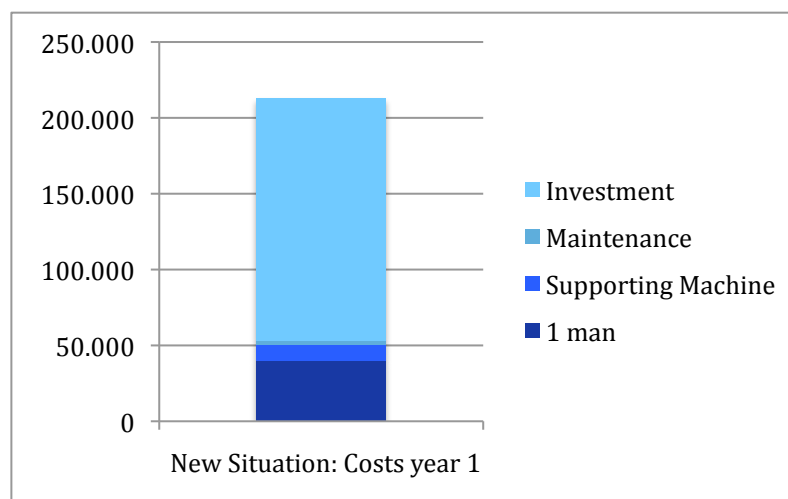


Figure 10 reveals what the current situation would cost, in order to attain the square meters per day the BLR attains. Thus, this means that 3 workers, which cost 40.000€ each per year, are necessary to be as productive as the BLR and make 150m². In total this would be 120.000€ fix costs, which equals the costs of 6€ per m².

Costs of the New Situation

The major player behind the 'new' situation is the BLR-situation. Hereby the robot and one fulltime worker, the operator, are needed to process the road.

Figure 11: Costs of Year 1 of the New Situation



Attached to the operator the same fix costs of 40.000€ a year as in the current situation are assessed. In addition, when deciding to purchase a BLR the customer has to wave the investment costs of 160.000€. In order to lift the pallet of bricks onto the BLR another machine is needed. Such a machine is generally, according to the interviewees almost always available. But to present a complete overview, these costs are included. The lending costs of the supporting machine are about 10.000€ per year. Furthermore, eventually the BLR needs maintenance and these costs amount, according to VHTech estimations, about 3.200€ per year (see figure 11). Comparing both situations with each other results in a cost-gap of 93.200€ after year 1.

We assumed an economic lifespan of 5 years; after this period of depreciation the BLR would have a residual value and it is possible to re-sell it. In contrast, the technical lifespan is assumed to be 8 years. After this period of depreciation the BLR is considered junk and has no residual value left. Basically, depreciation is a fix cost and thus is taken into consideration (Drury, 2004). The following figures represent two scenarios: 5 years depreciation (with residual value) and 8 years depreciation (without residual value).

Figure 12: Costs After 5 Years Depreciation

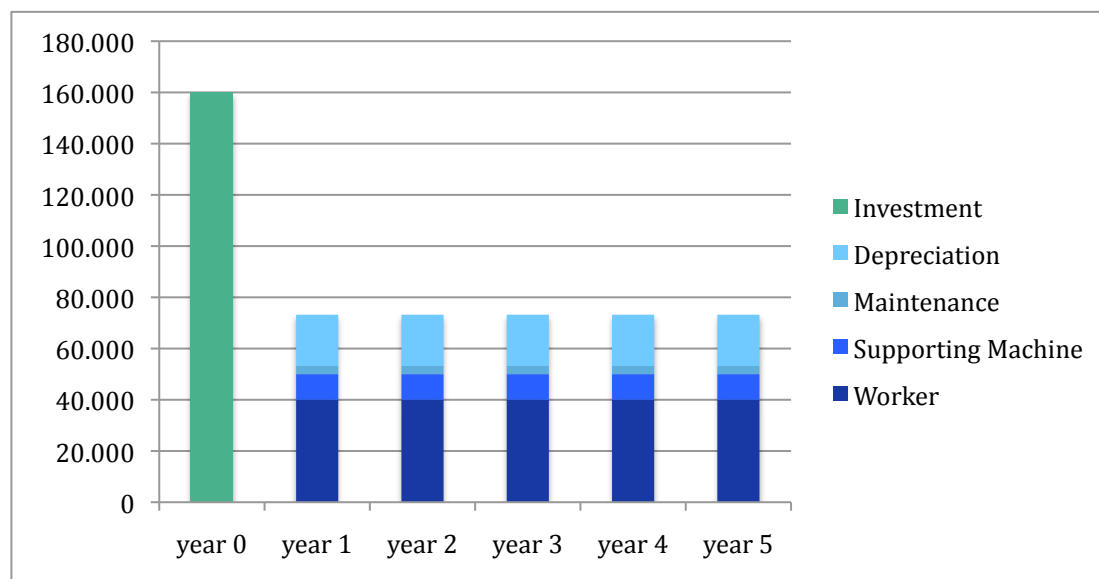
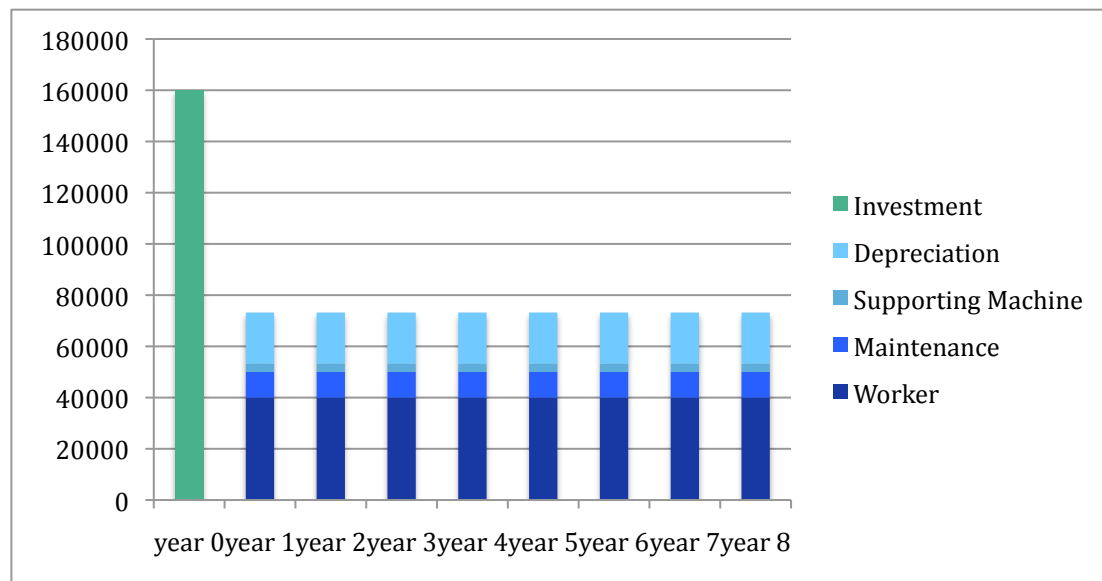


Figure 13: Costs After 8 Years Depreciation



Both scenarios don't differ that much, the difference lies in the decision when to abandon the BLR, either after 5 year with residual value or after 8 years as junk. The investment costs of the BLR are 160.000 in year 0, after that moment in time the annual costs are 73.200€. All costs are considered as fix costs; actually, though, for instance the maintenance costs would vary each year, the same holds for the supporting machine. Anyway, to simplify matters, fix costs are used.

With respect to the depreciation, a linear depreciation method is used with an estimated residual value of 60.000€. Hence, over a period of 5 years this would mean that the BLR is depreciated by 20.000€ each year.¹⁷ What is not included in figure 12 is the residual value; after 5 years 60.000€ remain. This is in sharp contrast to the 8-year depreciation period where nothing remains.

Comparison of Costs per Square meter

Within the current situation the costs of 120.000€ for three full-time working men were assumed. As stated earlier was the amount of square meters to be laid each year around 20.000. Hence, for the current situation one square meter would cost 6€ (120.000€/20.000m²).

We said above that the new situation would cost 73.200€ within both the 5 years as well as the 8 years scenarios; including residual value (which is treated as reducing the

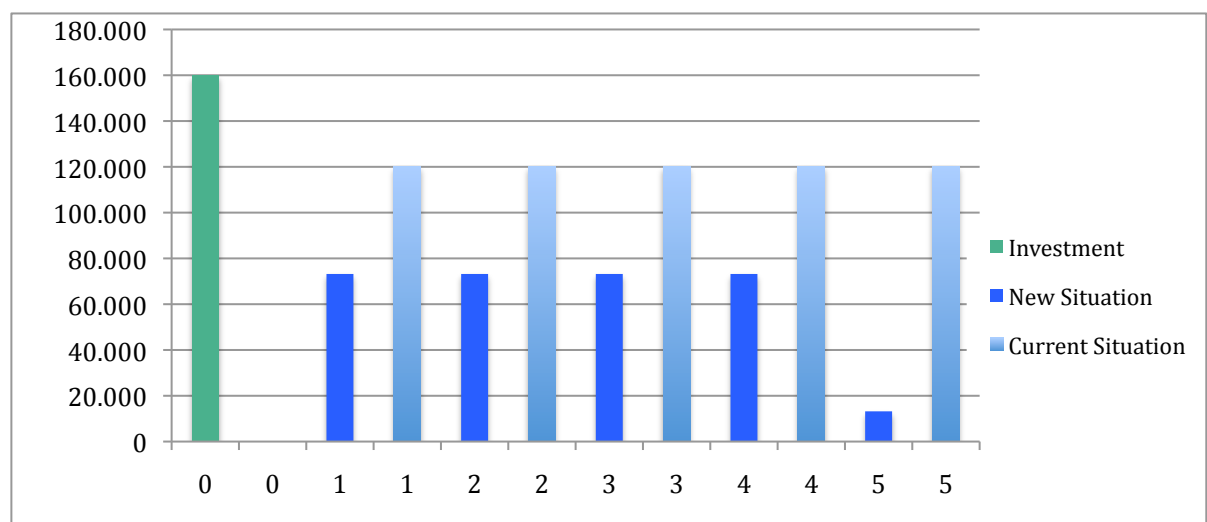
¹⁷ $(160.000 - 60.000) / 5 = 20.000$

annual cost by 12.000€ and applicable for the 5 years scenario only¹⁸) the annual costs would be 61.200€. Thus, for the 5 years and the 8 years scenarios, 1m² would cost 3.06€ respectively 3.66€.

The Benefits of Switching

Financial benefits are not expressed in profits gained by projects commissioned because only vague estimations about potential customer's profits could be made. Hence, prevalent investment decision models, such as ROI (Return on Investment) or DCF (Discounted Cash Flow), which are based on cash inflows, are inappropriate to our case. In order to be more accurate and reliable in our calculations financial benefits are mainly considered in terms of payback period including comparison of costs between the current and the new situation.

Figure 14: Comparison of Costs (5 Years)



This would lead, as indicated in figure 14, to an annual comparison of the costs; 120.000€ for the current situation against 73.200€ for the new situation. Whereas in year 5 the residual value of 60.000€ are added as negative costs, which reduces the costs to 13.200€ for year 5. In conclusion an average financial benefit of 58.800€ can be gained annually regardless investment costs. Hence, by means of the payback method the payback period can be calculated:

$$(160.000\text{€}/58.800\text{€}) = 2,721 \text{ (years)}$$

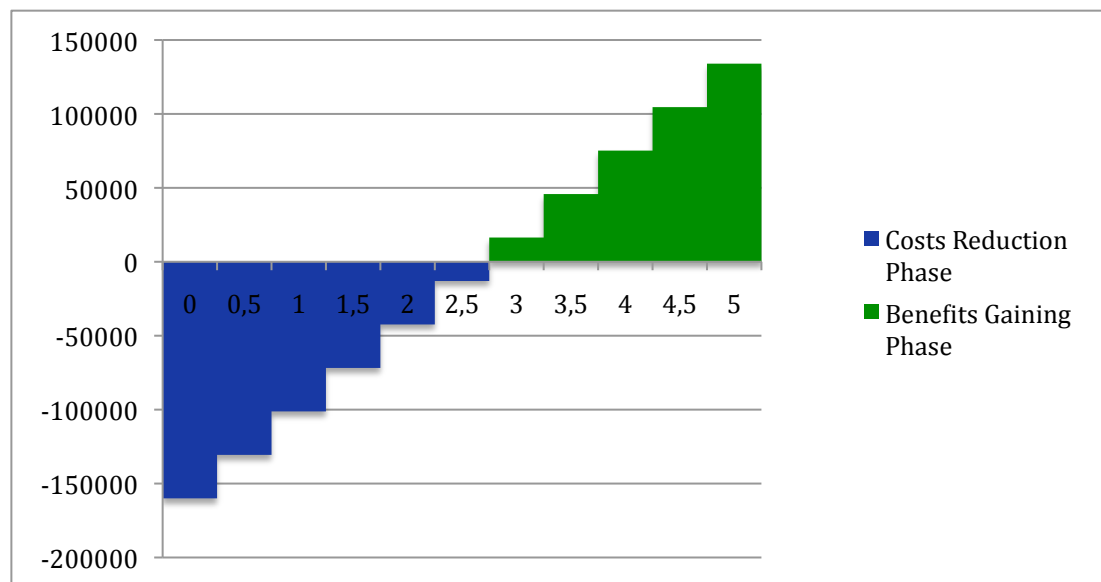
¹⁸ 60.000€ residual value /5 years = 12.000€

The calculation comprises to divide the investment by the financial benefit gained each year. Now we know already that the payback period is more than 2 years. To get the precise payback period another calculation can be applied:

$$160.000\text{€}/(58.800\text{€}/12) = 32,653; \approx 33 \text{ (months)}; \text{ or } 2 \text{ years and } 9 \text{ months.}$$

In conclusion the payback time for the BLR based on costs differences between the current and new situation is 2 years and 9 months. This scenario is reflected in figure 15.

Figure 15: Payback Period BLR



This figure precisely shows the costs and benefits of the BLR compared to the current situation for a 5-year period. Here, the residual value of the BLR (60.000€) is included. It shows that between the 2,5 -3 years (2 years and 9 months exactly) the costs of the investment became zero and benefits gaining phase starts.

In case it is not intended to sell the BLR after the estimated economic lifespan of 5 years but to recycle it after its 8-year technical lifespan, the payback period would be different: now the annual costs would be 46.800€ since the residual value is not included over the 8-year period. The same annual depreciation of 20.000€ is applied.

Hence, the payback period would be 3 years and 5 months¹⁹.

¹⁹ $160.000\text{€}/(46.800\text{€}/12) = 41,026; \approx 41 \text{ (months)}; \text{ or } 3 \text{ years and } 5 \text{ months}$

Risks

Since the BLR is a machine, it might be the case that the work cannot be progressed further due to for instance sudden breakdowns. This would cause the costs per square meter to increase, because the calculations made assume steady performances and therefore a perfect situation without breakdowns etc., in which a 150m² each day on average is expected.

Another issue the costs per square meter are sensitive to, is that as discussed earlier the road-making branch is affected by a decreasing workforce. This would increase the wages to be paid to the employees. At the moment this is not applicable but in the near future this could be an issue. This would mean that in the current situation the increase in wages would affect the costs per square meter more than in the new situation because here only 1 man is needed. In contrast to three men required for the current situation.

Conclusion

The major conclusion in this section is that the BLR has from a financial point of view enough potential to compete with and substitute the current situation. This is first of all because it is proven above that the BLR's operating fix costs are less each year compared to the current situation by applying equal productivity. From this starting point the estimated payback period of 2 years and 9 months could be calculated, which is in consensus of what the interviewees regarded as an appropriate payback period. They stated that the payback period should be around 2-5 years to be taken into purchase considerations. Anyway, again, here the same requirement is of appliance: when the BLR is just working faultlessly the payback period is of superior interest. By the way, the payback period is calculated based on costs comparisons instead of cash inflows/outflows; this holds that the payback period could be earlier but also later when calculating with cash inflows/outflows.

Of course, an investment of 160.000€ should be well considered, but the financial gains, which amount 58.800€ each year, with at least the same productivity as in the current situation, should be highly attractive for potential customers.

4. General Findings

4.1 Conclusions

This part of the research paper attempted to derive distribution possibilities of VHTECH's BLR. The results gained and presented in section 2 and 3 of this report aim at

providing data and information used for answering the main research question how many brick-laying robots can be sold annually at what price within the Netherlands. The following will emphasize and list major findings of this research in order to answer the main research question. In addition, recommendations will be made.

Within the roadmaking branch there are approximately 1.100 companies, which meet our criteria of having enough financial abilities to purchase a BLR in one rate. Applying for example leasing or economies of scale, which would lower the price, could extend the potential customer group so that the whole branch, about 3.600 companies, is included. Anyway, results from the pre-selection reveal that 7 out of 15 companies showed interest in a BLR. This is about 50% of the selection. By generalizing, this would mean that 50% of 1.100 companies would have interest in such a machine under present conditions. Being served by a robot or supporting machine does not inherently mean that those are without any interest regarding the BLR. These were findings of the interviews; 90% of the interviewees indicated to work at least with a clamp. Hence, approximately 550 companies are perceived as the target group for the BLR in the short run. The fact that only 50% of the companies are interested in a brick-laying robot is not positive but the forecasts for companies having interest are clear. Interest is pushed into the market predominantly enforced by governmental policies aiming at easing the hard physical work.

Polls indicate that 80%-87% of the communities and clients are convinced of an increase of automation within many projects. These stats reflect what governmental policies' impact on the roadmaking branch is.

Moreover, the branch is shrinking to a huge extent every year, less influx and a lot of outflow of worker. The application of a brick-laying robot, hence, would compensate this process and could motivate potential bricklayers to enter the roadmaking branch, since the work is more relieving now. Moreover is an outflow of workers related to an increase of the wages. By means of the BLR only one worker is needed, and thus the increasing wages can be avoided.

With respect to the whole branch, revenues are increasing, which means that more money could be spend on investments by potential customers. The traditional handicraft can be characterized by an enormous reluctant attitude, which also has an effect on potential customer's investment decision. This could have a negative impact on the distribution abilities of the BLR.

With respect to the discussion of the 5 competitive forces it may be concluded that the barriers for entering the branch are low to medium in the short run. The reason was

mainly due to less economies of scale and less diversity in existing products. This does not hold for the long run, where more economies of scale are applied, competition is becoming more fierce and the market is getting more and more saturated. Striking was that the discussion resulted in findings comprising that the threat of substitutes is little due to the unique characteristics, fully automation, of the BLR.

Research conducted reveals that the BLR is up to 50% more productive compared to the manual situation. This means that 2 full-time workers can be substituted. Though, comparison with the Sijnja Street Designer shows that productivity is slightly less. Another big plus in favor for the Sijnja Street Designer is that it aims at re-paving but still needs 2 workers to operate. The potential customer group, including 550 companies is steadily declining due to competitor products, which are getting bigger stakes of the market, in particular the semi-automated robots as the Sijnja and the Eagle.

Main results from the Users Specifications Requirements research were that firstly, the development of the BLR is proceeding in a favored direction USPs desired by customers. Secondly, the discussion gives direction for further improvements of the BLR in order to add more value to the customer. Thirdly, the major finding that the BLR should just operate faultlessly is of utmost importance to the customers. Any USP proposed, let it be specific features of the BLR, investment costs, social issues (relieving the bricklayers) or payback period was inferior to the requirement of faultless operating. Of course, though, This does not mean that issues such as investment costs were unimportant; productivity and economic performance plays a key role for the investment decision. This comes mainly forth from the interviews: customers are firstly interested in the economic performance of the robot compared to the machine/solution it supersedes. Secondly, they are interested in the social issues, mainly relieving the bricklayers of their hard physical work and finally they stress the importance of the ease of use of the new robot compared to the machine/solution it supersedes.

This research indicates that distribution of VHTech' BLR is possible because more stimulating and affecting factors could be identified influencing the distribution possibilities of the BLR within the Netherlands in a positive manner than factors hindering the distribution. How many BLR could be sold annually is strongly dependent on a couple of issues, but the most important one is that the BLR must be able to demonstrate as a prototype its accuracy and faultlessness. When the BLR can proof this, estimations are that in the first year 5-10 BLR could be sold to the market. This quantity is mainly due to the still reluctant attitude of the branch and that according to Rogers

(1995) only a small fraction is first in adopting innovation. When, the BLR is starting to profile itself and is pushed to the market, the following years pull market could be a logical scenario. This is likely since within the upcoming years governmental policies are enforcing this trend. Hence, for the upcoming years a steady increase of demand is estimated and therefore distribution of the BLR is increasing every year by an estimated 100-200%.

The benchmark reveals that the BLR with its 160.000€ investment costs is well positioned and interviewees' response amplify this. This means that the original investment costs could be 160.000€ in the first year and be increased subsequently.

Finally, the roadmaking branch is definitely moving towards the application of brick-laying robots and it could have the impact of a revolution since all traditional ideas and work processes will be undermined, overthrown and substituted by new ideas and work processes by means of brick-laying robots within the upcoming 5 years. This process already set in and thus, the time for introducing a brick-laying robot to the roadmaking branch never has been better.

4.2 Recommendations

The distribution of the BLR is most likely when the following issues are kept in mind and strongly considered for application.

1. Learn from the faults and benefits of previous machines and robots, particularly the Streetwise 1200 and translate those to BLR features.
2. Create and develop a robot that is more accurate and productive compared to the machine/solution it supersedes.
3. Consider USP for further improvements of the BLR, especially re-paving features are of importance.
4. Develop a robot that stresses firstly economic issues, then social issues and last but not least ease of use issues.
5. Do not stand still by details; proof that the BLR is accurate and faultlessly operating.

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Appendix

Appendix 1: Selection of Potential Customers

Handelsnaam	Vestigingsplaats	Homepage
Zandberg Wegenbouw	Drogeham	
Straatmakersbedrijf R. Postma	Stiens	http://www.straatmakersbedrijfpostma.nl/
Aannemings- en Bestratingsbedrijf Buitenpost	Drachten	www.abbbuitensport.nl
Bestratingsbedrijf V.S. Sneek B.V.	Sneek	
V.O.F. Spoelstra en Nijboer	Surhuisterveen	
Straatmakersbedrijf Vojo	Sneek	
De Vries Beplantingen	Oostwold Scheemda	
Aannemingsbedrijf G.A. Huberts B.V.	Meppel	http://www.hubertsbv.nl/
V.O.F. Straatmakersbedrijf D' Olde Smilde	Hoogersmilde	
Bestratingsbedrijf Tieck B.V.	Klazienaveen	
P. de Jong B.V.	Emmen	www.pdejong.nl
Van de Bunt Bestratingen	Noordscheschut	http://www.buntbestratingen.nl/index.html
Buning Wegenbouw B.V.	Zuidwolde Dr	www.buning.nl
Garden Stones Assen	Assen	
Straatmakersbedrijf Bergman en van Dalfzen B.V.	Genemuiden	
Schuurman Bestratingen	Nieuwleusen	
Bestratingsbedrijf Freek Kuipers	Almelo	www.bestratingsbedrijf-kuipers.nl
J. Moes Wegenonderhoud B.V.	Almelo	
Bonne Niks Stratenmakersbedrijf B.V.	Westerhaar- Vriezenv Wijk	www.bonneniks.nl
Tempelman V.O.F. Sierbestrating	Markelo	http://www.tempelmansierbestrating.nl/pagina/13/home.html
L. Wolf Bestratingsbedrijf.	Daarlerveen	
Tichelaar Bestratingen	Zwolle	
B. Bastiaan Straatmakersbedrijf	Hattem	www.bbastiaanbv.nl

B.V.		
Tonnie van Beek Bestratingen	Wezep	
Van Pijkeren B.V.	Nunspeet	www.vanpijkerenbv.nl
Koopman Bestratingen	Oldebroek	
V.O.F. H.J. Stange	Elburg	www.stange-elburg.nl
Bashkim	Deventer	
Bestratingsbedrijf van de Riet V.O.F.	Oldebroek	
Gebrs. van Oene Stratenmakersbedrijf V.O.F.	Wezep	
United 2000 Bestratingen V.o.f.	Noordeinde Gld	
H. van 't Hul Bestratingen V.O.F.	't Loo Oldebroek	
J & C Bestratingen	Wezep	
Eggink & Van der Weerd B.V.	Wezep	
Bestratingsbedrijf G. van Gelder/Fijn v.o.f.	Hattermerbroek	
Straatmakersbedrijf G. Versteeg	Uddel	http://www.gversteeg.nl/
Gebr. van Breda B.V.	Geldermalsen	http://www.gebr-van-breda.nl/
C. Verheijen Bestratingen	Venray	
Van Haaren Wegenbouw B.V.	Helvoirt	www.van-haaren.nl
Stratenmakersbedrijf Smulders	Berlicum NB	
EB Eindhoven Bestratingsbedrijf	Eindhoven	www.eindhoven-bestratingsbedrijf.nl
A&M Wegenbouw Holding B.V.	Waspik	
Stratenmakersbedrijf van Nispen B.V.	Sint Willebrord	
Gebr. Martens Bestratingsbedrijf Nieuw-Ginneken	Bavel	
L.W. van den Broek Beheer B.V.	Sprundel	www.vandenbroekbestratingen.nl
Aannemersbedrijf Van den Broek B.V.	Sprundel	
Freesmaatschappij Jongmans	Sint Willebrord	
Kemi Bestratingen B.V.	Sprundel	
P. Spijkstra Roosendaal V.O.F.	Rucphen	
Aannemingsbedrijf Adr. Van den Berg B.V.	Heinenoord	www.bergwestmaas.nl
Merwelanden Wegenbouw B.V.	Papendrecht	

Van den Dool Bestratingen	Alblasserdam	http://www.vandendoolbestratingen.nl/index.html
W.N. de Jong & Zn. B.V.	Ridderkerk	
W. le Comte Bestratingen B.V.	Rotterdam	http://www.wlecomte.nl/
Aannemings- en Transportbedrijf W. van den Heuvel en Zoon B.V.	Rhoon	
Aannemingsbedrijf D.C. Molendijk B.V.	Spijkenisse	
A. van Dongen B.V.	Schiedam	
Kalis Bestratingen	Hardinxveld Giessendam	
Van der Aart Bestratingen B.V.	Noordwijk ZH	
Aannemingsbedrijf W. & J.Molenaar B.V.	Nieuwerkerk ad IJssel	www.molenaar-nieuwerkerk.nl
Aannemingsbedrijf Th.A. van der Pool B.V.	Gouda	
V.O.F. Gebroeders Uithol	Zegvel	
Cor Nab B.V.	Loenen aan de Vecht	www.cornab.nl
A. Koot en Zn.	Utrecht	
Bestrationsbedrijf Van Veenschoten V.O.F.	Amersfoort	
Th. J. van de Wolfshaar	Hooglanderveen	
Fokker-Oomen Aannemersbedrijf B.V.	Bussum	
Aannemersbedrijf Wagelaar B.V.	Landsmeer	

Appendix 2: Recorded Cycle Times Manual Situation

werkzaamheden vooraf/upper		Tijden (sec)		
		per steen	per pak	per 100m2 (dag)
1. vooraf	stenen worden per pak gestapelde stenen geleverd			
	banden leggen			
	straat afreiden			
2. upper	stenen van stapel in kruiwagen en legen	1,1	764	6871,4
	Logistiek, rust en ander werk	1,1	759	6827
	- heen en weer rijden			
	- rusten			
	- plastic snoer eraf knippen			
	- meten			
	Totaal			
	13698,4			
			3,8 Uur	

werkzaamheden stratenlegger (gemeten)		Tijden (sec)		
		per steen	per pak	per 100m2 (dag)
3. stratenlegger	pakt steen, orienteert en sluit aan	1,8	1296	11664
	knippen			
	zand strooien			
	trillen			
	Totaal	11664		
				3,24 Uur

Appendix 3: Estimated BLR Cycle Times

Werkzaamheden Robot (schatting)		Tijden (sec)				
		per steen	per 6 stenen	per pak	per 100m2	per 150m2
3. Robot	plastic snoer eraf halen					
	scannen (positionering)				5	
	pakken en leggen van stenen (totaal)	2,52	15,1	1812	16308	
	- pakken steen	0,5	3	360	3240	
	- naar volgende steen	0,4	2	240	2160	
	- naar werk draaien	1,9	1,9	228	2052	
	- wegleggen steen	0,7	4,2	504	4536	
	- naar volgende steen	0,5	2,5	300	2700	
	- volgende stenen halen		1,5	180	1620	
	verplaatsen van machine (150cm, totaal)			69	621	
	- steunen in			3		
	- rijden 150cm (120cm/sec)			5		
	- plaats bepalen van machine			10		
	- steunen uit			3		
	wisselen pak stenen (totaal)			155	1359	
	- reinigen			30	270	
	- deur open			2	18	
	- stenen plaatsen			120	1080	
	- deur sluiten			2	18	
	- plaats bepalen van stenen			5	45	
	Totaal				18293	27439,5
					5,08 Uur	7,62 Uur

Appendix 4: Estimated Operator Work Process Times

werkzaamheden nieuwe situatie (schatting)					
		per steen	per pak	per 100m2	per 150m2
1. Vooraf	stenen worden per pak gestapelde stenen geleverd				
	banden leggen				
	straat afreiden				
	werktekening maken				
	motor plaatsen en aan zetten				
2. Operator	stapel stenen op machine	0,17	120	1080	
	naar machine rijden	0,42	300	2700	
	machine naar beginpunt			300	
	pionnen opzetten			300	
	digitale tekening invoeren (robot eerste steen)			300	
	machine verplaatsen		69	621	
	knippen				
	zand strooien				
	trillen				
	Totaal			5301	7951,5
				1,47 Uur	2,21 Uur

Appendix 5: Robot Specifications

Features	IST
Pace	
- m2/h	19,68 (m2)
- m2/day	150m2/7,62hour
Sound intensity	< 65 (dBa)
Precision	0,1/1000 (mm/m)
Capacity (massa stenen)	1600 (kg)
Weight	2000 (kg)
Laying width	5,5 (m)
Load capacity	a whole pallet
Patterns	focus on fishbone first; theoretically are all patterns feasible
Maintenance	
Available?	Yes
Transport	
How to transport the robot?	with a clinger
Circumstances	
Weatherproof	yes
Ergonomic	
Ease of use (education level)	LBO (training required)
Comprehension requirements	attending training
Operate	attending training
Security Issues	
Immediate stop	yes
Security zones	yes
Re-use	
Technical lifespan	8 (years)
Suggestion	Selling after 5 years due to new technological inventions

Appendix 6: Interviews

Interview met meneer Moes, private domain.

Inleidende vragen

1. Wat is uw houding tegenover machinaal bestraten?
In principe vind meneer Moes machinaal bestraten positief. Hij heeft al 30 jaar ervaring met machinaal bestraten. Bovendien was hij de eerste van zijn vak die sommige innovaties had geadopteerd. In het gesprek wordt duidelijk dat het bij machinaal bestraten alleen maar om geld gaat. Het is 'een pure geldzaak'.

Waarom? Omdat veel stratenmakers alleen de kosten van een innovatie zien en de opbrengsten achter wegen laten. Meneer Moes is hier echter een uitzondering omdat hij zijn werknemers, tenzij hoog verlof, als belangrijk acht. Zo belangrijk dat hij een innovatie zal adopteren om zijn medewerkers te ontlasten. Wat hij ook aangaf was dat er veel ZZPs en kleinere bedrijven bestaan die niet in een keer 160.000 Euro kunnen opwaaien. Dus deze en grotere bedrijven zijn erg terughouden in hun investeringsgedrag.

2. Kunt u aangeven waarom u deze houding heeft?
3. Hoe groot is uw bedrijf?
16 medewerkers
4. Waarmee houdt u zich vooral bezig?
Wegenonderhoud, dus ook asfalt en stenen.
5. Heeft u al eerder investeringen gedaan in nieuwe producten?
Ja, nieuwe klem. (35.000Euro)

Specifieke wensen

Wat meneer Moes belangrijk vond was een ronde plaat waarmee hij de baan rond kan afrijen. Verder hechtte hij veel waarde aan een vervoerbaar product, hij moet dus makkelijk op de aanhanger getransporteerd zou moeten worden (met een VW busje). Bovendien vond hij een terugverdientijd van een jaar redelijk.

6. Aan welke eisen hecht u de meeste waarde?
Hij hechtte de meeste waarde aan een functionerend product dat.
7. Wat zouden redenen voor en tegen een aanschaf zijn?
Meneer Moes antwoordde hierop met geld.

Samenvatting

Uit het gesprek bleken een aantal eisen die aan het product gesteld worden. Ten eerste was dit een functionerend product dat de mensen ontlast en baten (medewerkers vervangen) oplevert. Ten tweede wordt geld als belangrijk geacht en de hoogte van een innovatie zal uiteindelijk het wel of niet aanschaffen beïnvloeden. Wij vonden zijn redenering hypocriet omdat hij een de ene kant geld als de belangrijkste factor voor het wel of niet investeren aangeeft maar aan de andere kant zegt, dat 'als ik zie dat het functioneert dan heb ik er ook een'. In dit geval speelt geld op eens geen rol meer maar overwegen de factoren, opbrengsten en ontlasting voor de medewerker. Wat echter belangrijker is kon niet achterhaald worden en wij gaan ervan uit dat meneer Moes liquide zou zijn dat de laatst genoemde factoren overwegen.

Andere

- met 4 man kunnen 80m² per dag gehaald worden
- de stenen in een patroon geleverd te krijgen kost 1,5euro meet per m²

Interview, Van Bunt Bestrating, Private domain.

Environment

Competitive Pressure

1. Vind u dat er concurrenten zijn binnen uw vak?
Jawel, er is oneerlijke concurrentie. Er gebeurt nog veel werk dat in tegenstelling tot de arbo-wetgeving is. En de Arbo is niet up-to-date genoeg om controles uit te oefenen.
2. Kunt u beschrijven in hoe verre u door het feit dat er concurrenten zijn in uw investeringsgedrag beïnvloed wordt? (terughoudend of uitgevend)
Niet meer of minder uitgevend. Ik kijk naar mijn machinepark en wat wel mogelijk is wil ik ook wel volgens de regelgeving doen. En op den duur, denk ik, dat dit (machinaal bestraten) toch de weg is. Dat merk ik ook gewoon. De vraag naar machinaal is ook veel meer.
3. Zou u aan kunnen geven waaraan de stratenleg robot volgens u zou moeten voldoen om met andere stratenmaker bedrijven te kunnen concurreren?
Ik zal eerst even uitleggen hoe ik er tegenaan kijk. Op het gebied van machinaal nieuw aan te brengen materialen, hebben wij als firma alles in huis. Dan kom je bij hergebruik, reconstructies en her te gebruiken materialen; hoe kun je dat toepassen. Ik zie de zin van zo een robot zie ik nog niet echt. Zolang je daar nog een schaal van mensen omheen hebt, zie ik geen nut. De machines om machinaal aan te brengen zijn er, maar bij hergebruik... Waarom niet een machine die ze uit het werk haalt en weer plakkateert. Waarom niet meteen een machine die weer plakkateert, dan hoef je zo een machine (de brick-laying robot) niet te ontwikkelen.
 - a. Wat is het meest belangrijk?
Dat er weinig mensen omheen staan is meest belangrijk (dus het vervangen van werk; kosten besparing)
4. Zijn deze eisen belangrijk als het erom gaat geïnteresseerd te raken in een stratenleg robot?
5. Of denkt u dat de eisen belangrijker zijn voor de beslissing in een stratenleg robot te investeren?
De bereidheid in een machine te investeren is er wel maar dan moet er wel meer toezicht op oneerlijke concurrentie komen. Met zo een machine kun je niet concurreren omdat je altijd duurder bent, ten alle tijden.
6. Maakt het verschil?
Maakt geen verschil. Dat is hetzelfde.

Goals

Social responsibility

U draagt een bepaalde verantwoordelijkheid mbt uw organisatie en de mensen die hier van deel uit maken.

1. Klopt dat?
Ja dat klopt.
2. Kunt u deze verantwoordelijkheid nader toelichten/specificeren?
Ik ben de eigenaar. Ik ben eindverantwoordelijk van alles. Zo simpel is het.
3. Welke verantwoordelijkheid is voor u het meest belangrijk? Waarom?
Financiële verantwoordelijkheid en regelgeving, vooral Arbo-regelgeving meest belangrijk.
4. Waaraan zou een nieuwe stratenleg robot vervolgens aan moeten voldoen om uw verantwoordelijkheden tegemoet te komen/realiseren te kunnen?
Financieel erg belangrijk. Fysiek belangrijk (dus de mens). Ik denk toch wel fysiek meest belangrijk.
5. In het geval de innovatie voldoet aan de eisen, zouden deze eisen voldoende zijn om een stratenleg robot aan te schaffen? Waarom wel/niet?
Ja, het fysieke weeg zwaar mee bij de overweging een robot aan te schaffen.

6. Zouden de eisen (dan wel) voldoende zijn om geïnteresseerd te raken? Waarom wel/niet?
7. Maakt het een verschil?
Maakt geen verschil.

Size

1. Hoe veel medewerkers bevat uw bedrijf?
20 personeelsleden en 6-7 ZZP'ers. 27 mensen. Platte hiërarchie.
2. Denkt u dat u hierdoor vatbarer bent voor nieuwe producten ten opzichte van grotere bedrijven omdat het bijvoorbeeld korter zal duren voordat iedereen binnen het bedrijf de innovatie aanvaardt?
Ik denk dat ze het makkelijk oppikken als er iets nieuws komt. Dan zal wel anders zijn dan bij grotere bedrijven. Daar is wel meer te regelen.
3. Speelt de mate in hoe verre de resultaten van een stratenleg robot (minder uitval, productiever werken, werk wordt vervangen) zichtbaar zijn, een rol?
Ja, dat speelt een rol.
4. Is dit een belangrijk eis mbt het wel of niet aanschaffen van een robot?
De productie is het meest belangrijk. Maar de kwaliteit speelt ook een rol. Een weer fysiek. Wat is het voordeel voor de medewerkers? Als er geen winst is te behalen voor de werknemers dan maakt het weinig zin.
5. Stel dat iedereen de positieve en negatieve uitkomsten van een robot kent, dus ook het vervangen van hun werk. Denkt u dat dit belangrijk is voor het wel of niet aanschaffen van een robot?
Ja, ik denk het wel. Dat is wel belangrijk? Als het werk vervangen kan worden dan is het wel reden om een aan te schaffen.

Decision-making

1. Verloopt over het algemeen gesproken het beslissing nemen binnen uw bedrijf soepel?
2. Waaraan ligt dit?
3. In hoe verre bent uzelf vrij in het beslissing nemen mbt investeringen?
4. Waaraan hecht u hierdoor de meeste aandacht mbt een nieuwe investering/nieuwe innovatie?
5. Zijn deze aandachtspunten cruciaal voor het wel of niet beslissen een innovatie aan te schaffen?
6. Of zijn de aandachtspunten belangrijker voor het geïnteresseerd raken in een robot?

Knowledge

1. Over het algemeen gesproken, maakt u bij het beslissen een innovatie aan te schaffen gebruik van bestaande kennis van vroegere aankoop beslissingen, van kennis over bestaande producten of allebei?
Dat weet ik niet zo zeer. Het speelt allemaal een rol. Kijk, ik ben niet helemaal op de hoogte van dergelijke machines. Ik volg het wel. Maar, daar weet ik eigenlijk ook te weinig van. Maar ik heb investeringen gedaan in machines. Maar dat is ook nog niet zo heel erg lang geleden. Ik ben nieuwsgierig bijvoorbeeld over de streetwise. (Hij kon niet expliciet aangeven dat hij van vroegere aankoop beslissingen gebruik maakt, maar wel van bestaande kennis/producten zoals de robostreet. Mss maakt hij van vroegere aankoopbeslissingen intuïtief gebruik.)
2. Wat had deze kennis tot inhoud? Wat waren de knelpunten van eerdere investeringsbeslissingen?

3. Waaraan zou de robot moeten voldoen, vergeleken met eerder verworven kennis en knelpunten?
4. Hoe groot acht u eerder verworven kennis bij het beslissen een robot aan te schaffen?
Als er een machine dermate is ontwikkelt dan wel. Het is niet erg belangrijk, nee.
5. Hoe groot acht u eerder verworven kennis bij het wel of niet geïnteresseerd zijn in een robot?
6. Zijn er verschillen in?

Others

Education

1. Wat is het gemiddelde opleidingsniveau van de medewerkers binnen uw bedrijf?
Mavo Havo, MBO
2. Zou het opleidingsniveau van de medewerkers eisen aan de robot stellen?
Ja.
3. Welke zijn dat?
Dat is een goede vraag, dat weet ik niet. Dan kijk ik weer naar investeringen die we zelf gedaan hebben. (Marcel: Dat ie makkelijk te gebruiken is bijvoorbeeld, dat ie niet te complex is) Ja, dat zijn wel eisen.
4. Hoe belangrijk acht u deze eisen aan de robot? Zouden deze eisen u ervan kunnen overtuigen een robot aan te schaffen?
Ja, deze eisen zijn belangrijker dan financiële aspecten.

Financial Budget

1. In hoe verre bent u er vrij in om geld te investeren?
Ik ben de eigenaar, dus dat bepaal ik zelf.
2. Zijn er nog meer mensen bij betrokken?
Nee, er zijn geen mensen bij betrokken.
3. Welke overwegingen neemt u om geld te investeren?
Hoe veel vierkante meter hij kan maken, weegt zeker mee, maar of het het meest belangrijk is dat weet ik niet. Er zijn ook andere dingen belangrijk. Bij eerdere investeringen is de m2 wel erg belangrijk geweest. Als ie kosten beheersbaar blijft.
4. Welke overwegingen zijn het belangrijkste?

Total

1. Ten slotte, welke van de volgende karakteristieken van de robot lijkt u het meest belangrijk om een robot aan te schaffen?
 - a. De robot is vanuit een economisch perspectief (productiever, goedkoper, winstgevender) beter dan de vorige situatie/oplossing.
 - b. De robot is vanuit een sociaal perspectief (beter voor de gezondheid van de medewerker) beter dan de vorige situatie/oplossing.
 - c. De robot past beter bij de waarden en eerder opgedane ervaringen van ons bedrijf.
 - d. Met de robot kunnen wij van tevoren op experimenteer basis mee aan de slag.
 - e. De uitkomsten/resultaten/effecten van de robot zijn voor iedereen binnen ons bedrijf zichtbarer.
 - f. De robot is gemakkelijker te gebruiken/bedienen en te begrijpen

Interview NTP Infra Enschede, meneer Slot, CEO, Private domain.

Environment

Competitive Pressure

1. Vind u dat er concurrenten zijn binnen uw vak?
Ja, best wel. Met nadruk dat er in Oost-Nederland veel aannemers bedrijven zijn. Hier heerst een hoog concurrentie niveau.
2. Kunt u beschrijven in hoe verre u door het feit dat er concurrenten zijn in uw investeringsgedrag beïnvloed wordt? (terughoudend of uitgevend)
Ik denk dat wij gemiddeld gezien een redelijk hoog investeringsniveau hebben. Ik moet het echter splitsen. Wij hebben een aannemingsbedrijf dat zich bezig houdt met het aannemen en uitvoeren van wegenbouw werk; daarnaast hebben we ook een aannemersbedrijf dat zich bezig houdt met het aannemen en uitvoeren van boorwerkzaamheden. Wij hebben in de afgelopen jaren een redelijke groei doorgemaakt; we maken gemiddeld 10-15 % groei door per jaar. Dat betekent dat we redelijk goed bezig zijn op dit moment. Tegen de verdrukking van de markt in, die er toch is en hoge concurrentieniveau. Dus ik denk, dat wij ons wel wat onderscheiden: klantengerichtheid. We zien de gemeentes niet als opdrachtgever maar de eindgebruiker, diegene die over de weg rijdt, etc.
Ja, we hebben een hoog investeringsniveau maar niet door het feit dat er concurrenten zijn.
3. Zou u aan kunnen geven waaraan de stratenleg robot volgens u zou moeten voldoen om met andere stratenmaker bedrijven te kunnen concurreren?
Verschillende zaken moet ie aan voldoen. Hij zal in prijs concurrerend moeten zijn, dus de aanleg kosten per m2 zullen moeten dalen. Hij moet meer m2 moeten leggen dan andere methodes. Hij moet gebruiksvriendelijk zijn en een hoge schaal van inzetbaarheid hebben. Dus niet alleen op grote vierkante vlakken te gebruiken, maar ook eenvoudig inzetbaar.
 - a. Wat is het meest belangrijk?
Prijs. Als ie niet in prijs concurrerend is, dan is er geen markt voor.
4. Zijn deze eisen belangrijk als het erom gaat geïnteresseerd te raken in een stratenleg robot?
Ja
5. Of denkt u dat de eisen belangrijker zijn voor de beslissing in een stratenleg robot te investeren?
Ja, natuurlijk moet het concurrerend zijn en raak je erdoor geïnteresseerd maar het automatisch gevolg is dat je er ook over na denkt erin te investeren.
6. Maakt het verschil?
Nee

Goals

Social responsibility

U draagt een bepaalde verantwoordelijkheid mbt uw organisatie en de mensen die hier van deel uit maken.

1. Klopt dat? Ja.
2. Kunt u deze verantwoordelijkheid nader toelichten/specificeren?
Ik ben hier de directeur, dus ik ben eindverantwoordelijk. Arbo-regelgeving, financiering...alles

3. Welke verantwoordelijkheid is voor u het meest belangrijk? Waarom?
Geen, allemaal even belangrijk. Alle aspecten zouden moeten kloppen wil je een draaiend bedrijf houden.
4. Waaraan zou een nieuwe stratenleg robot vervolgens aan moeten voldoen om uw verantwoordelijkheden tegemoet te komen/realiseren te kunnen?
Aan alle aspecten zou ie moeten voldoen. In prijs, passen binnen arbeidsomstandigheden. Gebruiksgemak, niet te groot, niet te breed, niet te zwaar. Ik kan daar moeilijk onderscheid in maken.
5. In het geval de innovatie voldoet aan de eisen, zouden deze eisen voldoende zijn om een stratenleg robot aan te schaffen? Waarom wel/niet?
Ja, deze zijn voldoende.
6. Zouden de eisen (dan wel) voldoende zijn om geïnteresseerd te raken? Waarom wel/niet?
7. Maakt het een verschil?
Geen verschil

Structure

1. Hoe is uw bedrijf ingericht?
 - a. Zijn er hiërarchische lagen?
Nee, minder dan bij andere bedrijven. We hebben directie, dan komen de projectleiders, de uitvoerders; geen bedrijfsleider of dat soort zaken. Rechtstreekse aansturing.
 - b. Denkt u dat u open bent voor nieuwe producten/innovaties?
Ja zeker, we gaan nu weer met nieuwe productie bezig mbt milieutechniek. Daar zijn we wel redelijk vooruitstrevend, zeg maar.
 - c. Heeft u binnen uw bedrijf formele procedures? Zijn procedures schriftelijk vastgelegd? Denkt u dat deze meer zijn dan bijvoorbeeld bij gemeentes?
Duidelijk minder. Zeker omdat je kortere lijnen heb binnen platte organisaties. Investeringswensen komen direct van de projectleiding naar mij toe en dan is ook de link heel snel, waarom wil je dat, waarom moet het deze specifieke machine zijn en niet een ander. En dan beslissen we dat. En ja, hebben wij een investeringsvoorstel op papier. Maar dat is voor de archiveren en exploitatie noodzakelijk. Schrijven we hem af in een keer en dergelijke. Maar de beslissing te investeren is snel genomen.
2. Zou u eisen aan de stratenleg robot kunnen bedenken die hieruit voortvloeien?
Volgens mij heeft dat helemaal niets met elkaar te maken.

Size

1. Hoe veel medewerkers bevat uw bedrijf?
In zijn totaliteit 190 in drie vestigingen. Maar hier in Enschede 80.
2. Denkt u dat u hierdoor vatbarer bent voor nieuwe producten ten opzichte van grotere bedrijven omdat het bijvoorbeeld korter zal duren voordat iedereen binnen het bedrijf de innovatie aanvaardt?
Ja, we zijn door platte organisatie en weinig medewerkers vatbarer.
3. Speelt de mate in hoe verre de resultaten van een stratenleg robot (minder uitval, productiever werken, werk wordt vervangen) zichtbaar zijn, een rol?
Ja, als ie goed werk, dan zal ie sneller genomen zijn.
4. Is dit een belangrijk eis mbt het wel of niet aanschaffen van een robot?
Ja.
5. Is dit (dan wel) een belangrijk eis mbt het wel of niet geïnteresseerd raken in de robot?

6. Ja. Geen verschil ertussen. Investeren en geïnteresseerd raken ligt voor mij heel dicht bij elkaar. Als je geïnteresseerd bent ga je investeren anders niet.
7. Stel dat iedereen de positieve en negatieve uitkomsten van een robot kent, dus ook het vervangen van hun werk. Denkt u dat dit belangrijk is voor het wel of niet aanschaffen van een robot?
Ja, het is wel van belang. Er zal in de mate van belangrijkheid of in de mate van niveau van de medewerker zal ie toch zwaarder mee tellen in de beslissingen. Een stratenmaker die zich misschien bedreigt voelt door de machine is minder relevant, daarmee bedoel ik niet dat de man niet relevant is, maar is minder relevant omdat de wetgeving ons gewoon daartoe dwingt en de man zal altijd nog dat ding moeten bedienen. Ik denk niet dat een stratenleg robot echt bedreigend is voor de werkgelegenheid. Dat geloof ik niet.

Decision-making

1. Verloopt over het algemeen gesproken het beslissing nemen binnen uw bedrijf soepel?
Soepel en snel
2. Waaraan ligt dit?
Platte firma. Ja, het is inherent aan de organisatiestructuur.
3. In hoe verre bent uzelf vrij in het beslissing nemen mbt investeringen?
Vrij; andere medewerkers komen altijd tot een bepaald bedrag via mij.
4. Waaraan hecht u hierdoor de meeste aandacht mbt een nieuwe investering/
nieuwe innovatie?
Aan de noodzaak en de terugverdientijd. Noodzaak kan zijn arbo-technisch en inhoudelijk naar de machine kijk je ook naar de terugverdientijd.

Knowledge

1. Over het algemeen gesproken, maakt u bij het beslissen een innovatie aan te schaffen gebruik van bestaande kennis van vroegere aankoop beslissingen, van kennis over bestaande producten of allebei?
Allebei, maar in oplopende volgorde. Minder de kennis van vroeger. Vaak achterhaalt. Maar de kennis van de huidige middelen.
2. Wat had deze kennis tot inhoud? Wat waren de knelpunten van eerdere investeringsbeslissingen?
Het hele palet wat je. Alle facetten. Inzetbaarheid. Het verleden houdt je niet tegen om erin te investeren.
3. Waaraan zou de robot moeten voldoen, vergeleken met eerder verworven kennis en knelpunten?
Het hele palet weer.

Others

Education

1. Wat is het gemiddelde opleidingsniveau van de medewerkers binnen uw bedrijf?
MBO
2. Zou het opleidingsniveau van de medewerkers eisen aan de robot stellen?
Productie LBO, Middenkader MBO, aantal projectleider HBO – gemiddeld MBO.
Machine zal LBO niveau ingezet worden.

Welke zijn dat?

Gemaakt belangrijk en geen ingewikkelde zaken.

3. Hoe belangrijk acht u deze eisen aan de robot? Zouden deze eisen u ervan kunnen overtuigen een robot aan te schaffen?
Ja, deze zijn van invloed.
4. Zijn deze eisen (dan wel) cruciaal voor geïnteresseerd raken in een robot?
Geen interesse, geen investering. En vice versa. Ik persoonlijk vind dat er geen verschil zit. Ja dat kan ook aan de organisatie liggen.

Total

1. Ten slotte, welke van de volgende karakteristieken van de robot lijkt u het meest belangrijk om een robot aan te schaffen?
 - a. De robot is vanuit een economisch perspectief (productiever, goedkoper, winstgeverder) beter dan de vorige situatie/oplossing.
 - b. De robot is vanuit een sociaal perspectief (beter voor de gezondheid van de medewerker) beter dan de vorige situatie/oplossing.
 - c. De robot past beter bij de waarden en eerder opgedane ervaringen van ons bedrijf.
 - d. Met de robot kunnen wij van tevoren op experimenteer basis mee aan de slag.
 - e. De uitkomsten/resultaten/effecten van de robot zijn voor iedereen binnen ons bedrijf zichtbarer.
 - f. De robot is gemakkelijker te gebruiken/bedienen en te begrijpen

Interview, Gemeente Rotterdam, Public Domain

Environment

Competitive Pressure

1. Bestaat er concurrentie druk op de gemeente (...)?
Voor onze eigen afdeling niet. Al onze bestratingwerkzaamheden komen naar onze afdeling toe.
2. Kunt u beschrijven in hoe verre u door het feit dat er (geen) concurrenten zijn uw investeringsgedrag beïnvloed wordt? (terughoudend of uitgevend)
Wij zijn al gemeente heel erg terughoudend geweest om te investeren, altijd al. Alleen het laatste jaar zijn we gaan investeren. Da ligt erin dat wij meer machinaal moeten bestraten, nog meer als we al deden, we deden namelijk al heel erg veel. Maar dat werd voornamelijk gedaan door aannemers die we een jaarcontract geven. Nu willen we ook eigen ploegen laten bestraten, dus heb je eigen machines nodig.
3. Heeft dit specifieke investeringsgedrag invloed op de eisen die u stelt aan de stratenleg robot?
Nee.
4. Zijn deze eisen belangrijk als het erom gaat geïnteresseerd te raken in een stratenleg robot?
5. Of denkt u dat de eisen belangrijker zijn voor de beslissing in een stratenleg robot te investeren?
6. Of maakt het geen verschil?

Goals

Social requirement

Als gemeente bent u een openbare instelling binnen het publieke domain. Net zoals private bedrijven heeft een gemeente doelen en een missie. Bovendien moeten gemeentes de eisen vanuit de maatschappij tegemoet komen en dit moet in hun handelen duidelijk worden.

1. Bent u het hiermee eens?
Ja.
2. Welke maatschappelijke eisen heeft de gemeente (...) als het om een stratenleg robot gaat?
Geen. Wij hebben eisen aan het machinaal straten in het kader van arbeidsomstandigheden, maar dat heeft niets met een stratenleg robot te maken. Dat heeft alles te maken met het feit dat er veel minder stratenmakers zijn dan vroeger en dat er uitstroom is aan stratenmakers. Dus er moet wat veranderen binnen de hele branch. Daar zijn we al sinds 1981 voorloper in eigenlijk. Alle eisen zijn niet specifiek ontstaan door de stratenleg robot, deze hebben al altijd bestaan.
3. Waaraan zou de stratenleg robot moeten voldoen om aan deze eisen tegemoet te komen
Hij zou aan de boven beschreven eisen moeten voldoen. Arbovriendelijk bijv.
4. In welke mate is deze eis belangrijk voor het wel of niet aanschaffen van een robot?
Ja, het is een duidelijk eis om in een machine te investeren. We hebben 10 aannemers en al onze aannemers hebben als eis meegekregen om hier te mogen werken, dat zij bestratings machines moesten hebben.
5. In welke mate is deze eis belangrijk voor het wel of niet geïnteresseerd raken in een robot?
6. Verschillen deze?

Social responsibility

U draagt een bepaalde verantwoordelijkheid mbt uw organisatie en de mensen die hier van deel uit maken.

1. Klopt dat?
Ja.
2. Kunt u deze verantwoordelijkheid nader toelichten/specificeren?
Personeelsbeleid. Verantwoordelijkheid voor de doorstroom, wanneer ze het zelf willen. Want er is veel fysiek zwaar werk. Dan kunnen ze doorstromen naar andere fysiek lichter werk bijvoorbeeld.
3. Welke verantwoordelijkheid is voor u het meest belangrijk? Waarom?
Boven beschreven.
4. Waaraan zou een nieuwe stratenleg robot vervolgens aan moeten voldoen om uw verantwoordelijkheden tegemoet te komen/realiseren te kunnen?
Als met de machine met minder inspanning profijt kan brengen, dan prima.
5. In het geval de innovatie voldoet aan de eisen, zouden deze eisen voldoende zijn om een stratenleg robot aan te schaffen? Waarom wel/niet? Nee, want we investeren niet, we zijn wel geïnteresseerd. Om te investeren moet ie bewezen hebben dat ie functioneert.
6. Zouden de eisen (dan wel) voldoende zijn om geïnteresseerd te raken? Waarom wel/niet?
Ik ben in iedere innovatie geïnteresseerd maar dat wil niet zeggen dat ik er ook in wil investeren. Dat zijn totaal verschillende dingen. Het verschil is eigenlijk dat wij geen risico dragend kapitaal mogen vrij maken. Wij hebben met geld van de stad te maken en als we op de een of ander manier geld kwijt raken, dan....heb je geen goed verhaal naar je burger. Wij willen hem wel kopen maar dan moet ie

wel drie maanden perfect gefunctioneerd hebben in de markt. Innovaties prima, risico nee.

7. Maakt het een verschil?

Structure

1. Hoe is uw organisatie ingericht?
 - a. Zijn er veel hiërarchische lagen?

Burgermeester en Wethouder, dan heeft Rotterdam verschillende diensten zoals wij dat noemen. Een van deze is gemeentewerk Rotterdam; daar heb je een algemene directeur, hij heeft drie sectordirecteuren, een van deze is sectordirecteur buitenruimte. Onder deze heb je de subafdeling onderhoud wegen. Daar zit je mee aan tafel. Deze heeft ook nog drie teamleiders en sinds kort ook nog een adviseur.
 - b. Zou u zeggen dat de gemeente (...) flexibel is? Waarom wel/niet?
 - c. Denkt u dat u open bent voor nieuwe producten/innovaties?

Ja, we zijn altijd open voor innovaties.
 - d. Heeft u binnen de gemeente (...) veel formele procedures? Zijn procedures schriftelijk vastgelegd?

Ja, dit is nu eenmaal zo.
 - e. Bent u over het algemeen gesproken terughoudend risico's te nemen?

We nemen helemaal geen risikos.
 - f. Zou u eisen aan de stratenleg robot kunnen bedenken die hieruit voortvloeien?

Mits ja, zouden deze eisen voldoende zijn om in een stratenleg robot te investeren?
Hij moet marktconform werken. De prijs per m2 mag niet hoger zijn dan de prijs die we betalen of die we krijgen. Als ie dat kan, dan maakt de investeringskosten niet meer uit. Als ie dan 4ton kost maar marktconform kan werken. Prima. We maken 750.000meters op jaarbasis, en machine is bij ons altijd rendabel.
 - g. Zijn deze wel voldoende om in een stratenleg robot geïnteresseerd te raken?
 - h. Maakt het enig verschil?

Size

1. Hoe veel medewerkers bevat de gemeente (...)?
2. Denkt u dat de grootte van de gemeente (...) ertoe bijdraagt dat u een hoger verlangen heeft mbt innovatie adoptie om de performance te bevorderen in tegenstelling tot kleinere bedrijven?

Dat weet ik niet, maar we zijn wel continue opzoek naar nieuwe oplossingen om ons werk effectiever en efficiënter te maken om beter werk voor de burger te kunnen leveren.
3. Wat is vervolgens de eis aan de robot die hieruit voortvloeien?

Hij moet juist dit kunnen.
4. Is dit een belangrijk eis mbt het wel of niet aanschaffen van een robot?
5. Is dit (dan wel) een belangrijk eis mbt het wel of niet geïnteresseerd raken in de robot?
6. Is dit belangrijk voor het wel of niet geïnteresseerd raken?

Decision-making

1. Verloopt over het algemeen gesproken het beslissing nemen binnen de gemeente (...) soepel of woestig?

In het algemeen worden beslissingen iets te doen binnen de gemeente Rotterdam, heel hard genomen.

2. Waaraan ligt dit?
De mentaliteit binnen de gemeente Rotterdam. Geen woorden maar daden. Weinig gesprekken en vergaderingen...beslissingen worden hard genomen als er maar geen risico aan de burgen verbonden is.
3. In hoe verre bent uzelf vrij in het beslissing nemen mbt investeringen?
Helemaal niet vrij.
4. Zijn er veel instanties die toezicht op uw werk en uw beslissingen houden?
Ja, 600.000 burgers. Je hebt ook directe toezichthouders.
5. Waaraan hecht u hierdoor het meeste aandacht mbt een nieuwe investering/nieuwe innovatie?
Er moet een goed bewijsstuk liggen. Wij dragen voor en andere beslissen.
6. Zijn deze aandachtspunten cruciaal voor het wel of niet beslissen een innovatie aan te schaffen?
7. Of zijn de aandachtspunten belangrijker voor het geïnteresseerd raken in een robot?

Knowledge

1. Over het algemeen gesproken, maakt u bij het beslissen een innovatie aan te schaffen gebruik van bestaande kennis van vroegere aankoop beslissingen, van kennis over bestaande producten of allebei?
De hele scala. We hebben een 77 man op onze afdeling.
2. Wat had deze kennis tot inhoud? Wat waren de knelpunten van eerdere investeringsbeslissingen?
Het totale plaatje is belangrijk.
3. Waaraan zou de robot moeten voldoen, vergeleken met eerder verworven kennis en knelpunten?
4. Hoe groot acht u eerder verworven kennis bij het beslissen een robot aan te schaffen?
5. Hoe groot acht u eerder verworven kennis bij het wel of niet geïnteresseerd zijn in een robot?
6. Zijn er verschillen in?

Others

Education

1. Wat is het gemiddelde opleidingsniveau van de medewerkers binnen de gemeente (...)?
2. Zou het opleidingsniveau van de medewerkers eisen aan de robot stellen?
3. Welke zijn dat?
4. Hoe belangrijk acht u deze eisen aan de robot? Zouden deze eisen u ervan kunnen overtuigen een robot aan te schaffen?
5. Zijn deze eisen (dan wel) cruciaal voor geïnteresseerd raken in een robot?

Financial Budget

1. In hoe verre bent u er vrij in om geld te investeren?
2. Zijn er nog meer mensen bij betrokken?
3. Welke overwegingen neemt u om geld te investeren?
4. Welke overwegingen zijn het belangrijkste?
5. Hebben deze overwegingen voldoende kracht een robot aan te schaffen?

6. Hebben deze overwegingen voldoende kracht om u geïnteresseerd te laten raken in een robot?
7. Verschillen deze?

Total

1. Ten slotte, welke van de volgende karakteristieken van de robot lijkt u het meest belangrijk om een robot aan te schaffen?
 - a. De robot is vanuit een economisch perspectief (productiever, goedkoper, winstgevender) beter dan de vorige situatie/oplossing.
 - b. De robot is vanuit een sociaal perspectief (beter voor de gezondheid van de medewerker) beter dan de vorige situatie/oplossing.
 - c. De robot past beter bij de waarden een eerder opgedane ervaringen van ons bedrijf.
 - d. Met de robot kunnen wij van tevoren op experimenteer basis mee aan de slag.
 - e. De uitkomsten/resultaten/effecten van de robot zijn voor iedereen binnen ons bedrijf zichtbarer.
 - f. De robot is gemakkelijker te gebruiken/bedienen en te begrijpen.

Interview GMB-LBS, Private Domain

Environment

Competitive Pressure

1. Vind u dat er concurrenten zijn binnen uw vak?
Ja, daar op het ogenblik behoorlijk wat concurrentie in. Wij zijn zelf begonnen in 1983 met machinale bestrating. Ik denk dat we toen een voorloper waren. Nadat we in '83 met machinale bestrating begonnen zijn, toen waren we de eersten die op grootschalige manier met bestrating zijn gestart. Daarna zijn er nog wat andere gekomen, deze ontwikkeling is doorgegaan en waarom is er nu vooral concurrentie, omdat we volgens de regelgeving verplicht zijn om bepaalde hoeveelheden. Dan is, zo ver ik me herinner 1500m², 8cm, aaneengesloten, dat moet dan machinaal en daarnaast zitten wij in de havengebied met 10-12cm stenen en deze moeten we in principe alle machinaal leggen. Dus iemand die daar in mee wil doen, die zal machinaal moeten leggen, want met de hand, helaas zien we hier en daar nog wel wat gebeuren. Het mag eigenlijk niet meer. Dus veel concurrentie.
2. Kunt u beschrijven in hoe verre u door het feit dat er concurrenten zijn in uw investeringsgedrag beïnvloed wordt? (terughoudend of uitgevend)
Dat heeft alles met beleid te maken. Kijk, 25 jaar geleden, toen hadden wij als speerpunt in het beleid van onze onderneming, bestrating en toen dus machinale bestrating. Het beleid als zodanig is nu geen speerpunt meer in het beleid, dus, wij vinden dat wij een goed systeem hebben. Daarom wordt er op dit moment niet veel geïnvesteerd omdat wij een stuk of 15 klemmen hebben waar wij machinaal de stenen mee weg leggen. Daar is wat onderhoud aan, dat kunnen we zelf op de werkplaats repareren. Dus heeft dat invloed: ja, a) de concurrentie en b) het beleid is wat gewijzigd. Nu is het een afgeleide en geen speerpunt meer.
3. Welke eisen stelt u aan een robot vanwege het feit dat er concurrenten zijn?
Dat zou nauwelijks zijn. Misschien zijn we een beetje eigenwijs erin, maar wij denken dat we het beste systeem hebben. Dit moet het zijn. Dus omdat we zelf

een apparaat ontworpen hebben, weten wij het beste wat het gekost heeft en wat het dan nu in de huidige markt kost.

Goals

Social responsibility

U draagt een bepaalde verantwoordelijkheid mbt uw organisatie en de mensen die hier van deel uit maken.

1. Klopt dat?
Ja, dat klopt.
2. Kunt u deze verantwoordelijkheid nader toelichten/specificeren?
Als uitvoerende kracht heb je bepaalde verantwoording voor de mensen die ermee werken, veiligheid, arbeidsomstandigheden. Maar ook productie en financiële gebeuren.
3. Welke verantwoordelijkheid is voor u het meest belangrijk? Waarom?
Het is triest om te zeggen maar het is geld. Het is keihard. Ik wordt niet beoordeeld of ik heel erg veilig gewerkt heb. Ik wordt vooral beoordeeld van heb ik voor de kostprijs gedaan die we gezet hadden en als het kan iets lager en daar scoor je in. Dat wil niet zeggen, als de mensen zonder helm werken waar ze per se met helm moeten werken, dat er dan gezegd wordt, je hoeft nergens naar te kijken. Het is niets waar je op afgerekend wordt. Ik denk dat dit 30 jaar geleden anders was dan nu, maar de maatschappij is in wezen keihard. Het moet gewoon geld opbrengen en dat is ook de reden waarom het geen speerpunt meer is binnen onze organisatie. Omdat er wel weer veel concurrenten zijn.
4. Waaraan zou een nieuwe stratenleg robot vervolgens aan moeten voldoen om uw verantwoordelijkheden tegemoet te komen/realiseren te kunnen?
Ons systeem is het best. Als je aan herbestrating denkt dan hebben we al een keertje wat ontwikkelt, dat was de opper. Het was een prachtig systeem maar het bracht niet op wat het kostte.
5. In het geval de innovatie voldoet aan de eisen, zouden deze eisen voldoende zijn om een stratenleg robot aan te schaffen? Waarom wel/niet? Ja, maar hij moet aan de eisen voldoen. Een geld is hier wel het belangrijkste.
6. Zouden de eisen (dan wel) voldoende zijn om geïnteresseerd te raken? Waarom wel/niet?
Ja, geld is het belangrijk...maar er is voor mij geen verschil tussen investeren en geïnteresseerd raken. Geïnteresseerd raken is alleen een stap.

Structure

1. Hoe is uw bedrijf ingericht?
 - a. Zijn er hiërarchische lagen?
 - b. Denkt u dat u open bent voor nieuwe producten/innovaties?
 - c. Heeft u binnen uw bedrijf formele procedures? Zijn procedures schriftelijk vastgelegd? Denkt u dat deze meer zijn dan bijvoorbeeld bij gemeentes?
2. Zou u eisen aan de stratenleg robot kunnen bedenken die hieruit voortvloeien?

Size

1. Hoe veel medewerkers bevat uw bedrijf?
150. In totaal 460. Maar we hebben een drietal locaties. Vooral voor machinaal bestraten hebben wij onderaannemers die dit voor ons uitvoeren. We hebben

- wel zelf de machine, maar de mensen huren we wel op tariefbasis in. In de bestrating zijn we een grote spelen, en vooral in de zware bestrating. Niet zo zeer in het gemeentelijke werk, maar in industrieterreinen en havengebied.
2. Denkt u dat u hierdoor vatbarer bent voor nieuwe producten ten opzichte van grotere bedrijven omdat het bijvoorbeeld korter zal duren voordat iedereen binnen het bedrijf de innovatie aanvaard?
Ja....ja.....ja....maar ik denk ook dat innovatie en zo heeft ook alles weer met geld te maken. Ons beleid is wel gericht op innovatie maar dan neem je er wel iemand voor aan die daarmee bezig is. Die kosten zijn namelijk betrekkelijk klein. Als je gaat investeren in apparatuur, daar moet je wel enigszins verzekert zijn dat je daarmee een positief resultaat mee behaalt.
 3. Speelt de mate in hoe verre de resultaten van een stratenleg robot (minder uitval, productiever werken, werk wordt vervangen) zichtbaar zijn, een rol?
Nee, dat speelt geen rol.
Als er een robot is die het werk van een mens kan doen dan zouden we meteen voor een robot kiezen. Maar hij moet het wel doen.
 4. Is dit een belangrijk eis mbt het wel of niet aanschaffen van een robot?
Productief werken is het meest belangrijk bij de aanschaf van een robot.
 5. Verschil?
Nee, het maakt geen verschil.

Decision-making

1. Verloopt over het algemeen gesproken het beslissing nemen binnen uw bedrijf soepel?
2. Waaraan ligt dit?
3. In hoe verre bent uzelf vrij in het beslissing nemen mbt investeringen?
4. Waaraan hecht u hierdoor de meeste aandacht mbt een nieuwe investering/nieuwe innovatie?
5. Zijn deze aandachtspunten cruciaal voor het wel of niet beslissen een innovatie aan te schaffen?
6. Of zijn de aandachtspunten belangrijker voor het geïnteresseerd raken in een robot?

Knowledge

1. Over het algemeen gesproken, maakt u bij het beslissen een innovatie aan te schaffen gebruik van bestaande kennis van vroegere aankoop beslissingen, van kennis over bestaande producten of allebei?
Allebei, zondermeer. Het komt ook een stukje historie erbij. Dat wil iedereen betrekken, alleen,Vroegere ervaring met problemen en knelpunten van machines zijn belangrijk.
2. Wat had deze kennis tot inhoud? Wat waren de knelpunten van eerdere investeringsbeslissingen?
Vroegere functies van eerdere machines zijn erg belangrijk. Financieel niet zo zeer. Wel dat ie het op termijn eruit moet halen.
3. Waaraan zou de robot moeten voldoen, vergeleken met eerder verworven kennis en knelpunten?
4. Hoe groot acht u eerder verworven kennis bij het beslissen een robot aan te schaffen?
5. Hoe groot acht u eerder verworven kennis bij het wel of niet geïnteresseerd zijn in een robot?
6. Zijn er verschillen in?

Others

Education

1. Wat is het gemiddelde opleidingsniveau van de medewerkers binnen uw bedrijf?
Dan moet je wel aan LBO denken. Uitzonderingen zijn er.
2. Zou het opleidingsniveau van de medewerkers eisen aan de robot stellen?
Ja, de complexiteit van de robot is een belangrijk eis.
3. Welke zijn dat?
4. Hoe belangrijk acht u deze eisen aan de robot? Zouden deze eisen u ervan kunnen overtuigen een robot aan te schaffen?
Als er een hoog opleidingsniveau voor de machine vereist is, dan zouden we de keuze niet maken.
5. Zijn deze eisen (dan wel) cruciaal voor geïnteresseerd raken in een robot?
Geen interesse, geen investering. En vice versa.
Ook niet geïnteresseerd raken.
Nogmaals, het belangrijkste is, dat de machine dat oplevert wat ik erin heb gestoken. De investering moet er uit komen. Als hierdoor bijvoorbeeld een hoog opleidingsniveau vereist zou zijn is dat prima...

Financial Budget

1. In hoe verre bent u er vrij in om geld te investeren?
2. Zijn er nog meer mensen bij betrokken?
3. Welke overwegingen neemt u om geld te investeren?
4. Welke overwegingen zijn het belangrijkste?
5. Hebben deze overwegingen voldoende kracht een robot aan te schaffen?
6. Hebben deze overwegingen voldoende kracht om u geïnteresseerd te laten raken in een robot?
7. Verschillen deze?

Total

1. Ten slotte, welke van de volgende karakteristieken van de robot lijkt u het meest belangrijk om een robot aan te schaffen?
 - a. De robot is vanuit een economisch perspectief (productiever, goedkoper, winstgevender) beter dan de vorige situatie/oplossing.
 - b. De robot is vanuit een sociaal perspectief (beter voor de gezondheid van de medewerker) beter dan de vorige situatie/oplossing.
 - c. De robot past beter bij de waarden en eerder opgedane ervaringen van ons bedrijf.
 - d. Met de robot kunnen wij van tevoren op experimenteer basis mee aan de slag.
 - e. De uitkomsten/resultaten/effecten van de robot zijn voor iedereen binnen ons bedrijf zichtbarer.
 - f. De robot is gemakkelijker te gebruiken/bedienen en te begrijpen.