A Study on the role of Usability in Universal design certification system

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Abstract: In the preliminary stage of Universal Design(UD) implementation, as the public sector to popularize UD concepts to general public by market communication and knowledge education; and also to encourage and stimulate the industry circle to get involved in the research and development of UD. To establish the certification system of UD is one of the design promotion strategies. This study aims to review the UD certification system over the world to find out the crucial elements ensuring the UD commitment. We survey the existing 9 certification systems from USA, Germany to Japan, and the certificated targets are from visual design, product, service, space to professionals. We analysis these certification systems by its target, criteria, test method and relative promotion plan by interviewing the authorities and analyzing the reference documents. We found out the UD evaluation should include not only the Universal Design measurement program and user participation but also Usability testing. By conducting the usability testing, it provides quantitative performance information and professional suggestion to the subject. However, the usability testing method is vary from product to product, and the needed time and resource of evaluation task depend on the complexity of the subject. The establishment of UD certification system needs to consider its target and scope to come to the most beneficial result.

Key words: UD Performance Measure, Certification system

1. Introduction

Since 2000 the development of universal design (UD) in Taiwan began to draw the attention of the academy circle. In 2004, Taiwan's industries were thinking the future transformation and started paying much attention to the future importance for universal design. Currently, the field of UD has possessed certain capacity in academic research, public sector and design industry, but has not yet been formed an integrated trend. In recent years, the authorities proposed a direct method- "Certification Mechanism, Rewarding Development", while they were beginning to think that how to promote industries to develop the UD products; therefore, most global countries started to carry out the researches on rewarding UD and certification.

1.1 UD development in each country

Universal design is originated from the idea: "the design of products and environments to be usably by all people, to the greatest extent possible, without the need for adaptation or specialized design i." which proposed by Prof. Ron Mace in the United States around 1980s. However, in last two decades, different

practical guidelines of universal design existed globally and applied to the cut-in angle and development direction for various industries.

U.S. is the origin of this theory. North Carolina State University established the Center for Universal Design (professional research institute) in 1989, and ADA (the Americans With Disabilities Act) and ADAAG (the Americans With Disabilities Act) and ADAAG (the Americans With Disabilities Act Accessibility Guidelines) were promulgated in 1990. We can discover that the U.S. started with the protection of civil rights to ensure the accessibility for mental and physical disabilities, and continuously developed the accessible public spaces, architectural environment, information and service, and enactment of law; however, there're no specific issues on the development of design issues, design strategy and method; in addition, there're no specific key words of forming market communication.

The terms, Design for all (DfA), Inclusive Design, are mostly used in Europe, and some teaching institutes and design promotion organizations have successively proposed that innovation is came from the codevelopment with the extreme users and which is an important leading design concept. In addition, Norway is the only country that takes UD as its policy guideline and has promulgated UD Action Plan 2009-2013 in 2009. Norway has also published Norway Universally Designed by 2025 in 2010, and to be the country of practicing UD idea very thoroughly.

In addition, with respect to the coming aging and lower birth rate society, the German industries reached an agreement to regard the universal design as a basis of innovative design, including Weimar Declaration signed in the Germany industrial expert conference that held in mid-November 2009, to declare the UD's duty and viewpoint to German industries.

Moreover, in terms of Japan, the country possesses the intensive aging situation, it started to protect mental and physical disabilities in 1970s, next prepared for the aging welfare society in the late 1980s, and then in the 1990s, Japan placed much attention to the universal living environment for all their citizens; therefore, in Japan UD is not only applied to the protection of social welfare system (public systems of residence, transportation, information, etc.), but also developed some vital commodities into the standard for industrial development, as well as to be the principle for enterprises' operating strategy and CSR, and local government's policy measure. In addition, the media also will make an annual ranking for those enterprises who introduced UD.

In Taiwan, UD has drawn much attention since 2000, including industry, government, academy and research organizations all engaged in the research and trying. In recent years, the government authorities continuously published related books, carried out the promotion or established the task force to conduct the exploratory researches; however, enterprise and the public still have some myths about the universal design, such as: it is the design that only provided for senior personnel, and mental and physical disabilities, the introduction of such design is expensive, etc.; therefore, broadly speaking, it is still in the phase of guiding recognition and looking for the internal development.

1.2 Universal Design Performance Measures

In order to understand the effects of UD application on product, space and service, then provide designers as a framework and based on each design principle to communicate with users, as well as review the issues of product's usability. As a result, many evaluation methods yielded to investigate on the redesignable points for products, compare the difference in similar products, and confirm whether the design result follow the Among which, the main idea is the Universal Design Performance Measures, practice of UD principle. which is proposed by the Center for Universal Design (CUD), North Carolina State University, U.S., and developed according to 29 sub-principles of 7 main principles of the UD theory (announced on 1st April, 1997, 2.0 ver.).



Figure.1 UD Performance Measures (Picture Source: The Center of Universal Design)

It should be noted that the measurement of UD performance: product's actual score of each principle is meaningless, but needs to have users' opinions; and provide a framework which can be used to focus on the lifecycle of product usability, and confirmation of the usability feedback from users of various groups and mental and physical capability.

2. UD Certification Mark Systems

This study collects related UD certification marks from various countries, such as Japan, Germany, U.S., to carry out the further analysis, including: Organizer, evaluation object, evaluation method and system effectiveness. 9 certification systems in total, and the categories include visual design, product design, space, industrial standard and professionals, the list is shown as follows:

ator Test for

	Visual /Product	Space	Industrial Standard	Professionals	
Japan	2.1 Enterprise Mark 2.2 Usability Verified by user testing		2.4 U-mark (information, telecommunication products)2.7 Color UD Certification2.9 CRX	2.5 UD Coordinator 2.6 Certification Test fo Housing Environment Coordinator for Elderly and Disabled people	
Germany	2.3 Excellent UD!				
U.S.		2.8 UD HOUSING		2.10 UDCR (NARI)	

Table 1. List of UD Mark Certification Categories v.s Countries

2.1 Enterprise Self-established Mark

Japanese enterprises specifically have the mark on the package or promotion activity for their products that developed or considered according to UD principle, as their commitment to consumers. Thus, these are the basic prototypes for UD marks, such as KOKUYO, PANASONIC, TOTO, TOYOTA, etc.

In addition, since the late 1990s, Japanese media - NIKKEI DESIGN (Nikkei Business Publications, Inc.) also established the ranking mechanism for enterprises' introduction of UD, and the ranking method contains 2 sections: enterprises' self-evaluation and the implementation of market survey on customer, and after its editing sector carrying out the statistic evaluation, the result will be published then. This can be regarded as a key indicator of industrial climate.

2.2 Usability Verified by User Testing

Organizer: Institute of Advanced Studies in Universal Design (IASUD). The goal is to ensure the "evaluation of common consumers", and "development method and procedure". It initiated in 2004, and its goal was to serve as an impartial third party of evaluation and certification unit of the "usability" for Japanese products.

Evaluation Object: including visual design, image, product and space, etc.; and others, such as the policy and service system are within the scope of investigation.

System Effectiveness: so far, 11 products obtained certification, and the product types include: stationary, office appliance, hand tool, building hardware, packing, etc.

2.3 Excellent UD!

Organizer: German Design Council, Berlin's International Design Centre (IDZ), and TÜ V NORD CERT jointly cooperated to establish the product UD mark.

Since 2008, they carried out the certification for those "self-explanatory, easy to handle" universally usable, for all ages friendly products; at the same time, used the publication, planning of tour exhibition and professional knowledge website to promote the UD certification system.

Evaluation Object: except the medical products, there's no restriction on the applying qualification currently, and any application can be submitted all year round. Application fees will be different according to the complexity of the applying products.

System Effectiveness: since its launch in 2008, so far, there're 5-10 product applications per year, and 2 products would get certification; in addition, most applications were consumer household products.

2.4 Japan Tele-Communication Industrial Standard - Umark

Organizer: Info-Communication Access Council

Evaluation Object: focus on the tele-communication equipment and its software and service. According to the common standard for such industries, enterprises review the design standards as the referral guideline to R&D personnel for further development. The considering points can be divided into three aspects: operating usability, machine design and service.

Evaluation Method: The Council set the UD considering points for every product, next enterprises will make self-evaluation for their own products according to these considering points, and then submit the evaluation result. After this Council's confirmation, enterprises can publish such information on their official website as the reference to consumers. At the same time, enterprises can print the certification of Umark on their product packaging and user manual for consumers to make further purchase.

2.5 Universal Design Coordinator

Organizer: Institute of Advanced Studies in Universal Design (IASUD).

It promotes and carries out the cultivation of "professional talents" and the certification program, and it adopts 4 classes to determine the knowledge level and the practice of specific knowledge.

Evaluation Object: the certification of professional fields are 7 classes: daily life course, printing course, educational course, service course, space design course, product manufacturing course and interface course.

There're 4 classes totally, Class 3 and Class 2 as general knowledge can be directly joined; certification of Quasi-Class 1 and Class 1 include the practice of specific knowledge, it requires to attend the course of certain hours to get qualification of apply the certification. Since its launch in 2006, the accumulated number of passing certification is around 2,000 till 2011.

2.6 Certification Test for Housing Environment Coordinator for Elderly and Disabled people

Organizer: The Tokyo Chamber of Commerce and Industry. This certification test can make the living environment to more friendly and suitable for senior and mental and physical disabilities. Meanwhile, they have comprehensive knowledge of medical, welfare, architecture, household decoration and social system that allow them to provide a proposal of integrating cooperation with various professionalisms.

Evaluation Method: it can be divided into 3 classes, and the examination time will be 2 hours. Two exams will be held per year.

It established the association, fjc21(福祉住環境コーディネーター協会), for providing information exchange and advanced education for these qualifiers; and adopted regular workshops and study groups to build a good knowledge network. Then, it carried out the promotion activities to make the public to know the importance of such certification.

2.7 Color Universal Design (CUD)

Organizer: Color Universal Design Organization (CUDO for short). In order to make people with different color visibilities who can easily recognize and use objects, thus any facility or product that complied to CUDO's UD consideration can obtain the certification mark.

Evaluation Object: visual design, products and facilities

Evaluation Method: it adopts a user with normal color vision and 4 types of color vision defects to carry out the examination

System Effectiveness: started in 2005 and there're about 100 cases obtained the mark in 2008. In addition, there're few cases that got the certification with first-time application.

2.8 UD HOUSING

Organizer: Center for Universal design

Evaluation Object: building, housing.

Evaluation Method: provides a simple and applicable design suggestion to constructors as the reference example for modifying the existing space and environment. Its contents include: elements, characteristics, concepts and proposals, etc. In 2001, CUD carried out the UD verification for housing, and according to different UD practicing levels determined these verifications as Gold, Silver and Bronze medals.

2.9 Collaboration for Research and Exchange (CRX for short)

In 1995, Japan's three major office machine manufacturers - Canon, Ricoh and FujiXerox, considered that the office machine industry is lack of the design agreement between different brands that existed in the auto and stereo equipment industries, where the design styles of each interface are different to each other, thus users are unable to know how to use or operate. As a result, it only needs to compose a joint research institute to plan the design agreement for office machine, as well as correspond to ISO and JIS standards, thus the market territory of office machine can be expanded then.

2.10 Universal Design Certified Remodeler (UDCR)

Organizer: the National Association of the Remodeling Industry (NARI)

Evaluation Object: Remodelers, who have a minimum of five years continuous full time experience in the remodeling industry, and completed 8 hours of education addressing UD or universal remodeling principles, and sign an attestation to uphold NARI's Code of Ethics.

Evaluation Method: pass both an educational course and a certification test in universal design. The test is about: UD fundamentals, client needs assessments, Design, construction techniques, electrical Systems, plumbing Systems, exterior Universal Design Considerations.

Form the exploration of global universal design certification and mark, it discovered that the certification systems of professionals and color application possessed the best certification promotion effectiveness. In terms of the professional certification: especially for the certification of the housing and coordinator, which is not only the impartial review for their professionalism, but it also can be regarded as a common method of knowledge dissemination for industries. For the certification of color application, it's the basic design research issues, and the visual information related to products, services and spaces should be also considered the color vision. In addition, the certification method and criterion are fixed that the reason why this system can be used in different fields.

3. Usability as one element of the UD Certification Systems

This study mainly focuses on the UD certification of "industrial products", especially for carrying out the comparison between the certification systems of product "usability", in order to explore the aspect of usability for UD products. This study herein takes "Usability Verified by User" and "Excellent! Universal Design" as the cases to discuss. The data sources are from websites, related publications, and interview conducted by researchers, and organized as the following table:

	Usability Verified by User Testing (Japan)	Excellent! Universal Design(Germany)
Certification	Evaluation of product usability (including	Conformed to universal design and usability
content	universal design) and the development	testing, and passed the certification review of
	procedure	safety technique that conducted by TÜ V NORD
		CERT
Universal	No announcement of introducing the	• Call for users of various age groups to
Design	measuring of UD achievement rate	review 100 standards from 7 principles: the Point system, it needs to pass 80% standard
Certification		mainly.
Goal		• Experts can use a set of comprehensive criteria to carry out the review on product and information design for whether the product can be provided to users with different mental and physical capabilities
Testing	1. Users and main functionality	Users observation
Method	2. Methodology and accuracy of obtaining	semi-structured interviews,
		think-aloudetc.
	3. Accuracy of real usage	Record all processes for further analysis, and
	4. interview such as: think aloud, guided conversation	then propose the testing report at last.
	5. (Opened) users' behavior and thinking	
	6. (Designated) users' behavior and thinking	
	7. Recruitment of testee and management system	
	8. Functional tests and conditional test	
	(including certification survey questionnaire)	
	9. Professional (ensure of the accuracy and professionalism for the result interpretation)	
Certification	Except initial review, the main review is	It is divided into 2 phases: the initial review and
Procedure	aivided into 5 procedures:	product verification.
	investigation. Confirm the key to	evaluation
	improvement.	2. Product verification includes;
	2. Carry out the evaluation of usability	a. Universal design

Table 2. Case Study of Product UD-Usability Certification Systems

	proposal	b. Usability
	3. Verify the validity of new prototype	c. TÜ VNORD CERT (national standard)
Users	Call for actual users to participate in the review process	Call for users of every age groups as possible
Certification Fee	Certification Application Fee \forall 31,500 (USD 335-) Review Fee \forall 105,000 (USD 1115-) Month fee of Mark \forall 8750(USD 93-), paid annually. It can only pay for the first three months of the initial application.	 If this product will not change, the validity of certification will be 5 years. Application fee will be different according to products: Products with no key and switch : 5,000~7,000 € (USD 6390~8950-) Complicated Products (with key and switch, etc. : 8,000~15,000€ (USD 10226 ~ 19173 -) Precision products above 15,000 € (USD 19173 -)
Promotion Effectiveness	Since 2004 to date, 11 products obtained certifications.	Since the promotion in 2008, so far there're around 5-10 applications annually, and about 2 applications of products can pass and obtain certification
Review Period	Take the 11th product – doashisu (auto door lock) as example, it took about 2 years to complete the verification work.	Application time of mark depends on the precision of product, in average, it will take about 3 months to complete the verification work.

To discuss the difference and similarities between two certification systems comprehensively:

(Including method and promotion status)

- A. They are focusing on different key points for certification, but they have the same core value: Japan emphasizes the reliability for the methodology of product development, and Germany requires that product design should be conformed to national standard; therefore, except universal design and usability, they all regarded "Safety" as the important issue.
- B. These two major certification systems are all took the feedback from "users' opinions" as the basis of evaluation: among which, Excellent! Universal Design especially carries out the evaluation on the using status for users of "all age groups" and "different mental and physical disabilities", and the Usability Verified by User Testing can only reveal the participation for "actual users".
- C. Both systems establishes their own system verification methods: both two systems will carry out the design of preliminary testing method according to different types of products, and then the verification procedure will be adjusted according different precision levels of the testing object.

- D. Different time of project certification: Japan's certification scope for the Usability Verified by User Testing will place more attention to the trials of "development methods" and related proposals; therefore, the certification process may take more than one year to complete. Excellent! Universal Design adds the verification of whether it possesses national standard or not, and the certification process will take about 2~3 months.
- E. After review, Japan's Usability Verified by User Testing will grant the right of using the certification mark, without providing related market promotion package. Excellent! Universal Design announced the market strategy of quality mark, including marketing and promotion plans, and will hold exhibition to invite consumers to experience and to try out the products with initial certification; and their opinion and feedback would be noted.

4. Conclusions

The core concept of universal design yielded values due to it has considered every possible user demand and using possibility before developing. In general, it adopts 7 main principles to conduct the evaluation: the key point of usability design is to make product's design that can conform to users' habit and demand. There're 5 usability goals that frequently used to make evaluation, including: Learnability, Efficiency, Memorability, Errors (as in low error rate) and Satisfaction (Nielsen, 1994).

From the comparison between these two systems, we can easily discover that UD is the design of emphasizing mental requirement, and usability will focus on the issues of functional handling, which all pay much attention to the design value: "humanity", especially in the fields of software and product design. We need conducting the evaluation testing and design method as a framework to consider different users' demands and using situations, and also to implement these important principles. The most important issue to promote the industrial consciousness of UD certification system is to emphasize the consideration for all people from planning, manufacturing, marketing, usage and discard, every link of this circular cycle should be carefully deal with.

This study reviews the existing certification systems in various countries and discovers: the test and certification methods should be established by corresponding to different industrial attributes and various product types. In addition, the development of every test technique and basic theory are the core value to verify the certification system. In addition, the promotion strategy of certification system still needs to consider in other aspects:

First, the product UD certification fee is expensive and the review process will take a long time; thus, the most situations is that only few products can pass the verification and get the certification in the first application; therefore, they need the assistance from project consultants when applying the certification project. It shows that there is gap for enterprise to involve in UD certification. Thus, not only establish a verification system, it has to provide the knowledge exchange platform for professionals.

Second, when developing the certification system, it also needs to provide integrated plan to attract and encourage enterprises' involvment. For example, to promote the good examples which have passed the certification, to general public by mass media. By telling the story of UD products, it will also help consumers to connect to the idea of UD directly.

We can catch some issues from the Japanese enterprises' planning of the self-established UD mark, they use the self-own labeled products to communicate with the market and as well to educate consumers, and further commit to their social responsibility. However, Taiwan's industries are still in the phase of UD concept development currently, thus the market or consumers still have some myths for UD products. The product certification promotion still has a long road. Hence, the current phase needs to be returned to the discussion of the fundamental elements of UD in Taiwan's industry circle, and then establish a self-developed method. These are 2 important tasks now. Once the mindset has gradually matured, then implement the UD certification system will obtain the maximum effectiveness.

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