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asia eco-design electronics

The state of eco-design in Asian electrical and electronic companies

A study in China, India, Thailand and Vietnam

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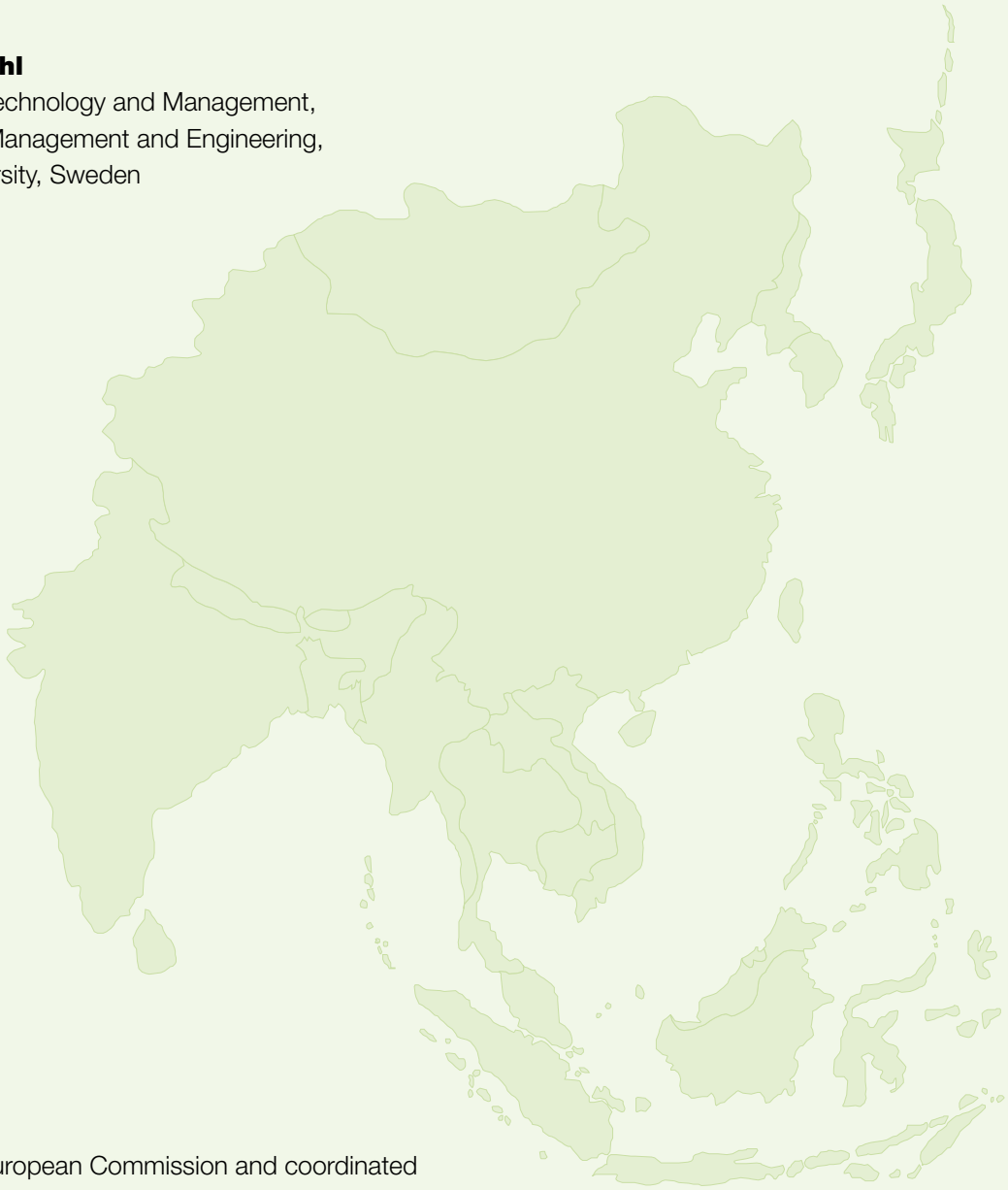

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Asia Eco-Design Electronics (www.cfsd.org.uk/aede) aims to raise awareness of product-related environmental issues and develop eco-design tools for the Chinese, Indian and Thai electronics industries

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1.0 Executive summary

This short report presents results from five separate studies, all focused on how electrical and electronic companies in China, India, Thailand and Vietnam work with eco-design. Many questions raised from the studies. Who is involved in the product development process? Do they need to tackle any environmentally-related product requirements for their products, and if so, what are those requirements? Are they using eco-design today? How much eco-design education do those working with eco-design have, and have they experienced a need for more education? What eco-design methods are used today? Do they have requirements for the methods used?

The five studies have proved to be valuable for tool development within the Asia Eco-Design Electronics (AEDE) project, and have reinforced the tool developers' existing knowledge about who will use the tool and what type of knowledge level they require. In addition, knowledge related to the type of requirements the tool should fulfil to increase potential use have been reinforced.

2.0 Introduction

Today it is clear that we are living in a global market, with many of the commodities used in our society coming from other parts of our world. Asia is today a fast-growing base for the manufacture of various kinds of products, e.g. electrical and electronic products, and more and more of our products contain electrical and electronic components.

In parallel, there is an increasing understanding of how the production, transportation, use and end-of-life treatment of such products is causing numerous environmental problems. For several reasons, electrical and electronic products have now come into focus, and several countries, e.g. in Europe and Asia, already have or are implementing product-related environmental legislation in order to reduce the impact of these types of products.

A large number of eco-design methods have been developed to support companies that want to develop products with a reduced environmental impact. Most of these eco-design methods and tools have been designed for major companies' needs, and then mainly in relation to European companies' needs and contexts. This is a problem when small and medium-sized companies want to apply eco-design, since their context often differs significantly from that of the major companies. Added to this is the cultural difference between companies in Europe and other continents, for example, Asia.

3.0 Objective

The main objective of the studies has been to increase the understanding of Asia's fast developing and growing electrical and electronic industry, and more specifically its needs and requirements for eco-design methods. The main focus has been on companies in China, India, Thailand and Vietnam.

Questions of interest have been:

- Who within the company participates in the product development process?
- Do they experience any environmentally-related product requirements for their products, and if so, what are those requirements?
- Are they using eco-design today?
- How much eco-design education do those working with eco-design have, and have they experienced a need for more education?
- What eco-design methods are used today?
- Do they have requirements for the methods used?

4.0 Method

Based on the types of questions and lack of cultural context, data collection was achieved through semi-structured interviews. Master thesis students were sent out to the target countries, where they identified and interviewed selected respondents. The Asia Eco-Design Electronics (AEDE)[1] project's partners have been supportive in this work, and have assisted the master thesis students with transportation and other aid.

Because of the students' language knowledge, it was possible to conduct most of the interviews in the respondents' local languages in China, India and Vietnam.

The students have developed and used their own interview guides for several reasons, (primarily cultural-contextual) and also because they had slightly different foci in their projects. However, the majority of the questions are more or less the same in those interview guides.

The studies in India and Thailand took place from August to October 2006, while those in China and Vietnam took place during Spring 2007.

[1] http://www.cfsd.org.uk/aede/

5.0 Results

This section describes the results from the different country studies.

5.1 Respondents

The selection of companies was done with the support of the Master thesis students' national and local contact persons. For a number of reasons, however, it was generally problematic to identify and engage companies in these national studies. This was particularly problematic in China and Vietnam.

The selected companies ranged from national small and medium-sized enterprises (SME) up to transnational Original Equipment Manufactures (OEM), as highlighted in the table below. Companies produced various kinds of products, e.g. capacitors and other types of electronic components, telecommunication equipment, VoIP (Voice over Internet Protocol) computer peripheral products, solar power chargers, membrane switches for cellular phone keypads, radio base stations, laptops, televisions and household appliances (white goods).

Country	No. of companies	No. of institutes, etc	No. of respondents
China (Beijing, Shanghai [2] and Qingdao area)	5	3	10
China (Hong Kong)	6	0	9
India	3	5	19
Thailand	5	5	13
Vietnam	4	0	4

All the companies owned their own production, although the size and structure varied. The majority of the companies also had their own research and development. Some companies designed the interior (printed circuit board (PCB) layout and integrated circuit (IC) design) and used subcontractors to manufacture the parts, and then performed their own final assembly. Other companies did most of the manufacturing themselves, from parts to finished goods.

As a result of the number of respondents and the way they were selected,the results from this study should be viewed as indicative, rather than comprehensive.

5.2 Persons participating in the product development process

China

Participants were mainly engineers between 20-40 years of age, and those from management. In some cases, employees from the quality department were also involved.

India

According to one respondent with insight into many companies' product development processes, those working with product development appear to be getting younger, and are mainly design engineers and research and development (R&D) managers. There are very few large companies that have dedicated design departments where senior managers head the design function. Such departments are usually found in the automobile industry or large consumer electronics and/or computer/information technology (IT) companies.

Thailand

Most of the small and medium-sized enterprises (SMEs) in this research had one specific department for product development. However, one company had two different departments: one handled product engineering and responded to the existing design and improvement to a small extent; and the other focused on R&D, and was in charge of designing entirely new products.

[2] The area around Shanghai has been China's prime economic development zone. Numerous companies in the electric and electronic industry are concentrated in this area (called Yangtze Delta).

The number of engineers and R&D managers that worked in the product development departments ranged from 5 to 13. The engineers in those SMEs were mostly from the electrical, electronic, power electronic and power electric fields. One problem mentioned during the study was that companies often had problems finding engineers, and the number of engineers working in R&D was often very few in relation to the number of people working in production. One illustration of this is a company with 13 engineers in their product development department, in a firm with over 2000 employees, i.e. less than 1 percent of the total.

Vietnam

All those interviewed had product development function based at their mother companies in other countries such Japan, Korea, and Taiwan. The main focus for the company located in Vietnam was to manufacture. When asked if it was possible to interview engineers from the main product design department from mother companies, the answer was that 'It's impossible, because they have no time and they don't speak English'. When asked if this was a general situation among Vietnamese companies, the answer was yes.

5.3 Experience with environmentally-related product requirements

China

Interviewees had experienced product-related environmental requirements from legislators and customers, but primarily from customers. Legislation in China (such as China RoHS; Restriction of the Use of Certain Hazardous Substances) has recently started, but the companies made comments that they felt it was not complete, and in reality it had no major effect as the companies adjusted their product requirements depending on the intended market. If exported to European Union (EU) or the United States, the products needed to fulfil the legal requirements, but domestically it is was a different story. As one respondent said, 'No authority cares about RoHS'. For the companies, the most important voice was that of the customer. If customers did not specifically require them to deliver RoHS-free content, they would not do so. Knowledge about the Waste Electrical and Electronic Equipment (WEEE) Directive seemed to be low. Finally, the new Energy Using Product (EuP) Directive was something that some companies were concerned about and were trying to prepare for.

India

According to the Electronic Industries Association of India (ELCINA), approximately 70 percent of their 220 member companies exported to the EU, and thus were affected by the RoHS Directive. Many companies saw RoHS as an obstacle, and some had not managed to modify their product design and manufacturing in time. A general point seems to be that RoHS has been harder and more costly to comply with for the larger companies. All participating companies stated that becoming RoHS-compliant was worth the effort.

Thailand

At the present time, the research indicates that there are minimal environmental requirements from company's customers, with the exception of customers in Europe. Even so, the companies thought this would increase in the future, and there was evidence of attempts at preparedness and working proactively to be able to meet these requirements. Today, the main focus is to comply with the European RoHS, which is the strongest driving power from the market, i.e. the European market. The companies are not affected directly by the WEEE Directive as they generally only produced parts of products or components for finished products. One company mentioned that the EuP and Registration, Evaluation and Authorisation of Chemicals (REACH) Directives were likely to affect them in the future, but there was no focus and work to prepare for this at the moment.

Vietnam

Most of the respondents said that except for parts and components made for Europe that must meet the European Directives and regulations, the parts and components made for other Asian countries were dependent on the prices that the customers offered them. As mentioned previously, the companies in Vietnam were manufacturing facilities and did not deal with orders or suppliers; this was controlled from the head offices that were located outside of Vietnam.

5.4 Status of eco-design

China

Of the interviewed companies, the larger firms worked primarily with saving energy in their products. They began to notice RoHS in 2003. The smaller companies had some eco-design-related work (mostly relating to reducing material). However, in general, eco-design is very new, having only been introduced to them in the last one or two years.

However, because of the sampling, this result should be seen as an indication of how some companies work with eco-design. While not proven, the impression was that one of the reasons why many companies declined to participate in the study was that they did not have any eco-design, and therefore thought they had nothing to contribute (and also they did not want to 'lose face').

This also further underlines the comments from participating companies that in China the main focus is on compliance. If the market does not have any product-related environmental requirements, then companies in general do not undertake eco-design, i.e. most companies do not feel any pressure and are therefore are not doing any eco-design work.

India

According to ELCINA, eco-design initiatives in the electronics industry are unusual, and most SMEs probably did not know what eco-design was. They were still learning why and how to collect their wastes, so the road to eco-design is long. A respondent at the Swedish Trade Council said that environmental awareness in Indian companies has generally increased over the last five or six years due to an increased focus on environmental performance from foreign investors. However, Indian companies do not ask about environmental issues; instead, it is the other way around, e.g. when they contact the Swedish Trade Council to inquire about Swedish business partners.

Thailand

The general impression from the study was that few companies worked with eco-design; this was especially the case for the SMEs. However, those companies interviewed were working with eco-design, and according to them saw benefits with implementing eco-design in their product development process. Examples of advantages of applying eco-design included that their products could become both smaller and cheaper. Since they were cost-focused, this was of course very important for them. Furthermore, participating companies did not see the eco-design work as time consuming; rather, they saw it as a 'must' for them to stay in business and keep market share.

Vietnam

The eco-design work amongst Vietnamese companies seemed to be close to zero. When contacting companies to get them involved into the study, several of them responded that they didn't want to participate since they had not undertaken any eco-design work. As mentioned earlier, it appears that electrical and electronic companies in Vietnam have no R&D functions, as they are more or less purely manufacturing facilities. This was also stated by a Vietnamese professor. Typically, their engineers simply follow the direction and plans from head office for assembling products. In all the companies interviewed, all designs were from the parent companies which were located in other Asian countries.

5.5 Status of eco-design education and the need for more

China

Most of those interviewed seemed to have basic knowledge about product-related environmental legal requirements. This was most likely to be a result of how the companies and respondents were selected (the impression was that this is not a general situation). Some of the participating companies give their newly employed staff obligatory training to ensure that they receive this knowledge. Otherwise, they only get training if for example a new law that affects them is implemented. To summarize, the education is mainly internal and very limited.

Current research on eco-design in manufacturing processes is being carried out at for example Xian Jiaotong University, Shanghai Jiaotong University, Shanghai Tongji University, Tianjing University, Wuhan University and Sichuan University. A few Chinese universities also conduct material analysis and research on replacement materials, including Tsinghua University, Xian Jiaotong University, Sichuan University and Zhongsan University. However, the studies concerning eco-design are not of high standard in China.

India

Formal education about product development methods was unusual among the product developers interviewed; most designers were self-taught. Some product developers claimed that when methods did not give the desired output, it was usually because the designer lacked competence. The conclusion was that these SMEs would benefit from methods that minimise the need for training. The overall conclusion was that there was a need for more education, both in basic environmental knowledge and life-cycle thinking. This applies to the whole industry; since even the companies studied, which were some of the most environmentally-aware SMEs in the Indian electronics industry, had gaps that needed to be filled. Some managers seemed to enlarge the concept of eco-design, thus creating a mental barrier towards it. For example, they interpreted that an 'eco-designed' product needed to be biologically decomposable; since they realised that this was impossible, they did not want to spend time and money on eco-design. On the other hand, some managers that had only limited knowledge about eco-design tended to diminish it, and thought that their products did not have any environmental impact.

Thailand

The respondents from SMEs received their knowledge about eco-design from different sources. For example, one respondent had been to Japan for training, while another had two weeks of training about the eco-design concept. The companies in the research had attempted to send certain employees to seminars and workshops. These seminars and workshops, offered by research institutes, concerned reducing product-related environmental impacts and compliance with new international regulations.

None of those interviewed at the SMEs had received any education in the eco-design concept from their education programmes while studying at universities in Thailand. For example, at present there are no specific courses in electrical or electronic engineering at the universities in Thailand that provide education about eco-design. Instead, there is a focus on educating engineers in industry, and education for students in electrical and electronic engineering programmes at universities in Thailand is in a development phase. On the other hand, there is education about Life Cycle Assessment (LCA) at one university in Thailand where SimaPro software is used. However, this kind of education is for students in the environmental science field, and not for the engineers in the electrical and electronics field.

Vietnam

As mentioned earlier, eco-design work among Vietnamese companies seemed to be close to zero; this also influenced the level of eco-design education and the need for more. The impression from the study is that the environmental awareness was very low. This is the problem of finding companies to participate in this study and that the national government has no specific product-related environmental regulations for EE products, e.g. for end-of-life treatment.

At the company level, most of the environmental staff (in participating companies) did not seem to have relevant environmental education for their job levels. To solve this, they had participated in various short courses in order to raise their knowledge levels, e.g. industrial and environmental management. At the public level, almost all Vietnamese people, given their economic situation, were not surprisingly indifferent about environmental impact, with price the most significant issue for them, not product's environmental impacts.

The impression is that environmental and eco-design education is needed at different levels in Vietnam. Based on the interviews with various respondents from industry and academia, one reason why foreign companies do not set up their R&D departments in Vietnam is because of the low level of education.

5.6 Eco-design methods

China

No specific methods or tools were used in the smaller companies. The larger companies were more developed and some even developed their own methods and tools for their products e.g. checklists. Some companies seem to have misunderstood ISO/TR 14062 and described it as a tool. Some companies also stated that they had problems finding information about some methods and tools.

India

In general, those interviewed seemed to use few methods; one reason given for this was economics. Investing in new methods requires more time and is costly. It is important that methods make a return on investment, directly or indirectly. Usually, the same set of methods are used for different product development projects and, due to the cost, new methods are only brought in if it is absolutely necessary. A majority of the product developers claimed that they had experienced a need for more methods.

Thailand

At present, the Thai companies interviewed were not using any special eco-design tools, except for the tools that had been demonstrated by two institutes and an academic research and industrial support centre within the eco-design projects. The tools demonstrated were Quality Function Deployment (QFD) Capture for 'QFD for Environment' and the LCA software SimaPro. Eco-design checklists or guidelines were not used by the respondents. In the eco-design projects the companies had participated in, there had been a focus on measuring the environmental impact of some of their products and product parts, rather than implementing eco-design.

Vietnam

At the moment, there are very few methods and tools used in Vietnam, primarily due to the current lack of R&D and resultant lack of R&D engineers in the local companies.

5.7 Requirements for eco-design methods

China

Smaller companies wish to use simple tools/methods that are quick and easy to learn, such as guidelines and simple checklists. Those working at these companies do not have time to read large comprehensive manuals of methods. The education must also be inexpensive to implement.

Comments from respondents highlighted that many existing methods and tools were too complicated to be used within their companies, and that they preferred to make tools more standardised. They also preferred methods that were software-based and could show them what to do and describe for example which materials to use. Some of them would like to have the methods integrated within their existing computer-aided design (CAD) programs.

India

Many of the product developers preferred software-based methods rather than manuals. The main advantages are that they facilitate the process when there is an abundance of information involved, that you can easily see what happens when a variable is changed and that information can be reused in later projects. On top of this, software-based methods facilitate documentation and make it easier to compare different products. However, when rough estimates are needed at an early stage, CAD methods can be time-consuming compared to calculating by hand. All said, the product developers were still in favour of the CAD methods.

Thailand

There were some complaints that the SimaPro software program was too complicated and too expensive to use by the SMEs themselves, and there was an impression that LCA is the same as SimaPro. SimaPro was seen as a very powerful tool and helpful for LCA beginners to illustrate how LCA results can be presented and how to interpret the LCA results, but the companies in the research were probably not ready to use it on their own.

When asked what stopped them from using additional methods, the answers included ‘expenses for purchasing’, ‘expenses for education’ and ‘demands from customers’. The eco-design tools need to be easy-to-use and not too expensive; they must also be suitable for use in their product development process.

Vietnam

Since very few were using eco-design methods and tools, it was not possible to get any answers to this question.

5.8 Other comments

China

China is undergoing a big change now, shifting from heavy state industry to a higher proportion of privately-owned industry – and along with this a new form of market economy. Environmental impacts are closely related to the country’s economic development. On one level, the government seems to be concerned and worried about the environmental situation, but at the same time it does not want to hinder economic development. Added to this, the primary goal for any company in the industry is to make money, and environmentally-related issues cost money. It will not be so easy, however, to force companies to invest in eco-design by only implementing legislation. Other policy tools and incentives are needed to persuade companies to ‘go green’. Cases need to be developed on how to be profitable by implementing eco-design.

Thailand

Thailand has just started to build up the infrastructure to support the SMEs to deal with the increasingly stringent legal and customer requirements related to environmental and social issues in the global electrical and electronic industry. Institutes offer education, training, and test facilities for RoHS compliance, and also run some research projects and cooperate with other parties and institutes to set up national material databases which will be helpful for spreading knowledge of LCA. To support the LCA work in Thailand, the Thai LCA Network has been established by one university, and according to many respondents this network will be a good resource for LCA and eco-design in the future. New voluntary networks have also been established. For example, the ‘Thai RoHS Alliance’ helps organise self-help services and reduce repeat or redundant implementation and provides guidelines for SMEs.

6.0 Discussion and conclusion

6.1 Who within the company participates in the product development process?

Based on the research in China, India, Thailand and Vietnam, it appears that designers are involved in the product development process, with some support from managers. The general impression is that there are rarely people involved that have a deeper environmental knowledge and/or are experts in eco-design. This is even more the case for small companies.

Conclusion

When developing methods and tools, it is important to try to find methods and tools that suit the designers' needs and demands, so that these needs and demands are efficiently and effectively considered within the design process. Furthermore, at the same time it is important to address managers' need, so they understand the need for engineers to start implementing and using developed methods and tools. However, managers are not usually the primary users of the specific tools, but rather users of the outcomes of the tool, e.g. they use the resulting information to help make decisions.

6.2 Do they experience any environmentally-related product requirements on their products, and if so, what are those requirements?

The general impression is that the number of internal and external product-related environmental requirements is increasing. The statements about different countries' concerns over RoHS and WEEE requirements, and particularly Chinese companies' concern about EuP, illustrate this. Even if this is not directly shown in the results, there was also an increased concern about increased material and energy use and resulting costs. Finding methodologies to reduce the use of material and energy will not only result in a cost savings, but will also reduce the products' environmental impact. Many companies see the holistic approach of eco-design as a way to find ways to reduce cost. If the savings are identified during the use phase, this could also be used as a selling argument (customers) and could motivate a higher price.

Conclusion

The number of product-related environmental requirements is increasing, and it is not likely that these will decrease in the foreseeable future.

6.3 Are they using eco-design today?

The level of eco-design knowledge and use is still quite low in South East Asian EE companies, and therefore is still in its infancy. The impression is that the current work lacks structure. If eco-design is being done, the work is on a basic level and very much hands-on, e.g. on specific products.

Conclusion

There seems to be a need for support and education on how to conduct eco-design in a more efficient way, i.e. how to structure and manage the work.

6.4 How much eco-design education do those working with eco-design have, and have they experienced a need for more education?

Some companies were in the process of educating new staff, but this was not the general situation; for the most part, the education level was low. Some of the answers from respondents have shown that they lack an understanding of the concept of eco-design and some of its basic principles. An example of this is that some used related ISO standards are viewed as tools for eco-design. Another example is that many respondents thought that LCA was equal to eco-design. Since LCA is quite tricky to accomplish, many companies are afraid or reluctant to start working with eco-design, as they thought it was too complicated for them.

Despite their minimal knowledge and understanding of eco-design, those companies interviewed at the companies seemed to be fully aware of their lack of knowledge, and on the whole were interested in obtaining more eco-design education. At the same time, one obstacle for carrying out eco-design was the cost of education; this is also related to the fact that many existing eco-design methods and tools, e.g. LCA, require extensive education in order for them to be properly used.

Conclusion

Companies need more basic education about eco-design. It is important that the management implementing eco-design obtain additional education regarding what eco-design really is and its potential advantages. Designers need more detailed and practical eco-design education, one that gives them an understanding how to use eco-design on an operational level.

6.5 What eco-design methods are used today?

Very few methods and tools are used, and the use seems to be quite unstructured. One reason for the limited use could be that the companies lack knowledge about existing eco-design methods and tools. Another potential reason could be that existing eco-design methods and tools are too complicated or not suitable for the industry.

Conclusion

Very few eco-design methods and tools are used.

6.6 Do they have requirements for the methods used?

The studies indicate that in general designers and managers have requirements, but they are not always clearly articulated. While not proven, the impression and assumption is that if eco-design methods and tools could tackle those non-articulated requirements, this would make it more likely that eco-design methods and tools would be used.

Conclusion

One of the most important requirements for design methods is that they help the product developer to fulfil the specified requirements of the prospective product. The design methods should generate answers that are easy-to-understand and communicate. Environmental information related to products is mostly used internally. The methods have to solve the technical issues and fit with other methods and systems. The methods also have to be easy-to-learn, since formal training is uncommon and often costly. How well the method works in practice depends on the competence of the product developers.

6.7 Final comments

The studies conducted for this research have been valuable for tool development within the Asia Eco-Design Electronics (AEDE) project. One of the aims of AEDE was to develop tools that could help SMEs in Asia to carry out eco-design.

The study has reinforced the tool developers' existing knowledge about who should use the tool and what type of knowledge level they must have. In addition, knowledge related to the type of requirements the tool should fulfil to increase the chance that it gets used has been reinforced.

Examples of the studies' conclusions are that it is preferable if the tool is software-based, and that the tool must not require extensive and costly education and should be easy-to-understand and use. The main AEDE eco-design tool has been designed as software-based and very self-instructional, and includes examples and short movies that the user can easily follow. Furthermore, the tool consists of templates that make it easier for the user to use. The tool has also one basic level and higher level; the basic level is for those who have never worked with eco-design, while the more advanced level is for those who desire to gain a deeper understanding.

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