

Factors Affecting Decision on Environmental Modification according to Universal Design: A Case Study of a Private University

Sridara Tipian¹ & Antika Sawadsri²

¹ Arch D. Student, Multidisciplinary Design Research Program, Faculty of Architecture, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand

² Faculty of Architecture, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand

Correspondence: Sridara Tipian. Tel: 66-61-846-8885. E-mail: gsrindar@gmail.com

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Abstract

The conventional belief of universal design objective is to benefits for few people with high cost of investment. It is, therefore, considered as unprofitable project, although Thai government has well developed laws according to the concept. A university is an organization which is affected by this concept, because it should be place where welcoming people of differences and opening opportunities for all to access education with equality. However, it is not easy for a private university to invest in building or modifying universal design environment due to surplus cost of implementation. The objectives of this research are to: 1) study factors in universal design implementation; and 2) analyze importance level of executives in deciding to invest in universal design implementation or modification. The research procedure and qualitative data collection was conducted with 59 informants by face-to-face semi-structured interview. The informants of this research comprised 56 physical users, and 3 executives and building managers. The research results show that factors affecting decision on environmental modification based on universal design principles in private universities are: 1) social structure, 2) understanding and recognition of human values; and 3) business image promotion. However, probable factors not facilitating universal design implementation in universities were: 1) investment budget, 2) architectural Aesthetic, and 3) utilization. Additionally, background of the interviewees is one of reinforcing factors for decision on universal design investment.

Keywords: Universal Design Implementation, Thai law, Decision Making, Education Provision for Persons with Disabilities Act, Executive's Perception, Private University, Social Value

1. Introduction

Universal design concept was firstly implemented in Thailand in public building such as hospital and public health centers, and then expanded to other public places such as educational institutions and government complex (Sawangjaroen, 2012). Thai government has well developed laws, ministerial regulations, standard criteria, and guidelines for building construction based on universal design principles. Because the government places importance to quality of life of all people in society, therefore, buildings and environments accessible for all must be considered. This is consistent with Sahachaisaeree (2011), that "when the environment does not facilitate participation in social activities of individuals with personal impairment, the state of handicap is impliedly discriminated by unfriendly environment." However, universal design implementations in public buildings, both newly constructed and modified, have been found in low rate. It is probably because of high cost in maintenance or construction, as well as perception of decision-making authorities on surplus cost. According to the research finding of Satio (2006), facility managers' understanding and recognition of advantages is the key to implement universal design; therefore, it is importance to increase understanding of the issues among authorities. Additionally, there is the conventional idea that projects under design for all or universal design concept support specific targets, for example disabled or handicapped people, which are few in numbers. The universal design, then, is considered unprofitable because benefits are low, investment cost is high (Odeck, Hagen & Fearnley, 2010). The above mentioned condition of universal design has affected many places. Educational institutions, for example, are places which play important roles in human capital development, leading to country development. They should be place accessible to all of any differences and provide opportunity to access education equally. In contrast, there are little numbers of educational institutions' facilities

built by universal design principles. According to statistical data of disabled people in Thailand in 2016, there are 48.37% of wheelchair occupants with ability to learn, but only 1.61% of them study in higher education system. This indicated that factors influencing education of persons with disabilities probably are individual economy or other related issues, i.e. physical environments that are not support or appropriate to living of person with disability (Tieammanee, 2009). As prescribed in Section 5 of the Education Provision for Persons with Disabilities Act, B.E. 2551 (2008) of Thailand, a person with disability shall have rights to access to education without cost, as well as to receive technology, facilities, media, services, and other educational assistances (Office of the Basic Education Commission, 2008). Consequently, the research has been conducted with 2 main objectives: to study factors affecting universal design implementation; and to analyze importance level of executives in decision to invest in construction or university's buildings modification based on universal design principles. This research is conducted by taking management characteristics of Dhurakij Pundit University as a case study. Dhurakij Pundit University is a private university in Thailand, where construct management system can be done comprehensively within the University, from the beginning to the end of the project. Data are collected by questioning and in-depth semi-structured interview. The questions are about factors important to consideration of universal design implementation in universities, including perception and investment decision of executives. This study indicates that decision on universal design implementation may be argued in terms of economic values. Additionally, the introduction of advantages and the study about social capital of universal design affect consideration and decision on implementing environment accessible to all. The researcher expects that the findings are able to motivate the application of regulations related to universal design in private universities.

2. Theoretical Framework

2.1 Thai Regulations on Universal Design

At present the national economic and social development plan of Thailand is stated that human is the center of development by promoting and enhancing citizen potential together with environment development. In other words, human capital is able to develop and add value. As in this conclusion, this research has been conducted by focusing on educational institutions as a component of human capital development. Educational institutions, therefore, should provide user-friendly facilities accessible to all people, so that they have equal opportunity in education. Education management should give importance on learners of all differences and provide services that can be reached by every learner. Thai government has developed laws focusing on importance of quality of life of all people in society, including those with impairment, i.e. the ministerial regulation prescribing the provision of facilities in buildings for persons with disabilities and the elderly B.E. 2548 (2005), the empowerment of persons with disabilities act B.E. 2550 (2007), the Education Provision for Persons with Disabilities Act, B.E. 2551 (2008), and the education act B.E. 2552 (2009). The ministerial regulation prescribing the provision of facilities in buildings for persons with disabilities and the elderly B.E. 2548 (2005) has been controlled and effective to buildings constructed after 2005. The cabinet has given approval to an urgent agenda in providing 5 facilities for the disabled, especially in government and public buildings, beginning from hospitals. However, the ministerial regulation is not enforced with buildings before 2005 and other types of public buildings, which is the gap in the law that has to be amended. The legislation serves as a recommendation and guides for professionals to practice according to their ethical value; however, many of them neglect moral responsibility in providing adequate facilities in order to cut cost or get faster profit. They lack awareness that a user-friendly environment can generate higher profit than an inaccessible one (Kadir, Jamaludin & Rahim, 2012). Even though, the benefits of universal design are high, but they are not adequate to motivate practice guidelines and implementation. To enhance the potential of universal design, law enforcement, standards, and practice guidelines according to the laws should be established.

2.2 Contributions of Universal Design

There is good development in knowledge and understanding of universal design principles and concepts in Thai society. Furthermore, the government has awareness and recognizes importance of impact of inaccessible social environment which hinders individuals from living and participating in mainstream activities, i.e. employment, education etc. This obstacle directly affects human resource which is the key in developing a country. Universal design is widely implemented in developing infrastructures, services and products that provide equal access to all people (Bangkok Department of Public Work). This concept is simplified and widely expanded by Center for Universal Design, North Carolina State University (1997). Universal design has been applied with amenities to upraise quality of life of social members. Therefore, universal design should be considered and implemented in modification and construction of buildings, environments, and facilities to the greatest extent possible and the widest range of situations as follows (National Disability Authority, 2012): 1) Benefits for persons with

disabilities and the elderly. Universal design is help persons with disabilities and the elderly to live independently, so that they are proud of themselves, strong minded, ready to face obstacles. It also develops quality of life of person with disabilities and the elderly to be productive manpower (Bangkok Department of Public Work). 2) Benefits for individuals. Universal Design is user-friendly and convenient, but is also respectful of users’ dignity, rights and privacy. It responds to different degree of difficulty that people experience when using products, services or environments. Every people are able to access and use products, services, or environments that are not specialized design. 3) Benefits for social. Universal Design promotes accessibility and usability, allowing people with all levels of ability to live independently and approaching services and environments individually. Universal Design assumes that the range of human ability varies according to the type of activity in which a person is participating or the environment in which that person is carrying out the activity (Ostroff, 2001). This research has applied overall benefits of universal design implementation as a key concept to develop the reduction of social environment impact which is barrier in well-being and social participation by emphasizing implementation of universal design principles in public buildings of educational institutions.

3. Research Methodology

This research aims to study perception and attitudes of physical users and university executives towards universal design. According to research framework, it shows that universal design principles enable the enforcement of governmental registration, i.e. laws, ministerial regulations, acts, and code of standards in universal design. These two factors indicate social benefits and values, and affect perception and attitudes of physical users and university executives in decision on investment in construction and modification of environment accessible to all, as shown in Figure 1.

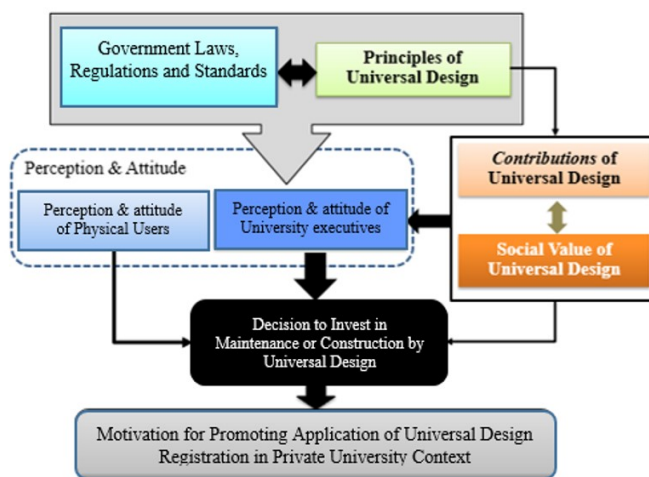


Figure 1. Conceptual Framework

This articles was concluded from the interview of physical users consisted of 53 participants, staff and students, 3 representatives of disabled students, and 3 executives of a private university, Dhurakij Pundit University. The qualitative method with semi-structured interview helps the study to focus on interviewees’ point of view (Bryman, 2008 cited in Kadir, Jamaludin & Rahim, 2012).

- 53 physical users of university’s facilities gave information and confirmed about current situation of universal design implementation in the university. 3 representatives of disabled students were informants about obstacles and real needs in using university area through semi-structured interview.
- The selective informants are a building manager, an executive who takes care of physical facilities, and a high level of executive, totaling 3 persons from Dhurakij Pundit University. The understanding of high executives is important to promote or push universal design into practices (Saito, 2006). Purposive sampling is used in this research, so that the researchers can intentionally select those related to the research questions.
- The informants are interviewed face-to-face by using open-ended questions. The interviews were recorded by digital recorders after the informant gives permission.

The questions can be divided into 2 main parts. First, it is about understanding and perception of universal design of both groups. The second part is the executive interview about aspects of advantages and value of universal design. The interviews have 2 objectives as follows:

- What factors are promoting universal design implementation?
- Why university executives place importance on universal design implementation?

Before conducting the interview, the current physical environment and facilities in the university under the universal design were studied, together with related effective registrations, by using a survey form as the research instrument.

- Overall survey of the university’s physical environment

1) According to the survey of outdoor environment, it can be concluded that the university has practice guidelines that highlight more on building entrances than others. The amenities such as benches along pathways or walkway are not efficiently designed for all accessibility. It is difficult for persons with mobility impairment or the elderly to step up 10 cm. to rest on the benches. Furthermore, 1-2 reserved parking spaces are provided but there is no sign to show the position. They have to ask for assistance from caretakers (Tipian & Sawadstri, 2017).

2) Regarding the survey of inside the building that constructed prior the building control law (before 2005), it is found that those in charge lacked of practice guideline and universal design implementation. The university only provided some components but still not meet standards prescribed by law. There were no toilets for persons with disabilities in buildings before 2005, which are considered the most priority according to the government resolution on 19 May 2009. As for the building constructed after the effective of building control law (after year 2005), the law enforced a building to have necessary facilities under universal design principles. The main components found give priority to building entrances, namely, practical entrance ramps, doorways with appropriate width, sufficient large-size lifts available but no mirrors and rails, and width indoor pathways. Only one building provides restroom for persons with disabilities. Therefore, it can be concluded that the buildings taking into studies, both before and after the effective of building control law, in Dhurakij Pundit University are unable to benefit for all users, but emphasize on building entrances more than other parts (Tipian & Sawadstri, 2017).

4. Results

4.1 Understanding and Perception of Universal Design Principles

Table 1. Perception of universal design principles from the interview of physical users in the case study university

Participants	Perception Issues	Perception and Attitude towards Universal Design
1) Physical users - Faculty members - Supporting Staff - Students	Knowledge and understanding of universal design principles Experiences in using facilities for all and inclusive area usability	- Design for persons with disabilities that also benefits users of all groups, essential to public and beneficial to society as a whole - The most common experiences are ramps, priority seats in public transportation, and signs in lifts. - Very low numbers of the disabled share public areas. - If there are amenities that cater needs of all users, it may enhance good relationship in society.
	Needs of facilities for all	The outside building facilities in order of priority are: 1) Parking lots and signage 2) Outdoor Benches 3) Pedestrian Walkways and Crossways 4) Lights 5) Curb Ramps The indoor facilities are: 1) Toilets 2) Lifts 3) Service Areas 4) Signage and Symbols 5) Clear Entrances.
	Applicability of universal design in Dhurakij Pundit University	Universal design implementation is for persons with disabilities. It may be interesting and gives equal access to education, as well as benefits for general users with physical injury or disease.

Table 2. Perception of universal design from the interview of representatives of disabled students

Participants	Perception Issues	Perception and Attitude towards Universal Design
2) Representatives of disabled students	Knowledge and understanding of universal design principles	- Universal design is mainly for persons with disabilities, and provide more comfortable in living.
	Experiences in using facilities for all and inclusive area usability	- The common facilities are ramps and guiding blocks. - If facilities are available, the disabled will participate more in society, and realize their places in society.
	Needs of facilities for all	In order of priority, the outside building facilities are: 1) Ramps 2) Curb Ramps 3) Crossways 4) Pedestrian Walkways 5) Road Components The indoor facilities are: 1) Entrance Ramps 2) Toilets 3) rails 4) Lifts 5) Service Area
	Applicability of universal design in Dhurakij Pundit University	The ability to travel and participate in university activities easier, live independently with less assistance from others

In conclusion of understanding and perception of both groups of interviewees, the answers vary in physical dimensions. The understanding about universal design principles incline to persons with disabilities, followed by serving all people. The second group of interviewees is representatives of disabled students with direct effect, the need for facilities are rather clear and show the real need. However, the interviewees in the first group answered the need of facilities overall in some components at the same points. Regarding the use of shared area, it is found in little number, maybe because the interviewees do not know why the disabled are inaccessible of the area. Additionally, the representatives of disabled students view that if the social environment is ready, they can have more space to live outside their houses. The physical users in the first group agree that universal design implementation opens the chance to attract disabled students to study at Dhurakij Pundit University. The interviewees from the second group claim that they can live independently without assistance of others.

As shown in Table 3, the executives' understanding of universal design highlights the persons with disabilities. They open up and give more acceptance of universal design implementation. It is best for the private university to implement universal design in compliance to related laws. Although the university has not pronounced official policy to accept disabled students, the issues did not raise up clearly. The practice guidelines first follow up the rule of laws, and then occurring budgeting, development and modification of environment accessible to all will be considered gradually.

Table 3. Perception of universal design from the interview of university executives

Participants	Perception Issues	Perception and Attitude towards Universal Design
University executives - high level executives - executive responsible for physical environment - building manager	Knowledge and understanding of universal design principles	- understand principles and concepts for design with benefits for disabled persons and the elderly - accept advantages of universal design implementation in universities
	Needs for facilities for all	- consider and prioritize necessary facilities, implement first in necessary area i.e. ramps, entrance way, and lifts.
	Advantages and disadvantages of universal implementation	Advantages: - make all people live more comfortably - overall benefit to social - be in accordance with social mainstream - create modern image for better acceptance in business Disadvantages: - maybe need high cost to modify all environments at the same time

Level of universal design implementation	- Although the university has no official policy in accepting disabled students, it welcomes those who can accept and live in the university facilities. - The existing universal design implementation focuses on related law compliance in the current urgent issues and standards, as well as needs of physical users.
Possibly implemented facilities	The university gives importance first to accessibility of buildings, i.e. ramps, entrances, and lifts, and plans modification to meet the standards.
Trend in full implementation of universal design	- Old buildings (before 2005) are modified. - New buildings (after 2005) are built according to the effective laws and social mainstream to create good organization image better to business acceptance.

4.2 Benefits and Values of Universal Design in Universities

1) Factors Facilitating Universal Design in Universities

The university executives views that universal design investment is probably not cost-effective for private universities, which have to invest in facilities and building by their own funding. But in social aspect, the number of persons with disabilities has increased. To give opportunity for disabled students to access higher education, universities should pay attention and give importance to need of the disabled as of general people. In other aspects, the universities should prepare physical environment according to education trend in Thailand, which opens equal opportunity in education for all. The examples are preparation for future changes, aging society and roles of aging people in education, and preparation for aging of university faculty members and supporting staff. To implement universal design in universities, it should be start from following related laws. For buildings after 2005, facilities are built according to building control laws; while old buildings are amended as necessity. The university executives accept advantages of universal design by focusing on accessibility of most buildings. They agree that universal design management by new built or modifying the existing one is the best practice or trend of modern design. Universal design is an issue under sustainable design concept which the case study university has aimed to develop. Universal design is viewed as promotion of good university image

2) Factors barring universal design in universities

It is difficult for the private university to decide on investment in facilities and physical environment. The cost-effective issue should be carefully considered. However, regarding investment worthiness, the interviewees said the return is unpredictable because the university plans environment modification into phases. The development project has started by priority or facilities in need. For example, if wheelchair students are accepted, the university will plan to modify accessible to buildings for them first. The considering issues in investing in facilities according to priority of necessity base on 4 factors: 1) low construction cost, 2) construction material available in Thailand, 3) practical facilities beneficial for all, and 4) aesthetic surroundings after construction or modification for good university image.

5. Discussion

The finding of this research about understanding of universal design principles among physical users shows that, faculty members and third- and fourth-year students have more understanding and are able to explain about universal design than first- and second-year students. It may be because universal design is related to variety of subjects. In the years of study, the subjects combine this concept in the content. Experiences in encountering facilities and sharing area in society partly affect acceptance and awareness of individual differences as normal issue, and create good relationship in society. For the representatives of disabled students, they views that if there are facilities for persons with disabilities, they will play more role in society and less introvert. It makes their places in society and reduces need of assistance from others, which they try to avoid. Outdoor facilities, in order of priority, are building entrances, toilets, lifts, and service areas which are in accordance with facilities the university executive has decided on possibility to invest and implement.

The executive in high level well accepts the advantages of universal design. Universal design is agreed to serve the following situations: 1) The change of social structure and benefits of changing society. Thailand is now passing to aging society. The governmental and private organizations jointly work to protect, promote and support status, role and activities of elderly people (Foundation for older person’s development, 2015). The university is a part of this supporting, for example, preparing for the return of retired persons to study. 2) Recognition of human being. The number of persons with disabilities continuously increases. To give

opportunity for equal access to education and care for aging personnel who have to live their lives in universities context, the university has to prepare physical environment. However, as a private university, it has to consider 4 main issues: low cost, material available in the country, facilities beneficial for all not only specific people, and Aesthetic that supports university's good image. In the point of view of the executive responsible for physical environment, the advantages of universal design have been accepted in 3 aspects. 1) University image aspect. Universal design is considered as modern issue under sustainable design concept. It is a part of the university's environmental development, leading to good image of the university. 2) Marketing aspect. Universal design makes the university well-known in education field which leads to marketing or business advantages. The physical manager also considers the users' need response. In case there are users in need of special facilities, it will be provided urgently. However, the investment in construction or modification of environment should benefits in all aspects. The worthiness of facility utilization is also focused, for example, use of ramp. The construction standards should be studied before building practical ramp with appropriate width size. The disabled students can use ramps by themselves without assistance of others. University housekeepers can also use trolleys on the ramps, as well as those with problem in using the stairs.

6. Conclusions and recommendations

Factors affecting decisions to modify environment according to universal design principles in the private university are: 1) Social structure aspect. While Thailand is now passing to aging society, universities play a part in developing quality of life of the elderly people together with governmental policy, for example offering curricular for retired people. The universities that adjust environment accessible to all will be a good choice for the elderly to study. 2) The aspects of understanding and recognition of human value comprises 2 parts. First, current situations of persons with disabilities, whether from birth or accident, should be studied and acknowledge. Currently, Thai government has provided monthly allowance, 800 baht per month, for the disabled who has registered and held identification card for persons with disabilities (Ministry of Social Development and Human Security, 2015). The promotion of equal opportunity to access education is part of sustainable development in quality of life of persons with disabilities. Additionally, it can reduce governmental burden in paying disability allowance, in case they graduate and earn enough living for themselves and their family. The second part is about recognition of human value and care of aging university personnel. At present in Thailand the retirement age is 60 years, but for faculty members or staff with that age may have potential to work, but with physical difficulty. If facilitated physical environment are built, these group of personnel can live and work in the universities with no difficulties. These also may motivate efficient personnel to work longer with universities and promote self-esteem of the elderly. 3) Business image promotion. Universal design is a modern issue for design subject. It can enhance good image and make universities well-known, leading to marketing advantages. This means the universities can reduce promotional budget for high advertising cost. Universal design can also partly help developing university ranking in environment development. As for factors not supporting universal design implementation in universities are: 1) As investment budget factor, to adjust barrier-free environment all over universities under universal design principle is difficult in case the university has to invest comprehensively. 2) As for aesthetic factor, there is a strong belief that to build environment for all it reduces the building aesthetic. 3) For utilization, it is about understanding of high advantages of universal design which is not only benefits special groups. It is difficult to improve perception of universal design of all people and familiarity of universal design environment. It is also found that backgrounds of the interviewees are supportive factors for decision to invest in building universal design environment.

The suggestion of research discussion is the way to create awareness by instilling universal design principles in basic education level. Especially, in the design schools for future designers, they must learn about universal design principles and apply it in their designed works (Kadir, Jamaludin & Rahim, 2012). These will reduce modification problems after the buildings are built. Another factor in mobilizing universal design implementation in Thai context is the cooperation of government. It should support, promote or jointly organize development projects with private sectors. The government also should offer rewards or privileges to private organizations in return of universal design modification or implementation which is according to the laws, for example.

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References

- Abdul Kadir, S., M. J. (2012). Building Managers' Perception in Regards to Accessibility and Universal Design Implementation in Public Buildings: Putrajaya case studies. Asia Pacific International Conference on Environment-Behaviour Studies (pp. 129-136). Famagusta, North Cyprus: Elsevier B.V. Selection. [https://doi: 10.1016/j.sbspro.2012.02.071](https://doi.org/10.1016/j.sbspro.2012.02.071)
- Abdul Kadir, S., M. J. (2012). *Applicability of Malaysian Standards and Universal Design in Public Buildings in Putrajaya*. ASEAN Conference on Environment-Behaviour Studies (pp. 659-669). Indonesia: Elsevier B.V. Selection. [https://doi: 10.1016/j.sbspro.2012.03.072](https://doi.org/10.1016/j.sbspro.2012.03.072)
- Afacan, Y., C. (2009). *An interdisciplinary heuristic evaluation method for universal building design*. *Applied Ergonomics*, 40, (pp.731-744) [https://doi:10.1016/j.apergo.2008.07.002](https://doi.org/10.1016/j.apergo.2008.07.002)
- Department of empowerment of persons with disabilities, (2008). *Ministerial Regulation: Education for Persons with Disabilities Act 2008, Section 5* [Online]. Available at <http://dep.go.th/th/node/432.PDF> (Accessed: January 2015).
- Holley Atkinson, D. D. (2013, April 24). <http://online.tarleton.edu/>. Retrieved from <http://online.tarleton.edu/ACEF/UDIL42413/.PDF>. (Accessed: June 2015)
- James Odeck, T. H. (2010). *Economic appraisal of universal design in transport: Experiences from Norway*. *Research in transportation economics*, 29 (1), 304-311. <https://doi.org/10.1016/j.retrec.2010.07.038>
- Jarutach, T. (2015) Universal design guide book [in Thai: คู่มือการออกแบบเพื่อทุกคน] In Jarutach, T. *Operations Unit: Research environment for the elderly and disabled people, the Thailand Research Fund (TRF)*
- Komolkiti, P. (2008). Life and the restrictions on the path of the disabled in Thailand [in Thai: ชีวิตและข้อจำกัดด้านการเดินทางของผู้พิการไทย]. In Komolkiti, P. [Online]. Available at <http://www.arch.chula.ac.th/ejournal/files/article/mlzppF86k8Sun103403.pdf> (Accessed: January 2015)
- North Caroline State University, College of Design (1997). *The Center for Universal Design*, [Online]. Available at <http://www.design.ncsu.edu/cud/>. (Accessed: June 2015)
- Oliver, M. (1990) *The Politics of disablement*. London: Macmillan Press.
- Ostroff, (2001). *The Centre for Excellence in Universal Design*. Retrieved from <http://universaldesign.ie/http://universaldesign.ie/What-is-Universal-Design/Benefits-and-drivers/.PDF> (Accessed: August 2015).
- Saito, Y. (2006). Awareness of universal design among facility managers in Japan and the United States. *Automation in construction*, 462-478. Elsevier B.V. Selection. [https://doi:10.1016/j.autcon.2005.06.013](https://doi.org/10.1016/j.autcon.2005.06.013)
- Sawadsri, A. (2012). *'Do I Look Like an Object?' A Quest of Exploring Person – Place Relationship of Disabling*. ASEAN Conference on Environment-Behaviour Studies (pp. 418-428). Bangkok, Thailand: Elsevier B.V. Selection. [https://doi: 10.1016/j.sbspro.2012.08.046](https://doi.org/10.1016/j.sbspro.2012.08.046)
- Sawangjaroen, C., Sirisali, P., & Sahavacharin, A. (2012). Assessment of the Physical Environment for Students with Disabilities Thammasat University Rungsit Campus. Bangkok: Faculty of Architecture and Urban
- Tieammanee, S. (2009). *'Methods of Improving the Providing of Educational Welfare for Disabled Students of Thammasat University at Rangsit Campus'* A Thesis for the degree of Master of Social Work in Education of Faculty of Social Administration Thammasat University. Pathumthani Thailand.
- Tipian, S. & Sawadsri, A (2017). The Role of Universal Design on Campus and Practical Mobilisation. AMER International Conference on Quality of life (pp.193-199). Bangkok, Thailand: E-B Environment-Behavior Proceeding Journal. <https://doi.org/10.21834/e-bpj.v2i5.665>

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