

The Influence of Pro-Environmental Behavior Stages on e-Learning Platform Acceptance in Public Works

Lisa Michanol and Jean-Christophe Sakdavong

CLLE Lab, UMR5263 CNRS, University of Toulouse, Allée A. Machado, 31058 Toulouse cedex 9, France

Keywords: UTAUT2, SSBC, Public Works, e-Learning, Ecological Transition.

Abstract: This study investigates the correlation between awareness of the importance of ecological transition and the acceptance of a digital platform providing educational resources for Public Works professionals. Using data from 42 users of the platform "tpdmain", the research examines the influence of an individual's stage in pro-environmental behavior change (as defined by the SSBC model) on their acceptance of the platform's resources. The study also explores the relationship between perceived organizational responsibility for ecological transition and social influence on platform adoption. While the level of individual awareness did not significantly influence platform acceptance, the individual's stage in pro-environmental behavior change did. The organizational dimension significantly impacted social influence, which in turn influenced the perceived acceptability of the platform's resources. These findings provide insights for further research on the intersection of pro-environmental behavior and technology acceptance in the context of Public Works.

1 INTRODUCTION

Climate change is a growing concern for citizens worldwide, impacting all regions from glaciers to the Pacific Islands and posing a significant threat to biodiversity, agriculture, citizens, and infrastructures. In France, the public sector is playing a major role in addressing the consequences of climate change. The Intergovernmental Panel on Climate Change (IPCC) estimates a temperature increase of 4°C by 2100. The National Federation of Public Works (NFPW) has implemented measures to mitigate these effects, such as exposing schools to extreme heat, 50% of the railway network, and 75% of the road network to extreme heat risks.

Digital technologies are increasingly being used in the public sector, particularly for facilitating technical learning through virtual and augmented reality. E-learning platforms are also available for public sector professionals, offering courses on various topics. However, the use of digital technologies by trainers is not automatic. To ensure the best use of these technologies, they must be well-accepted and mentored.

This study focuses on two aspects: the acceptance of information and communication technology (ICT) for professional enrichment and the recognition of the need to be aware of the environmental damage that can lead to public sector jobs being forced to adapt to the ecological transition. The study will explore different models of technology acceptance, distinguishing between acceptability and acceptance. It will also explore the relationship between a more environmentally friendly behavior and technology acceptance.

The research methodology used will be discussed, with the aim of concluding with the results obtained and proposing complementary research perspectives. The study will also explore the role of e-learning in public sector jobs, highlighting the importance of promoting sustainable practices and fostering a positive attitude towards climate change.

The question of the ecological transition is increasingly present in public work, as the consequences of climate change become more visible each year. Public works sector is one of the largest energy consumers, producers of waste, and a contributor to artificial soil use. As part of a DEFFINUM¹ project, an analysis on the cognitive ergonomics of the platform is being conducted. In

¹ <https://travail-emploi.gouv.fr/deffinum>

parallel, researchers are focusing on the acceptance of educational resources dedicated to the ecological transition.

The study aims to explore the influence of the perception of the importance of the ecological transition on the acceptance of a public work-oriented course platform.

The following part will provide an overview of the literature on the two important subjects of this paper: Pro-Environmental behavior and Technology Acceptance.

1.1 Pro-Environmental Behavior

Pro-environmental behavior refers to conscious actions taken by individuals to reduce negative impacts on the environment and/or increase environmental quality. There are several theories to explain this behavior, including the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Norm Activation Model (NAM) (Schwartz, 1977), and the Value-Belief-Norm Theory (VBN) (Stern, 20002).

The social cognitive perspective, with its model of reciprocal causality (Bandura, 1986) (Triadic Reciprocal Causation Model), suggests that three factors have a bi-directional effect on each other (cognitive or personal factors affecting the environment and behavior). Personal agency is also considered, as individuals can choose, execute, and manage their own actions to achieve desired outcomes.

The concept of 'goal' (the intention of an individual to engage in an activity) is another important notion in the social cognitive perspective. These theories focus on processes of behavioral change, particularly in the field of ecology. However, in our research, we will focus on a particular model: the Self-Regulated Behavioral Change (SSBC) model (Bamberg, 2013) (see figure 1).

1.2 From MAP to SSBC

The MAP (Heckhausen and Gollwitzer, 1987) is used as a theoretical base to conceptualize behavioral changes as a transition through four stages: pre-decisional, pre-actional, and post-actional. The first stage corresponds to the moment when an individual formulates voluntary wishes that they transform into actions. This form of self-engagement is called the intention of goal and is formed by the individual reflecting on the feasibility and desirability of achieving these goals. The second stage, pre-actional, occurs when an individual selects the best strategies for achieving fixed goals, followed by a phase of

reflection on the pros and cons of adopting an alternative behavior.

Behavioral intention marks the transition to the third stage, the action stage, where the individual is tasked with putting the chosen behavioral strategies into action by initiating and implementing the necessary actions. This implementation is facilitated according to (Gollwitzer, 1999, as cited in Bamberg, 2013) by the implementation intention, which creates a strong mental link between the desired new behavior and a future situation. This situation is critical, as it is what allows reaching the final stage, the post-actional stage, which is the stage of evaluating what has been done by the individual and reflecting on what requires further actions or not. It is also the stage where the individual must prove that they can maintain their new behavior and not regress.

The MAP does not describe in detail the psychological factors that contribute to progressions through the stages. The SSBC will also incorporate parts of the TPB (Ajzen, 1991) and the NAM (Schwartz, 1977). The TPB views Pro-Environmental behaviors as a consequence of a 'rational choice.' According to the TPB, the closest behavioral factors are behavioral intentions, influenced by the degree to which the individual maintains a positive attitude towards the behavior, the perceptions the individual has of the norms and conventions regarding the behavior (for example, the subjective norm), and the degree to which the individual perceives the behavior as being within their control.

The SSBC as a theoretical basis is also applicable to research on behavior change. Unlike static models like the TPB, the SSBC argues that behavior change is a decision made in multiple stages. The SSBC will also remove the social norm present in the TPB, as Bamberg rather assumes that in the pre-decisional phase, perceived social disapproval can motivate the individual to reflect on personal goals.

The four stages of behavior change, the three types of intentions, and the affective and socio-cognitive factors outlined by the SSBC (see figure 1) provide a solid theoretical foundation in behavior change research.

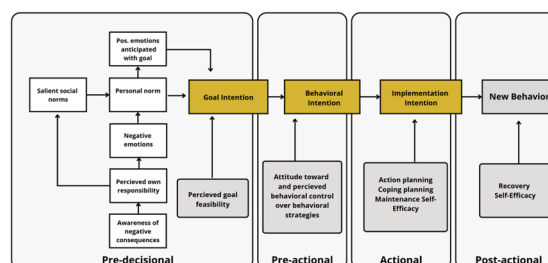


Figure 1: SSBC Model (Bamberg, 2013).

1.3 The Acceptance of Technology

The concept of technology acceptance is an important element for their proper use and appropriation by users. Research on technology acceptance has been inspired by social psychology research, particularly the Theory of Reasoned Action (TRA) (Sheppard, 1988, as cited in Venkatesh and al., 2003) and the Technology Acceptance Model (TAM).

Davis (1989) developed the TAM, which aimed to explain and predict an individual's acceptance of technologies. It encompasses two main concepts: the perception of usefulness and ease of use. If the technology is easy to use and useful, it increases the chances of actually using it. Davis and Venkatesh (2000) developed a second version of the TAM called TAM-2, which is an extension offering more variables.

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh and al., 2003) is the result of a theoretical study of major acceptance models and a longitudinal study on the other hand (see figure 2). The TAM models and their variants, TAM2 and 3 and UTAUT1 and 2, are based on the psychosocial theories of TRA and TPB.

The models primarily seem to allow for understanding users' intentions "a priori"; however, in our context, the participants are individuals who already have access to the technology in question. The TAM models and their variants seen earlier such as UTAUT1 and 2, are based on the psychosocial theories of TRA and TPB.

The interest of these approaches lies in the predictions that can be made regarding the use of a product. They seek to model probable future behaviors based on a number of social cognitive indicators. If the tool is not used effectively, these approaches allow for anticipating the subjective reasons for the rejection or adoption of the technology.

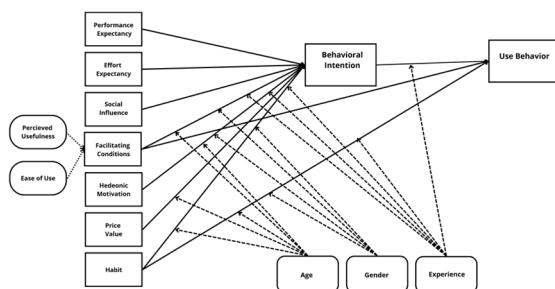


Figure 2: UTAUT2 Model (Venkatesh et al., 2012).

However, these models seem to rely primarily on a quantitative system, with a large number of

participants, thus risking overlooking the contextual nature of the professional situation and the heterogeneity of individuals. These predictive models highlight the crucial and determining role those social cognitions play, considering that the majority of actions are under the user's control, that their behavioral choices are deliberate, and that the intention to use is a commitment regarding their future behaviors.

1.4 Acceptability Models and Situated Acceptance

This notion of "acceptability" is addressed by technology acceptance models, which are described as ergonomic devices to make them more practical, usable, and digitally accessible. Models such as TAM and UTAUT are part of acceptance models, but they are also considered predictive models, allowing us to determine if an individual is likely to accept, but not whether they actually accept and concretely adopt a technology, and even less whether they continue to accept or reject a technology over time.

Practical acceptability (PA) is when we seek to create ergonomic devices to make them more practical, more usable, and digitally accessible, thus more compatible with the specific needs that individuals may have. PA is interesting when concrete solutions are needed to evaluate and design a system. It is a factor limited to functional and instrumental dimensions. Nielsen proposed a model in 1994 with Practical Usability (PU) and Social Acceptability (SA), which introduces the idea of taking into account users' perceptions regarding technologies.

Social Acceptability is an initial step in the process of adopting a technology, expressing the potential degree of acceptance by the user. Attention is thus focused on the subjective representation of technology by its potential users. Models such as TAM and UTAUT are part of the Social Acceptability.

Social acceptability would predict less the intentions of use for upcoming tools than it would gather the feelings of past uses. It indeed considers that social acceptability models would perceive technology as an independent and autonomous object in relation to the user and the environment in which it operates. Social acceptability could therefore be a first step in a broader process of individual appropriation of a technology.

Situated Acceptance (SA) is described by Bobillier-Chaumont (2016) as the implementation of technology in its context of use, allowing for a

concrete evaluation of its contributions and limitations, and thus defining its relevance in relation to the individual's activities and projects. Technology only makes sense within a framework and an organization.

Bobillier-Chaumon (2016) proposes four dimensions in SA: the individual or intra-personal dimension, related to the individual's own activity; the impersonal or organizational and technical dimension, related to the organization in which the individual works and the technology's ability to meet needs and inspire trust from the individual; the relational or interpersonal dimension, related to collective and collaborative activities in the workplace; and the transpersonal or professional and identity dimension, related to the individual's sense of self-efficacy.

1.5 SSBC, UTAUT2 and Situated Acceptance

The choice in this research is to draw inspiration from these studies on technology acceptance using the UTAUT2 model and the concept of SA, and the effective use of a device.

The SSBC and UTAUT2 are two behavioral models designed to predict and understand behaviors related to ecology and the use of new technologies.

While there are numerous articles referencing these models for assessing the acceptance of technologies and the adoption of Pro-Environmental behavior, no studies have been conducted combining them. In a study by Keller et al. (2021), it was found that in addition to the four stages of transition, individuals may be in a denial or inhibition phase of transitioning from disposable to recyclable goblets. This idea is interesting because it opens up the possibility of seeing whether an individual in a pre-decisional denial or inhibition phase would also be in a less acceptable and effective form of accepting resources from a Public Work (PW) platform.

The research on the acceptance of technologies and Pro-Environmental behavior has allowed for a global view of the state of the research. Many studies have been conducted in various contexts, and it is important to consider the elements of social acceptability, with some factors of UTAUT2 (perceived usefulness, ease of use, and social influence) and the elements of situated acceptance (organizational dimension and effective utilization). The SSBC model's transition stages (pre-decisional, pre-actional, actional, and post-actional) and the intention to implement are considered.

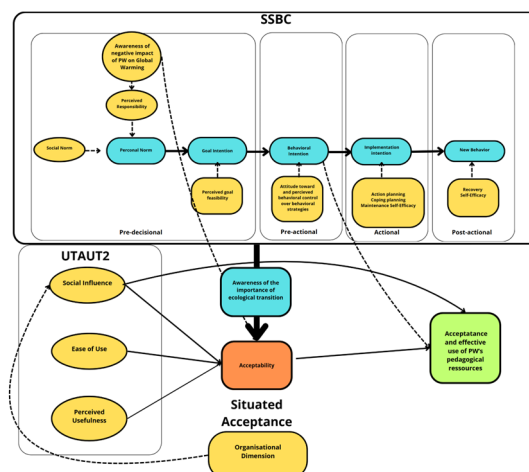


Figure 3: Combination of SSBC and UTAUT2 Models with Situated Acceptance.

The research aims to determine the impact of awareness of the impact of climate change on the level of advancement in ecological transition in the PW instructor's work with a PW e-learning platform.

The proposed hypotheses are the following:

- H1. The level of awareness positively influences the acceptance of a PW e-learning platform.
- H2a. The stages of SSBC positively influence the acceptability of a PW e-learning platform.
- H2b. The stages of SSBC positively influence the acceptance of a PW e-learning platform.
- H3. The organizational dimension of situated acceptance has a positive influence on the social influence (from UTAUT2).
- H4. The “social influence” has a positive influence on the acceptance of the resources from a PW e-learning platform.

2 METHOD

This research was conducted with participants from the tpdmain platform, an e-learning PW platform created by the Fédération Nationale des Travaux Publics (NFPW) in France. tpdmain is a platform that gives access to educational resources such as texts playlists, videos, and educational pathways accessible without the need for account creation. It responds to the DEFINUM project, a plan of transformation and digitalization of training piloted by the Ministry of Labour, and the ‘Ecological Transition in Public Works’ project within France 2030.

tpdomain proposes a wide range of themes related to various public sector jobs, ecological transition, and a training program for PW instructors, aiming to sensitize them to pedagogy in an autonomous training path. The platform offers various types of content, including educational videos, images, and courses produced with the French Learning Content Management System (LCMS) Storiz.

The majority of the educational resources on tpdomain are creative e-learning content for different clients, their employees, and their instructors, and can be used without a teacher.

The study involved 59 participants who were instructors and had previously used resources from the PW platform. The selection criteria included the knowledge of the platform, age limit, and potential affinities with technologies or climate change. Only 42 participants completed at least 18% of the questionnaire, while 17 others were excluded due to lack of data to handle.

The questionnaire was sent via social networks to a community of PW instructors who had already used the platform. It was available for about two months.

The research was conducted on various axes, with several hypotheses proposed. The questionnaire was divided into four blocks: one on UTAUT2 (thirty-four items), one on SSBC (with questions for the four stages of transition), and one block on the organization's responsibility (one question divided into five parts). For each item, a five-point Likert scale was used.

We created the questionnaire and collected the data on Qualtrics. The data has then been statistically treated on Jamovi.

3 RESULTS

Among the 42 participants, most were men ($n=30$), with a smaller number of women ($n=4$). One participant did not specify their gender, and 7 did not answer the question. The average age of the participants was 49.1 years for men, 45.5 years for women, and 53 years for the participant who did not specify their gender.

The majority of the participants (91.2%) indicated that they had used the digital platform at least once. In terms of the level of awareness of the importance of ecological transition, the participants showed an average level of awareness. Regarding the stages of the SSBC model (Bamberg, 2013), most of the participants were in stage 4 (post-actional).

To test the hypothesis H1 (the level of awareness positively influences the acceptance of a PW e-learning platform), we conducted an ANOVA test that showed the level of awareness did not have a significant influence on acceptance (measured by Effective Use) ($F(1.33)$, $p = .268$, $\eta^2 = .541$). This suggests that the level of awareness of the training organization does not influence the acceptance of the resources by the trainers.

For Hypothesis H2a (the stages of SSBC positively influence the acceptability of a PW e-learning platform) and H2b (the stages of SSBC positively influence the acceptance of a PW e-learning platform), we tested the influence of SSBC stages on both Acceptability and Acceptance with two ANOVA tests.

The ANOVA test for the influence of SSBC stages on UTAUT2 was close to significance ($F(2.83)$, $p = .054$, $\eta^2 = .209$), indicating a potential positive effect.

The ANOVA test for the influence of SSBC stages on acceptability measured by effective use was significant ($F(4.92)$, $p = .006$, $\eta^2 = .316$), indicating that the SSBC stages have an influence on the acceptance of the platform by individuals with a large effect size.

To test Hypothesis H3 (The organizational dimension of situated acceptance has a positive influence on the social influence), we conducted an ANOVA test which confirmed that the organizational dimension of situated acceptance has a significant impact on social influence ($F(3.88)$, $p = .002$, $\eta^2 = .556$) with a large effect size.

For hypothesis H4 (The "social influence" has a positive influence on the acceptance of the resources from a PW e-learning platform), we conducted a linear regression analysis and an ANOVA test which did not confirm the influence of social influence on Effective Use ($p = .491$ and $p = .349$, respectively). Based on the data, we cannot prove that social influence has a direct impact on the effective use (acceptance) of the platform.

4 DISCUSSION

4.1 Discussions of Findings

Due to our lack of participants, we can't reach definitive conclusions. However, we can discuss the results obtained with our sample.

The results of the study show that the level of awareness of the impact of public works on the climate at the organizational level has not been

significantly influenced by the acceptance of technologies according to the hypothesis (H1). This could be due to the fact that the questions were not about individuals but about their organizations, meaning that participants were not influenced by their organization's acceptance and use of tpdmain resources.

The study reveals that the progress in the transition stages from SSBC is closely related to the acceptability and acceptance of the resources from the platform tpdmain.

The hypothesis H2a was near from significance, but due to the small sample size and individual variability, it is recommended to conduct a larger study to confirm or refute this trend.

H2b has been confirmed with a large effect size, showing a relationship between individuals' awareness of climate-related issues and their desire to change their behavior, as seen in Keller and al.'s study 'Why consumers shift from single-use to reusable drink cups' (2021), and the acceptance of the tpdmain platform with effective and concrete use of the other part.

Thus, we can determine that a possible link between the adoption of a Pro-Environmental behavior and Technology Acceptance can exist, at least in Bobillier-Chaumon's Situated Acceptance (2016).

Bobillier-Chaumon's organizational dimension (2016) positively influences Venkatesh and al.'s social dimension (2012) (H3), with higher scores indicating a stronger influence on the social dimension. The study has confirmed the relationship between social acceptance and the situated acceptance with a quite high effect size.

The hypothesis H4 aimed to highlight the influence of the context in which individuals work, highlighting the link between social acceptability (UTAUT2) and effective acceptance (effective Use). The organizational dimension of Situated Acceptance has an impact on the social influence of UTAUT2, as explained by Bobillier-Chaumon and Dubois (2013) and Bobillier-Chaumon (2016).

This study shows no influence of SI on effective use of tpdmain resources, suggesting that participants may not use them effectively due to their influence from colleagues or superiors.

The results did not confirm the hypothesis H4.

Further research is needed to determine if social influence can be correlated to certain dimensions of Situated Acceptance.

4.2 Limitations and Future Directions

In our research to write this study, we weren't able to identify studies about both Technological Acceptance and Adoption of Pro-Environmentally behavior. This is why we had several objectives such as trying to determine if people in a pre-decisional denial of inhibition (Keller and al., 2021) could also be in a weaker acceptability and acceptance of an e-learning platform's resources. However, the study's sample size seemed to be too small for this hypothesis to be studied.

Furthermore, the analysis of the responses was problematic due to the limited Likert scale, which may have encouraged participants to make the choice of not to actually choose their response. Future research should propose a larger Likert scale with four or six choices to better align participants' expectations and needs. A larger sample is also needed to study the hypothesis. Indeed, to be able to generalize our findings, we need more participants. It would be interesting to open this study to people who are not used to the platform, as well as making a longitudinal study to see if a change in the SSBC stages of transition concretely influences the effective use of the e-learning platform.

It is also important to have in mind that there are potential biases in the data, due to the fact that it is self-reported answers.

5 CONCLUSION

This study aimed to investigate the relationship between the acceptance of technologies and the adoption of a Pro-Environmental behavior.

The study also sought to determine if the acceptability and acceptance of a technology, specifically the resources of the tpdmain platform, and the adoption of a Pro-Environmental behavior could be significantly related. The hypothesis was tested showed that the stages of the SSBC have a positive influence on acceptance and possibly acceptance. As a matter of fact, the results showed that when the participants indicated to be in SSBC's stage 3 or 4, their results in questions about effective use of the platform went in the same direction.

Furthermore, we have been able to determine that a gateway can be made between Pro-Environmental behavior and acceptability/ acceptance of technologies. Further research is needed to better understand how these factors can be combined to improve the acceptability and acceptance of technologies and support sustainable practices.

ACKNOWLEDGEMENT

This research has been funded by TP D'AVENIR without any conflict of interest.

REFERENCES

- Ajzen, I. (1991). The Theory of Planned Behavior. *Organization Behavioral and Human Decision Processes* 50, 179-211.
- Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology*, Vol. 34, 151-159.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall;1986.
- Bobillier-Chaumon M-E. (2016). L'acceptation située des technologies dans et par l'activité : premiers étayages pour une clinique de l'usage. *Psychologie du travail et des organisations*, 22 (1), ff10.1016/j.pto.2016.01.001ff.
- Bobillier-Chaumon M-E., Dubois M. (2009). L'adoption des technologies en situation professionnelle : quelles articulations possibles entre acceptabilité et acceptation ? *Le travail humain*, 2009/4 (Vol. 72), pp. 355-382. DOI : 10.3917/th.724.0355.
- Heckhausen, H., Gollwitzer, P.M. (1987) Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motiv Emot* 11, 101-120 (1987). DOI:10.1007/BF00992338
- Keller, E., Köhler, J. K., Eisen, c., Kleihauer, S., HANSS, D. (2021). Why consumers shift from single-use to reusable drink cups: An empirical application of the stage model of self-regulated behavioural change.
- Keller, E., Eisen, C., Hanss, D. (2019). Lessons Learned From Applications of the Stage Model of Self-Regulated Behavioral Change: A Review. *Sec. Environmental Psychology* Vol. 10
- Pinho, M., Gomes, S. (2023). What Role Does Sustainable Behavior and Environmental Awareness from Civil Society Play in the Planet's Sustainable Transition.
- Schwartz, S.H., 1977. Normative influences on altruism. *Adv. Exp. Soc. Psychol.* 10, 221-279. DOI:10.1016/S0065-2601(08)60358-5 .
- Stern, P C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*. *Journal of Social Issues*, Vol. 56, No. 3, pp. 407-424.
- Venkatesh, V., Morris, M. G., Davis, G. B., & DAVIS, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, pp. 425-478.
- Venkatesh, V., Thong, J. Y., & xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157-178.