

# Exploring Culture Changes to Help Develop Product-Service Systems

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**Abstract:** This thesis considers how the development of Product-Service Systems (PSS) relates to cultural changes in the organizations doing the development. On one hand, reducing cultural shift is desirable to absorb shocks and reduce obstacles that come from internal relations. And on the other hand, the cultural changes may be an opportunity and a breakthrough - or even necessary - to develop PSS. In exploring the possibility of managing culture, the Analytic Hierarchy Process (AHP) was used to prioritize three possible actions to support the best culture to help PSS development. A survey was also carried out through sending questionnaires to nineteen experts. The results suggest that when people prioritized the three actions, the most important was related to pursuing “economic benefits”, and adopted “strengthen executive support and performance management”. This study proposes a portfolio of practices which is targeted at deep into the prioritized action and figure out an action plan as well as some sub-activities around the four quadrants which formed by the integration of Fulfilment, Informal, Innovation, and Formal approach. And each action and planning could still be applied to PSS development as well as other changes, prepare organizational culture changes and create a more harmonious enterprise culture.

**Keywords:** Product-Service Systems, Culture changes, Analytic Hierarchy Process, Executive support

# Author's Statement

This thesis is attached the programme of Master of Sustainable Product-service System Innovation in the School of Engineering, Blekinge Institute of Technology (BTH), Karlskrona, Sweden.

I come from Yinchuan, China, and have got Bachelor degree of Economics in Wuhan, 2010, and then got my Master degree of Management in Kunming University of Science and technology who send me here as an exchange student and start a new experience with MSPI in 2012.

Today, I had to say that I feel honoured to become a MSPI in BTH; it is a garden in which I plant, cultivate and harvest the most precious of crops- that is my-self.

And this thesis research was the fruit of one year formative experience of learning and training, and influenced by my former research on “The Pressure of Employees Affected by Organization Cultural Changes”. I managed the thesis with myself and took cognizance of the importance of independent thinking, even though lack of some collaboration works. However, I achieved friendship with old MSPIs, specialized knowledge and skills, precious experience of contacting companies, experts and carrying out questionnaires.

From a beginning student of the area of Sustainability as well as Product-Service Systems, I rejoice at growth and gains in everyday working, and I dream to devote myself to develop Products-Services Systems that is for the wellbeing of all companies, staffs, and customers, and bring the perception to specific works in the future, therefore, I believe that it is the value and significance around this thesis.

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Hereby, I am extremely grateful for all the participations of those who responded to my questionnaires, especially old MSPIs and BTH lecturers and staffs. Some of them are working for PSS education, and some of them put PSS into practice in the outside world, they are always infectious enthusiasm and helpful to MSPI community and Product-service System innovation.

Further, I need to pay my respects to former researcher, this thesis based on their works in some extent, such as Professor Oksana Mont in PSS area, and Thomas L. Saaty in AHP area, etc.

In the end, I would like to leave my most special thanksgiving to my parents; they paid great anticipation behind the thesis, which give me encouragement in my difficult days.

I had to say that this thesis will be a new start for me. I won't cheer up for the ending, but to celebrate for the new beginning. I won't announce the accomplishment of the thesis, but to remember every improvement.

# Executive Summary

## Introduction

Product-Service Systems (PSS) lead up to the cultural shift, and require reasonable cultural changes. It services a role in sustainability, and creates new sources of added value as well as competitiveness. Companies need to be more focus on PSS improving than before to survive, to compete, to grow, and even to lead. Consequently, the needs of developing Product-service System for Companies have grown up, when concerning about the added values; companies can't neglect the influences of soft sides of developing process, like cultural issues.

Cultural shift has become the main barrier to adopt PSS; it requires the capability of organizational culture to support a more systemic innovation and service-oriented business (UNEP 2002). On one hand, reducing cultural shift is desirable to absorb shocks and reduce obstacles that come from internal relations. And on the other hand, the cultural changes may be an opportunity and a breakthrough - or even necessary - to develop PSS.

This academic paper would focus on the prioritizing activities of managing best culture to help develop PSS. And the main research question is: **What cultural changes to take to help develop PSS for organizations?**

And it might contribute to organizations that concerned about their pursuit of PSS, and have identified needs to strengthen their culture to give enough supports. And a best culture to help develop PSS is ...

**...A culture of supporting PSS development is one in which organizational members hold shared assumptions and beliefs about the importance of the balancing economic efficiency, environmental accountability and social equity of product, service as well as the network within them. (NBS)**

## Research Method

In exploring the possibility of managing culture, the Analytic Hierarchy Process (AHP) was adopted to prioritize three possible actions to support the best culture to help PSS development. AHP is a method to help decision

maker figure out the best suits their goal and problem by using the framework of hierarchies: problem, criteria & sub-criteria, and alternative activities, and making pairwise comparison and weighting the intensity from one to nine. The Hierarchy is as following:

**Problem:** Which activities to prioritize in order to make the best culture to develop PSS.

**Criteria:** Economic benefits, Environmental benefits, and social benefits

**Sub-criteria:** (Under Economic) Financial Benefits, Increase Opportunities and Competitiveness;

(Under Environmental) Input & Output friendly;

(Under Social) Satisfy customer's needs & Enhance employees' life and working quality.

**Activities:** 1 Strengthen executive support and performance management

2 Practice effective communication

3 Training and continuous learning

In this research, a survey was carried out through AHP questionnaires by mailing to nineteen experts which consist of scholars in school as well as personnel working outside in company in equal portions.

## **Result**

According to the analysis above, sub-research questions have got definite answers.

### ● **Sub-RQ1: What criteria to pursue in order to prioritize the cultural changes to develop PSS?**

The results suggest that when people prioritized the three actions, the most important was related to pursuing "economic benefits", and regarding "Increase opportunities and competitiveness".

### ● **Sub-RQ2: What activities to prioritize in order to make the best culture to develop PSS?**

The results suggest that when companies required cultural changes to help develop PSS, the most prioritized action is to "strengthen executive support and performance management".

## **Discussion**

Based on all above studies, this discussion deep into the prioritized activity - strengthen executive support and performance management; and figure out action planning around the four quadrants which formed by the integration of Fulfilment, Informal, Innovation, and Formal approach. They are:

- Foster commitment, which strategic goal is to motive employees to get involved with the PSS development by providing executive support and encourage those who are making efforts on PSS practice;
- Clarifying expectation, which strategic goal is to capture evolving behaviors and procedures in well structured and formal way;
- Building momentum for change, which strategic goal is to inspire employees to innovate;
- Instilling capacity for change, which strategic goal is to develop foundation and mechanisms for further development of PSS;

## **Conclusion**

- Companies should pay more attention on “Strength the execute support and performance management” than ever before.
- “Increase opportunities and competitiveness” is the absolute principle that is the key to resolve all problems.
- The link between PSS development and cultural changes really exists.
- AHP is well-worked for the prioritization and decision-making in this study, and might be used in a broader relative research to deep into PSS development.

In the future work, this study might be applied to PSS development as well as other possible changes, prepare organizational cultural changes, create a more harmonious enterprise culture, and some other applications that we cannot foresee at this present time.

# Glossary

**Analytic Hierarchy Process:** A method used to assist numerous corporate and government decision makers to make consensus and decision on choosing activities or strategy. Generally it has three hierarchies, objective, criteria, and alternatives.

**Cultural changes:** A process of changing happens and influences the cultural capital on individual and community; it is sometimes dramatic and sometimes slight. And managing culture is equal with changing culture.

**Execute support:** The support from formal organizational power, usually, it is a team of executive sponsor or leadership at high level of organizational management, and who is well-respected and knowledgeable.

**IPAT formula:**  $I=P*A*T$ , namely, Environmental Impact (I) is equal to the product of Population (P), Affluence (A), and Technology (T);

**Innovation:** New solutions to meet new requirements and needs.

**Logic Model:** A systematically present and share about the flow and relationship of the resources and stakeholders in a programme or planning, it describes a working process from planned work to intended results.

**Organizational Culture:** The shared values, beliefs or perceptions held by employees within an organization or organizational unit. (Robbins & Coulter, 2005)

**Performance Management:** A process or a strategy that organizations make overall integrated planning and co-ordinate resources in efficient manner.

**Product-Service Systems:** A mix of products, services and supporting networks within them, usually, it's designed to be more competitive, better satisfy customers' needs and lower environmental impacts.

**Team-based Performance Management:** A model of performance management is in team-based knowledge work settings, and could be applied to business units.

# Acronyms

AHP: Analytic Hierarchy Process

BTH: Blekinge Institute of Technology

CCF: The Compassion Capital Fund

CDC-HKEAA: The Curriculum Development Council and the Hong Kong Examinations and Assessment Authority

FSSD: Framework for Strategic Sustainable Development

IPAT: Environmental Impact (I), Population (P), Affluence (A), and Technology (T) formula

LCA: Life Cycle Assessment

MSPD: Method for Sustainable Product Development

NPD: new product development

PSS: Product-service Systems

SPs: Sustainability Principles

TBPM: Team-based Performance Management

UNEP: the United Nations Environment Programme

# Tables and contents

## Table of Contents

<b>Author’s Statement .....</b>	<b>II</b>
<b>Acknowledgements.....</b>	<b>III</b>
<b>Executive Summary .....</b>	<b>IV</b>
<b>Glossary .....</b>	<b>VII</b>
<b>Acronyms .....</b>	<b>VIII</b>
<b>Tables and contents.....</b>	<b>IX</b>
Table of Contents .....	IX
List of Figures and Tables.....	XII
<b>1 Introduction .....</b>	<b>1</b>
1.1 Background.....	1
1.2 Research Question .....	3
1.3 Goal and Scope .....	4
<b>2 Literature Review.....</b>	<b>7</b>
2.1 PSS.....	7
2.1.1 Definition .....	7
2.1.2 Opportunities.....	8
2.1.3 Challenge.....	10
2.1.4 Needs of Developing PSS .....	10

2.2	Organizational Culture.....	12
2.2.1	Definition .....	12
2.2.2	Multiple levels.....	14
2.2.3	Influences and Functions.....	16
2.3	Sustainability .....	16
<b>3</b>	<b>Research Methodology.....</b>	<b>18</b>
3.1	Analytical Hierarchy Process .....	18
3.2	Research Design .....	20
3.2.1	Design of Questionnaire.....	20
3.2.2	Validation .....	26
<b>4</b>	<b>Results and Analysis .....</b>	<b>29</b>
4.1	Test and weight.....	30
4.1.1	Criteria.....	30
4.1.2	Sub-criteria .....	31
4.1.3	Activities .....	32
4.2	Analysis of priorities.....	34
4.2.1	Criteria and Sub-criteria .....	34
4.2.2	Activities .....	36
4.3	Additional findings .....	37
4.4	Brief Summary.....	37
<b>5</b>	<b>Discussion.....</b>	<b>39</b>

5.1	Discussion of results & answers to research question.....	39
5.1.1	Fostering Commitment.....	41
5.1.2	Clarifying expectation.....	43
5.1.3	Building momentum for change.....	44
5.1.4	Instilling capacity for change.....	45
5.2	Validity & Feedback.....	47
5.2.1	Validity.....	47
5.2.2	Feedbacks.....	47
<b>6</b>	<b>Conclusion.....</b>	<b>51</b>
6.1	Key findings.....	51
6.2	Future work.....	52
<b>7</b>	<b>References.....</b>	<b>53</b>
	<b>Appendix A: Questionnaire.....</b>	<b>62</b>
	<b>Appendix B: The experts list.....</b>	<b>67</b>
	<b>Appendix C: The fundamental scale of absolute numbers.....</b>	<b>68</b>
	<b>Appendix D: Pairwise Comparison Matrix of Sub-criteria.....</b>	<b>69</b>
	<b>Appendix E: Pairwise Comparison Matrix for Activities.....</b>	<b>70</b>
	<b>Appendix F: Prioritizing results for activities from School.....</b>	<b>74</b>
	<b>Appendix G: Prioritizing results for activities from Company.....</b>	<b>75</b>
	<b>Appendix H: Action list.....</b>	<b>76</b>
	<b>Appendix I: Other Recommendation.....</b>	<b>78</b>



# List of Figures and Tables

Figure 1.1 Research Design .....	6
Figure 2.1: Stakeholders in a products and services life-cycle mix .....	9
Figure 3.1 Steps of decision-making followed in the AHP .....	20
Figure 3.2 Path to cultural change and activities .....	24
Figure 3.3 Validation based on Vee-model.....	27
Figure 4.1 Hierarchy Structure.....	29
Figure 5.1 A portfolio approach to embedding PSS .....	39
Figure 5.2 Action plan for embedding PSS .....	40
Table 2.1 Analysis of the needs to develop PSS .....	12
Table 2.2 Levels of organizational culture.....	14
Table 4.1 Pairwise comparison Matrix of main criteria with respect to the problem.....	30
Table 4.2 Pairwise comparison Matrix for sub-criteria with respect to Economic Benefits .....	31
Table 4.3 Final prioritizing results for activities through criteria and sub-criteria.....	33
Table 5.1 Action plan of Fostering commitment .....	41
Table 5.2: Action plan of clarifying expectations .....	43
Table 5.3: Action planning of building momentum for change.....	43
Table 5.4: Action planning of instilling capacity for change.....	45



# 1 Introduction

## 1.1 Background

Product-Service Systems, an objective demand and an inevitable result of development of companies, industries, and the whole society, represents the trend of the times. Klaus Toepfer, the former executive director of United Nations Environment Programme (UNEP 2002), said that “Serving specific needs of consumers is their core business and to do that in a more sustainable way will be challenging new business opportunity as well as being responsive to societal needs”<sup>1</sup>. Accordingly, PSS has attracted a lot of attentions for playing industry and service a role in sustainability, and creating new sources of added value as well as competitiveness. Companies need to be more focus on PSS improving than before to survive, to compete, to grow, and even to lead.

Culture, the soft side changes will not only affect them directly, but affect the product and service that they provided indirectly. In recent years, several strange social phenomenon made a big splash in China; events like “Abnormal Deaths of Young Employees”, “Labour Shortage”, “Worker Strike”, and “Employees Frequently Leaving” are issued by media, and shocked the employing unit and even the labour market who suffered severe loss in these events. Researching into the occurrence of such events, this study found that the reasons induced the abnormal reaction involve with a lot of ground, however, the very core of these issues is employees with their viewpoints. An organization with strong culture has common values and codes of conduct for its employees, which should help them accomplish their missions and goals, and by this way, the work recognition and job satisfaction can be achieved when employees can complete the tasks assigned to them (Tsai 2011). Research has indicated that the culture of company shows a close link to its effectiveness (Kotter & Heskett, 1992). And it also addresses the impact of service climate that culture brings, and examines the relationship and connection between the characteristics of an organizational culture and its impact on organizational outcomes (Schneider, White, & Paul, 1998).

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<sup>1</sup> Klaus Toepfer. Resource Efficiency and Sustainable Consumption and Production - Product Service Systems & Sustainability: <http://www.unep.org/>

Firstly, the behaviours as well as the attitudes of individual employees will be influenced besides the group-level outcomes (Spector, 1997), and it will also act on the capability of executing efficiently, engagement of employees and empowerment of controller. It is the companies and staffs that provide and support a whole PSS system.

“If businesses are to grow their way out of the current economic malaise, they will have to get more productivity out of their people – not by cutting and slashing, but by nurturing, engaging and recognizing.” (John A. Byrne, editor in chief, Fast Company magazine, Jan. 2002)

Secondly, customer satisfaction - the key component of a successful enterprise as well as the main content of PSS, will be impacted by potential ideas and solutions from the culture, relate to the essence of PSS directly, and even link to profit margin, customers’ repeat purchases, etc. In addition, the intensity of the environment also makes big differences on that effectiveness (Sorensen, 2002).

And it is due to these influences that this study bravely makes the hypotheses: it is possible to link organizational culture and Product-Service Systems, and even manage culture to develop Product-Service Systems.

PSS are resilient and create economic value, healthy ecosystems and strong communities, it has been seen an opportunity to survive by companies, however, the development of PSS leads up to cultural shift which plays double roles.

On one hand, one of the main challenges to develop PSS is the cultural shift from traditional product patterns to sell functionalities (UNEP 2002), in another word, businesses as well as technological changes are threatening organizational sustainability and modern management faces many challenges (Drucker 1999). Knowledge takes unpredictable changes of culture and uncertainty growing of economic, at the same time; it has impacted on and also been affected by the mode of thinking, and brought about a fundamental shift of management philosophy in the enterprises throughout both internal and external environment. And Product-Service Systems is a design-based business strategy, and relies on existing technologies and socio-cultural contexts (UNEP 2002).

Reducing the cultural shift is desirable to absorb shocks and reduce obstacles that come from internal relations. And it is the cultural shift that has been the

main barrier to adopt PSS, not only the value changes of users, but the businesses as well. It requires the corporate culture have the capability to support a more systemic innovation and service-oriented business. So to speak, PSS as well as sustainability would require cultural changes. And Further, cultural shifts consist in changing the mode of thinking that attracts the traditional management, and a sustainability concept is also a new important factor; for when an enterprise makes its business more sustainable, it will knock on a demander's door easily.

And on the other hand, the cultural changes may be an opportunity and a breakthrough - or even necessary - to develop PSS. It must be pointed out to make sense that corporate culture is a kind of universal tool for competitiveness (Alvesson 2002).

Consequently, corporates try to make cultural changes constantly, however, lots of reports illustrate that unsuccessful culture changes will also result in some other further frustration problems which bring further crisis in competition. And almost three-quarters of failures of process re-engineering, quality management, strategic planning and other major events happened in an enterprise are the results of having miscalculated the impacts of corporate culture, or failing developing a good relationship between culture changes and other elements. (Cameron, 1991; Gross, Pascale & Athos, 1993) In fact, an organization without distinctive culture can hardly obtain a leading position. The more successful enterprise would pay more efforts in order to reduce the internal instability by using cultural change, and finally complete the transmission of culture.

Therefore, both cultural changes and PSS are supposed to happen; and this study links the organizational culture and PSS together to help enterprise with this transformation by exploring activities of cultural changes.

## 1.2 Research Question

Product-Service Systems as well as sustainability would take cultural changes in an organization, however, its development also need the supports from soft sides which author supposed to be managing culture successfully. In this way, this study would focus on helping an enterprise to develop a Product-Service Systems approach from a traditional one or developing one by changing culture reasonably.

The main research question is then defined as:

## **RQ: What cultural changes to take to help develop PSS for organizations?**

And in relation to the main research questions, this study is going to figure out the following sub-research questions as well.

**Sub-RQ1: What criteria to pursue in order to prioritize the cultural changes to develop PSS?**

**Sub-RQ2: What activities to prioritize in order to make the best culture to develop PSS?**

### 1.3 Goal and Scope

#### *Purpose*

This thesis is targeted at those organizations that concerned about their pursuit of PSS, and have identified needs to strengthen their culture to give soft side supports. The purpose of this thesis is to help companies as well as staffs to manage the organizational culture with better regarding sustainability and the transformation of PSS. It is practical to find the solution- prioritized activities of cultural changes which cater for the company needs for PSS as well as its developing actuality.

To define what I mean by a supporting culture to PSS, I view PSS as a goal rather than as an end point. In today's business practice, it is something that many companies are striving toward, and few of them have embedded it into organizational culture.

For my purposes, a best culture to help develop PSS is ...

**...A culture of supporting PSS development is one in which organizational members hold shared assumptions and beliefs about the importance of the balancing economic efficiency, environmental accountability and social equity of product, service as well as the network within them.** (Refer to "culture of sustainability" by Network for Business Sustainability)

And organizations with strong culture of supporting PSS strive to support sustainability while continuing to operate successfully over the long term.

### *Interested crowd*

Accordingly, the interested crowd includes:

Employees, people who work for the suppliers of product and service in their full-time or even part-time are the support group of working atmosphere. Staffs, especially managers in companies without PSS will care more about the methods and transition processing, and staffs in companies with PSS will be willing to find out the advantages of PSS and come to understand the result of their complemented changes.

Employers, people who hold the shares, control profits and own the power of decision making is not only the supplier of PSS, but also the provider of staff welfare, they care more about the business cases, the reputation within government, customer and even the whole marketing, the balance of costs and returns. Further they believe that PSS would enhance the productivity, create commercial promise in the future marketing, and also realize their wild ambition to achieve a sustainable development.

Learning partners, people who share the understanding of PSS perspective and sustainability development of an enterprise, like cooperation, associations, universities, etc.

Consumers, people who demand for the product and service everywhere, they focus on the variety of choices, user-friendly design, quality assurance, healthy influences and even their contribution to the society. So they have the motivation to choose a PSS Company and its product and service which is better regarding sustainability.

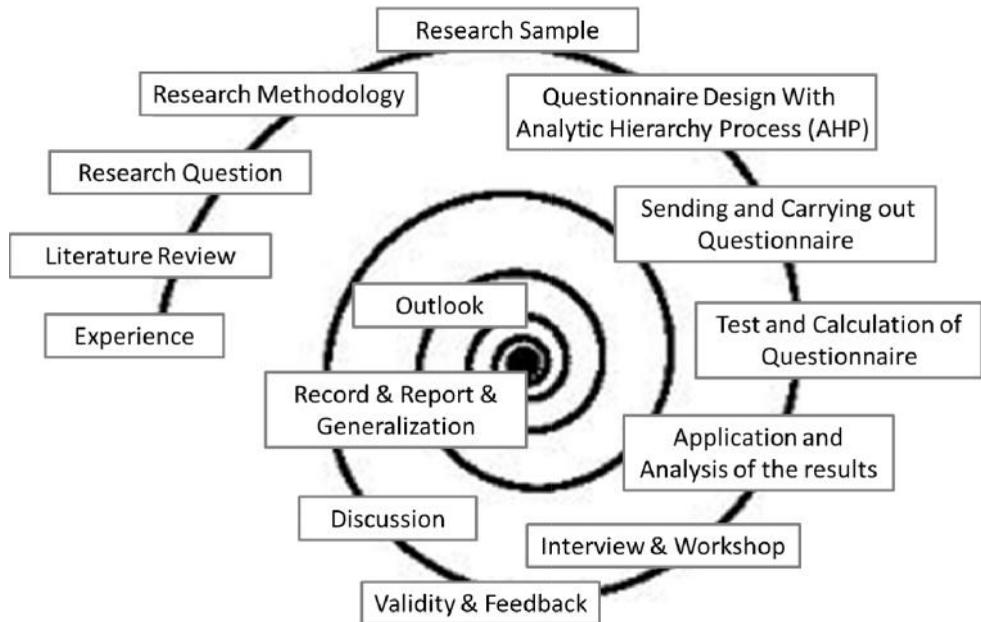
Government and industry association, organizations who concern about building a business model of PSS in an over-all interest, and commit to solve current affairs, as well as make PSS go into service in a broader world in the future, and would like to see the positive influences of PSS with best culture act on social community and environment.

### *Scope*

This thesis talked about making cultural changes in general organizations and companies, and it won't specify any business especially and make any hypothesis for any occasion.

And this thesis didn't consider take into account the differences between the different types of PSS which could be divided into Product-oriented, Use-oriented, and Result-oriented services (Tukker and Tischner 2006). It just refers to the general integrated of products, services and the networks within them.

Based on the research question, I drew up the research plan with regarding to the research question. The deeper I went into the specialized field; the closer I could find out a solution throughout a series of coming steps (See Figure 1.1).



*Figure 1.1 Research Design*

## 2 Literature Review

### 2.1 PSS

#### 2.1.1 Definition

The concept of Product-Service Systems has been defined in a broad view and one of the first formal definition as well as the most often quoted definitions is “A system of products, services, networks of ‘players’ and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models” (Geodkoop et al. 1999). Towards development of PSS, various approaches and trends has been used to describe the products and services capable of jointly function fulfilling users’ needs (Mont 2002), such as repair-society approach which instead of a throw-away society (Blau E al.et. 1994), the change to a leasing society (Braungart M), service become the substitution of goods (Schmidt 1994), sale usage of product instead itself (Stahel 1991), and address the changes in technology and social and consumer attitudes (Manzini 1996).

In addition, a lot of definitions acknowledge the combination of product and service, like “Consist of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs” (Tischner et al. 2002). However most of them focus on the mixes, but neglect the weight which results in service-less products and product-less services. Among the varied groupings, product is tangible commodity, service is activities for value-added, and system is a collection of relations, a network of producing a product-service.

For Consumers, PSS mean a shift from purchasing product itself to by means of services, functions, solutions with less environmental impacts (Mont 2002). It requires higher level of involvement of stakeholders, but at the same time, achieves higher satisfactory of needs and wants.

For Producers or providers of product and service, PSS means concerning about the life cycle, system engineering, and eco-design that requires greater support of education and knowledge. However, it could attach additional value to a product or service, and form a strategy on innovation in future industry, and become the potential regarding competitive advantage.

## 2.1.2 Opportunities

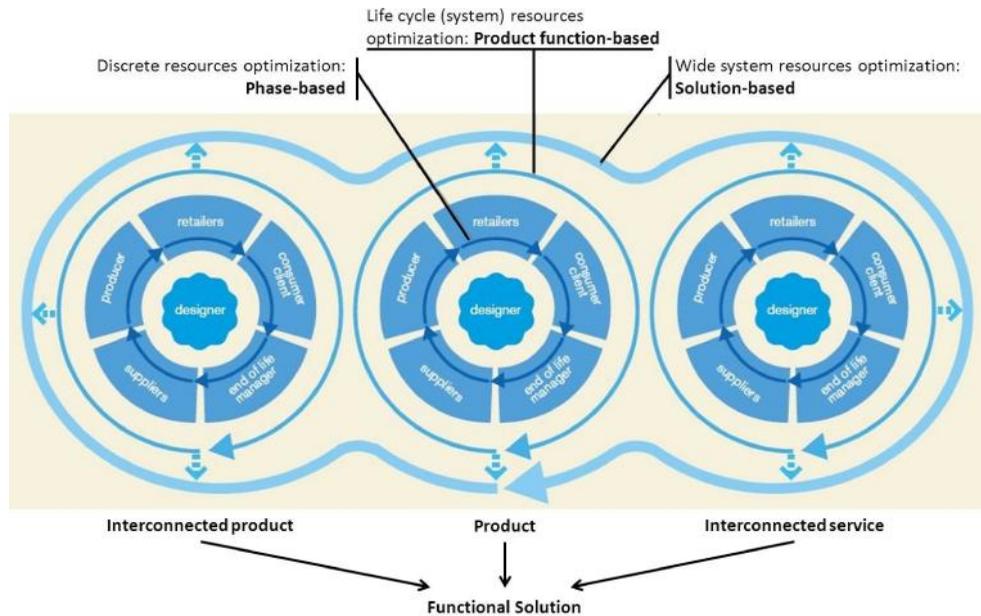
Different with the traditional product model, the goal of PSS approach business is to achieve an integrated functional solution which could meet customer needs, and during this process, synergies produced by PSS would contribute to sustainable consumption, financial benefits, and future opportunities, etc. Basically, some of the worth noting benefits have been displayed in Table 1.1 to prove the needs of developing PSS for its advantages. And they could also be summarized and formed a consensus that PSS are designed to be:

### *Competitive*

PSS could be the core competence of corporations (Arnold et al. 2004, Mont 2004, etc.), and it could be owed to more cost-efficient through Product-oriented services, use-oriented services, and result-oriented services. They acted in different ways, and have different financial profile by improving transaction, inducing pre-finance and influencing the risks. Besides of the cost efficiency, there are still some benefits under competitive: improving bargaining power; preventing development of substitutes; quick in picking up signals of change; flexible in adapting to change (Tukker 2004).

### *Satisfy customer needs.*

PSS is based on it to identify stakeholders, lead a functional requirement and attributes requirement fulfillment service, and finally obtain better customer satisfaction. (Geodkoop et al.,1999, Manzini & Vezzoli, 2002, etc.); From a stakeholder perspective, PSS business model implies new types of relationships of stakeholder, the panorama is much more complicated, but offers greater potential for eco-efficiency system innovations by broadening the notion of whole system and interconnecting series of product and service life cycles (UNEP 2002).



**Figure 2.1** Stakeholders in a products and services life-cycle mix (UNEP)

In the rebound mechanism, PSS could also contribute to wider effects, such as saving consumption, enhancing needs, and even more transformational effects.

### *Lower environmental impact*

PSS could deplete the environmental impacts. (James et al. 2001, Brezet et al. 2001, Mont 2004, etc.). And an IPAT formula has been illustrated the relationship between environmental impact and top three of the environmental issue drivers, and the Impact (I) is equal to the product of Population (P), Affluence (A), and Technology (T) (Ehrlich, Holdren 1971). And through the fundamental knowledge, Tukker (2004) used and certificated that PSS could enhance the impact efficiency of production which related to intervention mechanism: by reducing resource input as well as the emissions of the system, using cleaner technology, enhancing the multiple functions and developing radical innovation, etc.

### 2.1.3 Challenge

#### *Time and resources*

Time will not only cover the life cycle perspective PSS development, but also be significant to every processing in PSS development. For example, the short-, medium-, and long-term planning should be built up and examined over time, and it might relate to scheduling of daily performance; the accuracy and sources of time standards could help decide the design of system, every selection, quantity of equipment, and even scale; and it helps evaluate performance of employee.

Resources may include methods and tools (e.g. accounting, designing, assessing), as well as infrastructure and technologies (e.g. remanufacturing and recycling, information, skilled personnel, and partnerships etc.).

#### *Cultural shift*

From Consumer aspect, consumers might not be motivated by ownerless consumption that would be brought by PSS, and the old habit, custom, and even preference might be the possible barrier. (Braungart 1993, Mont 2002, Stahel 1997, UNEP 2002)

From Producer aspect, the barriers might come from design, development and delivery of PSS. Except the necessary knowledge, technology, and infrastructure, culture and organisational management should be able to support a more systemic innovation and service-oriented business (UNEP 2002). In addition the co-operation within suppliers and final consumers would play an important role.

From Employee aspect, in relation to requirement of fundamental cultural shift of PSS, the human resources, canteens, psychological and physical care for workers might be included as services. (Mont 2002)

### 2.1.4 Needs of Developing PSS

PSS offered for sale and combined products with services to deliver the functions required by customers (Wong 2004). However, it would also be a win-win solution and this study analysed and confirmed it in Table 2.1; this paper started with the trends of challenges which related to sustainability, product or service issues from a government, company, and citizen

perspective respectively which refer to UNEP, and then considered their likely desires and needs in the future, afterwards linked to how PSS might response and contribute in facing these challenges and requirements. Finally we could say that no matter whatever they are governments, company itself or clients, they need to develop PSS as a solution to response to the sustainability challenges.

Trends of challenges (related to sustainability, product or service)	Likely desires and needs	How could PSS response and contribute?
Government (Source: Center for sustainability.org)		
Regulation is NOT sufficient in dealing with destruction, contamination and consumption while guaranteeing development	Maintain sound economy	<ul style="list-style-type: none"> <li>● Encourage creative problem solving (Mont 2004);</li> <li>● Develop sustainable economy (Mont 1999), influence risk profiles and feedback loops (Tukker 2004);</li> <li>● Increased employment (UNEP 2002), and require more or higher priced human (Tukker 2004);</li> </ul>
	Environmental friendly	<ul style="list-style-type: none"> <li>● Smaller environmental impact comparing with separate products and services under equal condition. (Mont 2004);</li> <li>● Provide Eco-services and stronger use of renewable resources in an environmentally efficiency (Jasch 2000; Hinterberger et al. 1994);</li> </ul>
Company (Source: Economist Intelligence Unit Report)		
Lack clear leadership on sustainability	Enhance competitiveness (Omann 2003; Mont 1999; etc.)	<ul style="list-style-type: none"> <li>● Term a radical new approach of “value innovation” (Kim &amp; Mauborgne 1997);</li> <li>● Help market development (Omann 2003; Mont 1999; UNEP 2002);</li> </ul>

Companies are worrying more about what customers and governments think, and what rivals do	Strong share price performance (Paul Kielstra 2008)	<ul style="list-style-type: none"> <li>● System resources optimization (UNEP 2002)</li> <li>● Increased productivity (Hinterberger et al. 1994);</li> </ul>
	Improved reputation (Paul Kielstra 2008)	<ul style="list-style-type: none"> <li>● More and longer-term client relationship (UNEP 2002);</li> </ul>
<b>Citizen</b>		
Cannot balance the relationship between sustainable consumption and the quality of life (William al et. 1997)	Saving money, time and troubles, etc.	<ul style="list-style-type: none"> <li>● Fulfill client needs in an integrated and customized way (Arnold 2004, Mont 2001)</li> </ul>
	Sustainable consumption	<ul style="list-style-type: none"> <li>● Support sustainable lifestyles (Mont 1999)</li> </ul>

**Table 2.1** Analysis of the needs to develop PSS

And the UNEP has given the requirements of a PSS approach for a company to generate a new corporate culture:

- The capable of recognizing and adding value as well as enabling platform;
- The capable of promoting internal organization;
- The capable of promoting external partnership and interaction with stakeholders;
- The capable of application of the knowledge and technology.

## 2.2 Organizational Culture

### 2.2.1 Definition

#### *Organizational culture*

Organizational culture which is the ‘soft’ side of organizational life (Geert Hofstede 1991) has emerged meaningfully not only in academic research and educational field, but also in organization theory as well as in management

practice. And it has been discussed a lot; traditional culture usually addresses the lived experiences of people, and the organizational approach is the connection within the organization which could be seen as a whole and everyday experiences and individual actions. (Smircich, 1983)

It could be summed up as following key points:

- A way: It is well-known that organizational culture has been recognized to be “the way we do things around here” (Lundy & Cowling 1996). It could conduct businesses; treat employees, customers, and wider communities (Ouchi 1981, Kunda 1992).
- An objective: everyone ought to comply with. And it was generally acknowledged that Organizational culture is on behalf of deeply rooted values and beliefs that are shared by personnel in an organization (Ogbonna 1992, Bro Uttal 1983, Andrew Brown 1998, etc.).
- An extent: “Organizational culture is also an interpretation of events, ideas, and experiences that are influenced and shaped by the groups within which they live” (Frost et al. 1985). Therefore, it’s the “set theory” (Sun 2008) provides ways of thinking, feeling, reacting that influence the decision-making and activity arrangement (Davis 1984, Ogbonna 1992, etc.), and help develop personalities and ideas as well. (Ouchi 1981)
- A power: contain hierarchy. Good culture ought to have the capacity to thrive over the long run despite new competition, new regulations, new technological developments, and the strains of growth. (Baker, 1980)

### *Cultural changes*

In reality, different Group have different cultural orientations which could respond to the different results under the same management acts and material arrangement.

The important trend away from mass production to service, knowledge and information in the economy makes ideational aspects – regulation of beliefs and images, for example, in service management (Alvesson 1990), and the service-mindedness which in turn has an impact on the level of customer satisfaction. Therefore, the employees’ attitude and recognition of culture would be significant in management, and these changes happened in

production and working organization as well as cultural dimension should be come into focus.

About the process of changing, Lewis has advanced a refrigerator-model, and he divided the phases into “Unfreezing, Change and Freezing”.

### 2.2.2 Multiple levels

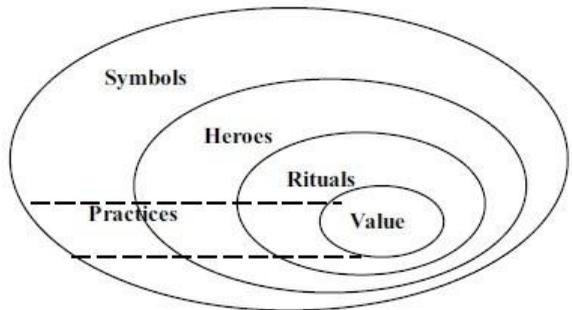
Scholars used to divide culture into different layers, and some representative ones will be set out in Table 2.1.

Scholars	Range	Levels
William G. Ouchi (1981)	Expectations, experiences, philosophy and values of an organization, and be express by self-image, inner workings, interactions outside world, and future expectations.	<ul style="list-style-type: none"> <li>● Shared attitude, beliefs and customs</li> <li>● Written and unwritten rules</li> </ul>
Deal & Kennedy (1982)	The way things get down around here	<ul style="list-style-type: none"> <li>● Work-hard, play-hard culture;</li> <li>● Tough-guy macho culture</li> <li>● Process culture</li> <li>● Bet the company culture</li> </ul>
Edgar Schein (1992)	Organizational products, services, founders, leadership and all other physical attributes, etc.	<ul style="list-style-type: none"> <li>● Artefacts that could be seen, felt, and heard</li> <li>● Shared values</li> <li>● Tacit assumptions that are unseen and not cognitively identified</li> </ul>

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### Onion Diagram

Geert Hofstede (1997) “Collective programming of the mind which distinguishes the members of one category of people from another”

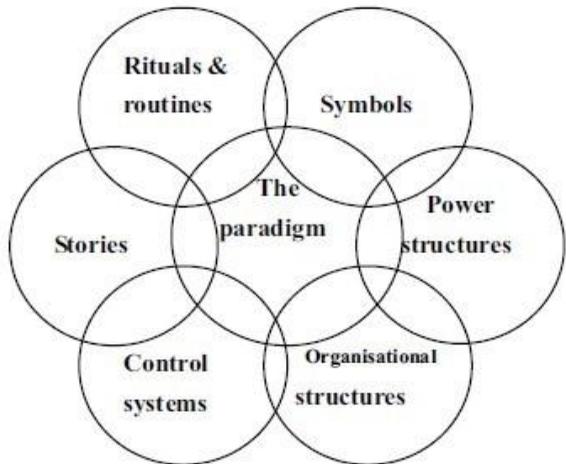


- Values are from the core of culture, and connect with moral and ethical codes;
- Rituals are considered as socially essential;
- Heroes are persons who possess characteristics;
- Symbols are the overt elements

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### Cultural web

Johnson and Scholes (1999) “Artefacts’ of the organisation- such as organisational routines, systems and structure.”




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**Table 2.2** Levels of organizational culture

### 2.2.3 Influences and Functions

#### *Learned entity*

Basically, organizational culture could cope with the problems of external adaptation and internal integration, and teach new members the correct way to perceive, think, and feel in relation to those problems (Schein 1984).

From employee perspective: affect productivity and performance (Ouchi 1981, Olu Ojo 2009, Mohammad al et. 2012).

From customer perspective: improve the capacity of satisfy needs (Michael 2007, Tsai 2011).

From product perspective: provide guidelines on quality and safety (World Health Organization 2008, ECRI Institute 2009)

From service perspective: provide guidelines on customer needs (Donald & Stephanie 2001, Kotter & Heskett 1992)

From social perspective: Concern about sustainability

From marketing perspective: gain good reputation and advertising practice

#### *Strategy*

Bate (1995) said: “Culture is a strategic phenomenon, and strategy is a culture phenomenon too”, in another word, every strategy formulation is included in the cultural activity, and as the same time, every cultural changes could be considered as a strategic changes. As a result, they should not be separated; when we put forward a cultural programme, it means strategic processing has been stated, and when strategic planning is taken place, cultural issues should be taken in account.

## 2.3 Sustainability

The understanding of sustainability for this report is based on the Framework for Strategic Sustainable Development (FSSD). The FSSD first clarifies what it is to be sustained (human society and the ecological system that society depends upon), and then defines “success” via basic principles that must be met in order for society to be sustained. The four sustainability

principles for a sustainable society state that, nature is not subject to systematically increasing...

SP1 ...concentrations of substances extracted from the Earth's crust

SP2 ...concentrations of substances produced by society

SP3...degradation by physical means

SP4...in such a sustainable society, people are not subject to conditions that systematically undermine their capacity to meet their needs. (Ny et al. 2006)

## 3 Research Methodology

This section first explains Analytical Hierarchy Process (AHP) and then goes on to explain the specific steps taken to conduct this research project.

### 3.1 Analytical Hierarchy Process

In order to make the research and design fit the knowledge requirements of new PSS design effort and make the marketing personal skills fit the design and analysis of questionnaires, experts around PSS area will be involved in and joined efforts with the *Analytic Hierarchy Process (AHP)*<sup>2</sup> to go towards more reasonable qualitative results. Here, according to the principle of Kipling Method - the Five Ws and One H method in Rudyard Kipling's "Just so stories" (1902), the AHP technology could be explained complete by answering following questions:

#### *What*

AHP was developed by Dr Thomas L. Saaty in the early 1970's, and usually used to assist numerous corporate and government decision makers to make consensus and decision on choosing activities or strategy, like resource allocation, make selection, ranking, prioritization, benchmarking, quality management, and conflict resolution (Forman al et. 2001). It has been applied widely in government, business, industry and education. Rather than prescribing a correct decision, AHP helps decision maker figure out the best suits their goal and problem. Generally the framework of AHP has three hierarchies, objective (or problem), criteria, and alternatives. When using an AHP, the most important step is to decompose the decision problem into a hierarchy of sub-ones, and evaluate and analyse by pairwise comparison. Then calculation for each alternative could be prioritized.

#### *Who*

This study first considered about the choice swatch experience of Delphi method which character is purposive sampling, and it is helpful to collect the consensus, concurrently, get the authoritative and wise statement from experts. Taking this into account, this study also employs the similar way to

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<sup>2</sup> In the following, the method - Analytic Hierarchy Process will simply be called "AHP".

select the experts group around PSS area. As a method for complex qualitative issues, inviting experts is more used in macro subjects, and contribute to predict and assist to make decisions during a set of survey rounds, it focuses on answering “What could or should it be?”(Powell 2003). Therefore, this study is going to collect data from experts, and then stand on the experts, in that case, we knew less, but somehow understand more.

About the sample size, this study referred to some published researches which share the similarities (carrying out questionnaires with professionals) with our study. For instance, the study of “Identify national park selection criteria” carried one round survey with twenty-eight experts (Kuo & Yu 1999).

In the end, totally 19 people filled up the questionnaire survey, including 9 scholars around PSS education, mainly consist of PhD & MA of product-service innovation, and 10 staff who are working with product and service system in specific companies.

#### *When*

The preparation of this research takes two weeks, and it takes three more weeks for sending questionnaires, calling them back as well as carrying it out, then calculation and analysis process consuming the rest of time.

#### *Where*

Questionnaires were sent by email messages or administered by the researcher herself. The goal and whole process were explained to the participants in advance.

#### *Why*

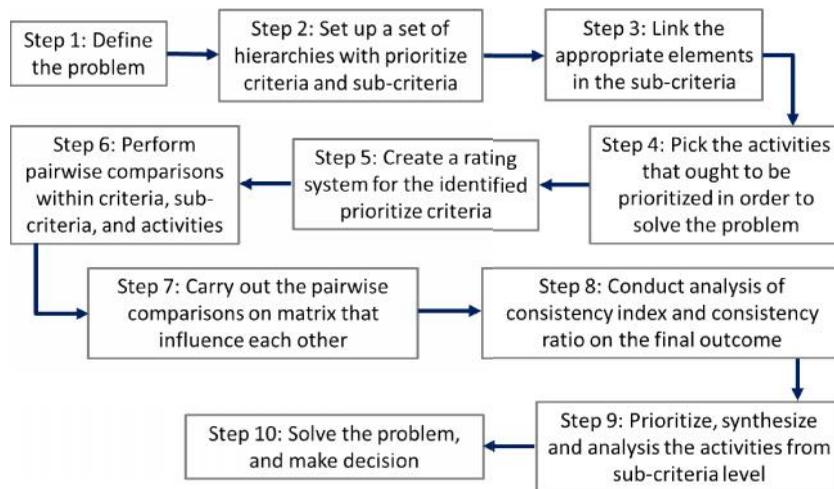
AHP technology has advantages on quantifying and comparing difficult alternatives, and it could provide a structured guideline to communicate with experts and learn from their specializations, terminologies, as well as perspectives. In addition, it's useful to work on complex problem involving human judgements, and long-term repercussions (Bhushan al et. 2004). And this research which attempt to select the most desirable changes by ranking conforms to this characteristics of complicated, requiring subjective experience and professional competence.

## How

Generally, the process of making final decision can be decomposed into the following steps. (Saaty 2008)

- 1 Define what question should be answered in the decision-making.
- 2 Structure the criteria hierarchies and objectives from a broad perspective based on the problem, namely to formulate the highest, lowest level as well as a set of intermediate levels with different intensity.
- 3 Construct the pairwise comparison matrices, and each element will be used to make comparison.
- 4 Weigh the priorities for every elements based on the comparisons.

Following AHP modelling, steps of this study have been made to point to the solution of problem and decision-making. (See Figure 3.1)



**Figure 3.1** Steps of decision-making followed in the AHP

## 3.2 Research Design

### 3.2.1 Design of Questionnaire

In general, AHP requires a three-level structure to engage for organizing and systematizing the process to derive a logical conclusion.

## *Problem*

Through the analysis of complex problems, the first thing is to define the problem or this study could regard it as the goal or target of decision and it stays at the top level of the whole structure of AHP modelling. That is why it has only one element, but above everything else. In this study, while focusing on the research question all the time, the core problem is defined as:

### **Which activities to prioritize in order to make the best culture to develop PSS?**

## *Criteria and sub-criteria*

And then this study identified a set of hierarchies with prioritize criteria and sub-criteria that is the determinant of whether the goal could be achieved. To some extent, it is the principle or benefit that should be achieved during the changing process. Or in another words, it is the most important factor that should be considered in order to best manage culture during the development of PSS system.

Below the target layer, it involves great number of factors that display complicated interrelationship. With implementation of PSS, this research divided the prioritized criteria into three dimensions according to the dimensions of sustainability which has been used in a multi-criteria evaluation for Austrian companies-“Product Service Systems and their impacts on sustainable development” by Ines Omann in 2003; they are Economic, Environmental, and Social, respectively. Close behind it, this study pointed out the affecting factors under each principle, divided them, grouped them and also defined them in some sub-criteria. The details are as following:

### ***3.2.1.1 Criteria 1: Economic Benefits.***

There is no doubt that sustainable Product-service System offers enterprises as well as customers several economic benefits, like economic flexibility, high return on investment, and substantial medium or long cost saving (Sopko 1992). But, this study summed it up in “Financial benefits” as one of the sub-principles to help consider the contribution of culture, especially the economic thing of the action itself, because financial benefits should be always taken into account. Moreover, Omann’s research indicates that PSS supply has played the role of companies’ objectives and advantages, which is

important to new market opportunities and increased competitiveness. Further, other gains include a stronger innovation orientation from a cultural perspective (Mont 1999).

In this way, the economic benefits could be divided into three sun-principles:

- **Sub-criteria 1: Financial benefits**, is the direct economic figures and relations which includes not only microeconomic, but also macroeconomic group, that is to say, this study would like to put this sub-principle into a broader group. And it relates to companies, products, and stakeholders as well, like customers, distributors, and public image, etc.
- **Sub-criteria 2: Increase opportunities and competitiveness**, this sub-principle is basically aiming at organization itself. Sustainable PSS offers better service performance and flexibility with less risk (Hargroves 2007). In addition, the organization could be a role model of PSS with better reputation with implementing the whole scope of sustainability, and more successful organizational culture.
- **Sub-criteria 3: Gain a stronger innovation orientation**. Sustainability and PSS takes a culture change, and also effects with culture changes on organizations to form positive and strong environment of innovation and creativity, that would stimulate the emotion of staffs, and perform better themselves to provide better service performance.

### ***3.2.1..2 Criteria 2: Environmental Benefits***

In many of today's leading enterprise, business decisions are based on environmental issues as much as they are on economic and traditional business issues (Hargroves 2007). Successful enterprises would seek for lower costs and use them in environmental management to make better collection, remanufacturing, and recycling activities, and at the same time, increase resource productivity. Therefore, key environmental principles behind PSS and culture changes are relatively input and output friendly, namely, respect to Four Sustainability Principles.

- **Sub-criteria 4: Input friendly**. Input includes material input and energy input. As one of the sub-principles here, input friendly means that every activity of managing culture should consider the sustainability of input.

- **Sub-criteria 5: Output friendly.** Like input friendly, every activity should take the output into account at the same time. It includes waste and other emission of the activity.

### **3.2.1..3 Criteria 3: Social Benefits**

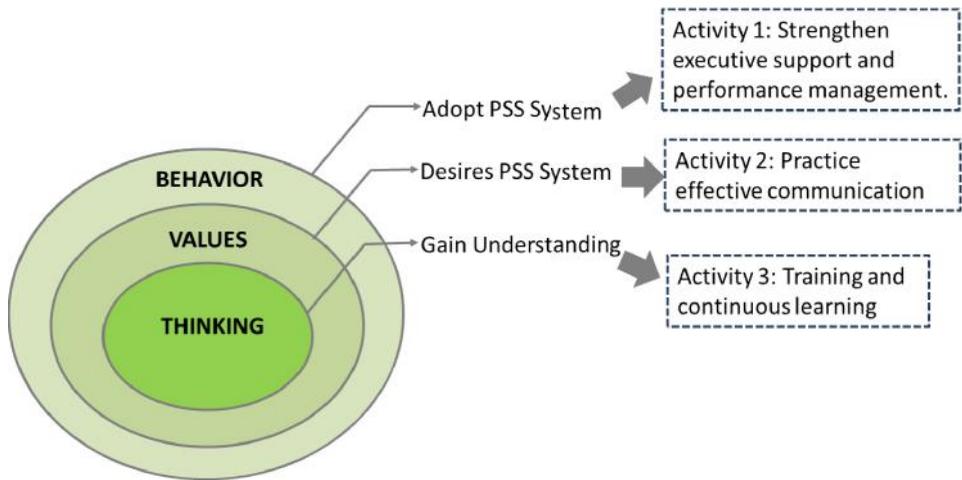
Social impacts influence and be influenced in many ways during this process, such as supporting sustainable lifestyles, changing regional characters, etc. (Mont 1999). This study would like to strengthen the key stakeholders of this system: customers and employees. From a customer perspective, a better PSS supply could save time, money, as well as troubles, and even more important, it would satisfy the customers' needs, and make their needs be acknowledged and recognized. At the same time, the enterprise could win customer loyalty. From an employee perspective, managing products and services by changing culture could win freed human resources to concentrate on their core business or expansion. (Davey 2005). Human resource is an important part of businesses today; employees also need benefits to fulfil their requirements, increase sense of security and gratification, obtain better working environment and achieve healthy insurance (including physiological and mental), etc. In short, it's a win-win situation, and one of the principles of measuring a good cultural change should be enhance the employees' life and working quality.

- **Sub-criteria 6: Satisfy customers' needs.** It means that any activity implemented by organizations should be customer-centric, put customer first to identify the requirements, look up solutions, and satisfy every need.
- **Sub-criteria 7: Enhance employees' life and working quality.** In this way, employees could perform better themselves.

### *Activities*

Based on one research about path to cultural change with product attachment, this study proposed three activities in this part, and they could be gathered from these three levels (See Figure 3.3): Behaviour level where the PSS system is adopted, Value level where people desire the PSS system, and Thinking level where understanding and acceptance has been developed (Mugge R. 2005). And considering of this philosophy, we also believe that to change behaviour, first values must change, and if values must change, then

the way of thinking must change at first. Further, these three levels should respect to the sub-principles above, and further contribute to the Goal.



*Figure 3.2 Path to cultural change and activities (Mugge 2005)*

### **3.2.1..1 Behaviour level**

The ultimate objective of most communication activities is to change behaviour, however, even if changing habits by attitudes may be too strong to break and therefore behaviours might not change. It is mostly better to focus on attempting to directly change employee's behaviours which is important to reduce accidents and improve service quality, such as some rules, company policies and practices, procedures and systems, rewards, recognition and incentives, etc. (Kim Harrison 2004). Ramus and Steger (2000) found that employees were more likely to develop creative ideas that positively affected the natural environment when they perceived supervisory encouragement for doing so. And Stopford and Baden Fuller (1994) found that chief executives of organizations who supported learning by removing barriers to teamwork and collaboration makes different. In this case, this research proposed Activity 1.

- Activity 1: Strengthen executive support and performance management. Executive supports beyond verbal support would be good for leading the change of new PSS, and executives in an organization would provide behavioral support to change others' behaviors (Heathfield 2013). Moreover, it is generally accepted that culture influences behavior, which in turn affects organizational performance, in a circular way,

culture is in turn affected by behavior and performance. Employees' would response to the input of their fresh ideas and new attributes (Kim Harrison 2004).

### **3.2.1..2 Value level**

The personal values of employees are widely considered to influence their workplace behaviours. Overwhelming corporate experience shows that values are not successfully imposed from the top down. The most immediate and pragmatic approach is to start by getting some of that pressure working for management – by making the new behaviour consistent with an already existing employee value, concern and respect (Kim Harrison 2004). This could be accomplished by communication (Larkin 1994).

- Activity 2: Practice effective communication. In order to become aware, communicate is a possible alternative for the current system. Members of the organization must realize that they need to make changes to shift from a product ownership model to a new PSS system, and know how to actually do the new behaviors. Keeping employees informed by sound communication and information-sharing about the culture changes and PSS development process to tell them what is expected of them is critical. Rumor will consume valuable time and detract from ongoing, everyday performance. Misinformation will increase uncertainty and anxiety, further affecting performance negatively.

### **3.2.1..3 Thinking level**

Poor understanding of the concepts and expected performance of PSS often compromises success (Hochstein 2005). People assimilate information much more thoroughly if they are obliged to describe to others how they will apply what they have learned (Kim Harrison 2004). That would also contribute to continuous improvement (Hargroves 2007), and ensure that all all employees have the right skills sets to support PSS development. So training could be very useful in both desiring expectations and teaching new behaviours.

- Activity 3: Training and continuous learning. Employees need to equip with new skills; after absorbing new information, practicing, integrating, and interpreting it with existing knowledge as well as time and inspiration, they learn to reflect, experiment and apply these new knowledge and skills. Jassawalla and Sashittal (2002) showed that training could help 1) build cohesion and commitment; 2) develop skills;

### 3) Show commitment.

In summary, the hierarchies with problem, criteria, sub-criteria and activities could be constituted like this (See Figure4.1).

#### 3.2.2 Validation

Based on the former study of soft sides of eco-design and new product development (NPD) areas, it has been confirmed that additional aspects which includes social, cultural and psychological factors equally or even more importantly than the traditional internal value chain (Casper 2006). And we have reason to believe that in the development of Product-Service Systems, the influence of culture shift should be taken into account, and the hierarchy this study proposed above should be incorporated in prescriptive and descriptive research related to PSS development.

On the downsides, this project takes the risk of following puzzles:

Measurement validity, relates to the tool of measurement and pairwise comparison: questionnaires with AHP technology, it might not be a best method to measure the weights of hierarch. In addition, it also includes the usage of other statistical tool, like Excel 2000, SPSS 17.0 and AHP Calculation software.

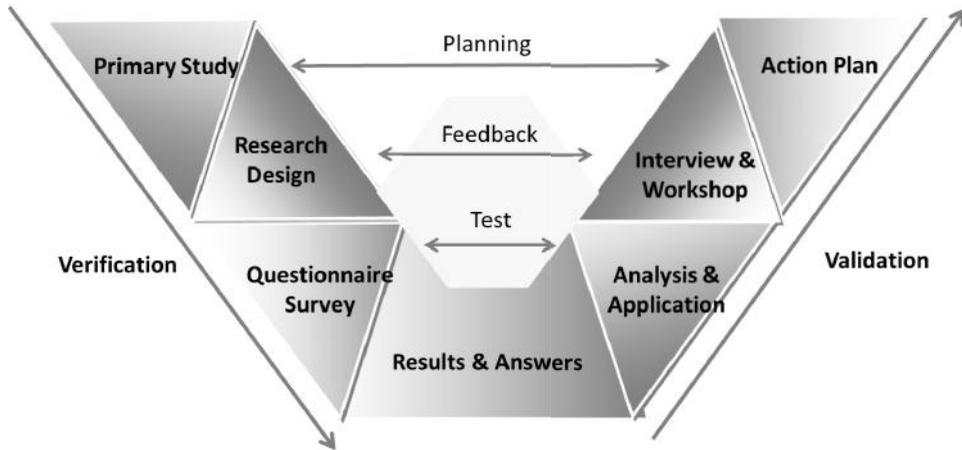
Recognition validity, relates to the different cognitions of questionnaire participations with different background; the choices of investigation subjects and respondents might be imperfect.

Data validity, imprecision data from the questionnaires and interviews may lead to the false belief of getting the results, when in fact it only has what is on someone's point of view. In this case, the use of additional participant observation would address this concern.

Analysis validity, relates to the appropriate skills. Knowledge is limited by personal education; it is hard to keep professional and avoid the influences affected by complicated environment during the calculation and analysis.

By going through the AHP, the activities ought to be prioritized. The following validation phase would be adopted to build up the relationships between survey and feedback structure. It is most likely based on the framework: Vee-Model which generally is used in system development

lifecycle and could improve the understanding of the relationships between feedback structure and dynamics behavior to improve complex system (Richardson 1981), so that the policy for improving the validation can be developed and a good detailed design can be created.



**Figure 3.3** *Validation based on Vee-model*

### *Experts*

This study relied on knowledgeable people and it is so important that guarantee the involvement of experts all the time, they would not only help make consensus, but also provide feedbacks about the questionnaire and research design that is significant to help prepare and execute the improvements of the survey in right direction.

### *Interviews*

Interviews could provide chances to hear from the views, opinions and current affairs about the practice and attempts of enterprises to develop PSS in a non-structured way. It helps judging the gap between theory and practice, help exchange the information between company and researcher, and also help assess the possible deviations and discrepancies.

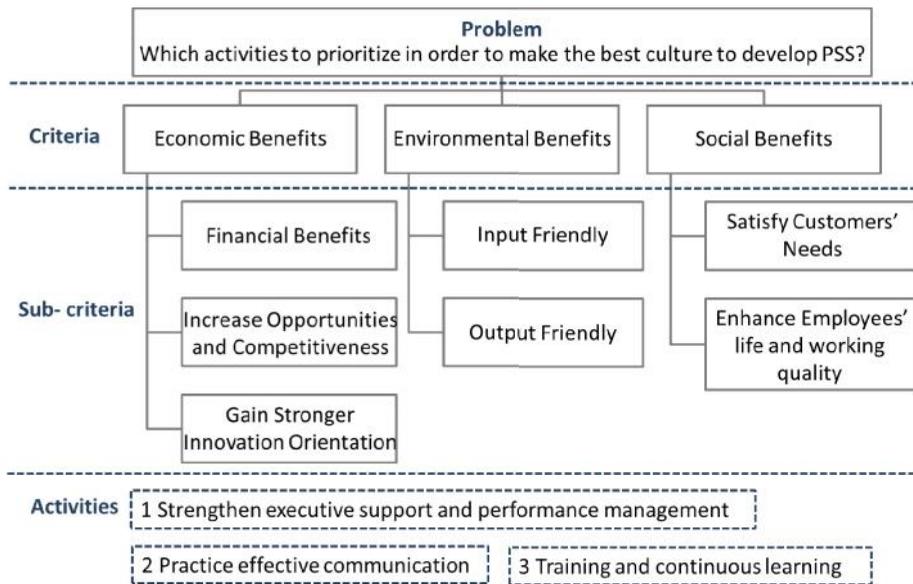
### *Workshop*

In order to fit the interest as well as compensate for the shortcoming of the activities which is not concrete enough without detailed operation planning,

workshop with employees could be an expansion plan to develop divergent thinking under each activity.

## 4 Results and Analysis

Figure 4.1 comes from the chapter of Research Methodology, and it is our research decision structure to determine which prioritized activity could make best culture to develop PSS: Strengthen executive support and performance management, Practice effective communication, or Training and continuous learning. The goal is to determine the best cultural change which is best suited as spelled out by the criteria for help develop PSS.



**Figure 4.1** Hierarchy Structure

And, the fundamental scale of absolute numbers has been formulated in Appendix B.

After carrying out the questionnaires where priorities have been weighed, this study turned our steps to statistical analysis by using a software package-Statistical Product and Service Solutions (SPSS) 17.0, and AHP Calculation software by CGI which act on pairwise comparison matrixes, and display weights and values.

There are eleven pairwise comparison matrixes in all, and one for criteria with respect to the goal which will be shown in Table 4.1, three for the sub-criteria under Economic benefits, environmental Benefits as well as

Social benefits which will be given in the following Tables, and the rest of them will be listed in Appendix C. And following, this study will show every result, make analysis, and give brief discussion.

## 4.1 Test and weight

### 4.1.1 Criteria

#### *Pairwise comparison Matrix*

The three covering criteria are: Economic benefits, Environmental benefits and Social benefits. In Table 4.1, the criteria listed on the left of the table have been compared with each criterion listed on the top of the table one by one to prioritize which one is more important with respect to the problem of implementing a most reasonable cultural change.

<b>Criteria</b>	Economic Benefits	Environmental Benefits	Social Benefits
Economic Benefits	1	5	4
Environmental Benefits	1/5	1	2
Social Benefits	1/4	1/2	1

**Table 4.1** *Pairwise comparison Matrix of main criteria with respect to the problem*

#### *Consistency Test*

Through a series of mathematical operation, the priorities or the weights could be worked out by the formula below, and they are 0.687, 0.186, and 0.127 with a maximum Eigen value of 3.094 and a consistency ratio of 0.090 which is less than 0.1, and it illustrates that the result is quite up to the consistency test, and the consistency of this decision is acceptable, because, if Economic benefits is more important than Environmental benefits, and at the same time Environmental benefits is more important than social benefits, then logically Economic benefits ought to be more important than social benefits. Therefore, the consistency test could help rule out the unacceptable result in pairwise comparison.

$$\text{Weights: } W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kl}} = \begin{pmatrix} 0.687 \\ 0.186 \\ 0.127 \end{pmatrix}$$

Maximum Eigen Value:  $\lambda_{\max} = 3.094$

$$\text{Consistency Index: } C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0.047$$

Random Index: R.I. = 0.52 (Statistical Abstracts)

$$\text{Consistency Ratio: } C.R. = \frac{C.I.}{R.I.} = 0.090 < 0.1$$

#### 4.1.2 Sub-criteria

##### *Pairwise comparison*

Here, this study will give details of Economic benefits analysis as an example, and the rest of the processing of calculation could be looked up in the Appendix. In Table 4.2, the sub-criteria on the left are compare with those on the top of the table with respect to relative factors for potential increase in Economic benefits.

<b>Economic Benefits</b>	Financial Benefits	Increase Opportunities and Competitiveness	Gain Stronger Innovation Orientation
Financial Benefits	1	1/2	2
Increase Opportunities and Competitiveness	2	1	2
Gain Stronger Innovation Orientation	1/2	1/2	1

**Table 4.2** *Pairwise comparison Matrix for sub-criteria with respect to Economic Benefits*

### Consistency test

$$\text{Weights: } W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.311 \\ 0.493 \\ 0.196 \end{pmatrix}$$

Maximum Eigen Value:  $\lambda_{\max} = 3.054$

$$\text{Consistency Index: } C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0.027$$

Random Index: R.I. = 0.52 (Statistical Abstracts)

$$\text{Consistency Ratio: } C.R. = \frac{C.I.}{R.I.} = 0.052 < 0.1$$

Further, the final weights of sub-criteria should base on their parent criteria – Economic Benefits (0.687) to obtain their integrated priority.

$$\text{Final Weights: } \begin{pmatrix} 0.311 \\ 0.493 \\ 0.196 \end{pmatrix} * 0.678 = \begin{pmatrix} 0.211 \\ 0.334 \\ 0.133 \end{pmatrix}$$

In addition, the results of Environmental benefits and Social benefits are (0.124, 0.062), and (0.102, 0.026) respectively.

#### 4.1.3 Activities

Then, after multiplying each ranking by the priority of its criteria and sub-criteria, we got the final priority by resulted weights for the three activities. And the weights as well as overall priorities will be given in Table 4.3. The overall priorities for the activities sum to 1 approximately (0.993), and the largest one is executive support.

The pairwise comparison matrix, particular computational process as well as consistency test process will be given in Appendix C.

<b>Criteria</b>		<b>Economic Benefits (0.678)</b>			<b>Environmental Benefits (0.186)</b>		<b>Social Benefits (0.127)</b>		<b>Overall priorities</b>
<b>Sub-Criteria</b>	<b>Financial benefits (0.211)</b>	<b>Increase opportunities and competitiveness (0.334)</b>	<b>Gain stronger Innovation Orientation (0.133)</b>	<b>Input Friendly (0.124)</b>	<b>Output Friendly (0.062)</b>	<b>Satisfy Customers' needs (0.102)</b>	<b>Enhance employees' life and working quality (0.026)</b>		
<b>Activities</b>	Strengthen executive support and performance management	0.133	0.138	0.042	0.083	0.037	0.025	0.017	0.475
	Practice effective communication	0.046	0.087	0.061	0.021	0.012	0.061	0.007	0.295
	Training and continuous learning	0.032	0.110	0.029	0.021	0.012	0.016	0.003	0.223

**Table 4.3** Final prioritizing results for activities through criteria and sub-criteria

## 4.2 Analysis of priorities

### 4.2.1 Criteria and Sub-criteria

Based on the process of decision-making of AHP, this study go through the outcome of the prioritization, and make an assay of possible reason for the results and enlightenment for cultural changes to help develop PSS. It's easy enough for everyone to guess that Economic benefits (0.687) always lead the list, because PSS is usually a company approach utility which combined products, services, and the network within them systematically.

According to the survey, under the criteria of Economic benefits, "Increase opportunities and competitiveness" (0.334) is the most important factor that should be concerned a lot in launching cultural changes, and it has got almost 1.5 times weightier than "Financial benefits" (0.211), and nearly tripled times weightier than "Gain stronger innovation orientation" (0.133). And regarding Environmental benefits (0.186) and Social benefits (0.127), the force of their sub-criteria is weak with comparatively speaking, Input friendly got 0.124, Output friendly is about half of Input, in addition, Satisfy customer's need (0.102) is apparently higher than Enhance employees' life and working quality.

It deserves nothing that all this part has achieved consensus with consistency test which is supposed to be less than 0.1 in a statistical standard, and the following analysis will be in deference to the results of ranking.

#### *Increase opportunities and competitiveness (0.334)*

Most participants considered that when companies pitch PSS approach, the cost of production will be reduced by proved performance of personnel, and the same as the price of product, that make the company more competitive and flexible beyond doubt. As the price leader, companies might opt to lowering the cost continuously and risks. Cultural changes would make the contribution, and the activity itself should respect the item all the time, and further increase profit margins from the consumption of materials and energy as well as the behaviour and think from influenced value. Additionally, culture ought to set up a common sense that "greenness" PSS will not only encourage consumer to purchase over competitors, but also enjoy preferential policies from government, like tax, and foreign-owned contracts.

### *Financial benefits (0.211)*

It related to the cost of establishing a Life Cycle Assessment (LCA) perspective. The concept of PSS should be plated into every step to set up a systematically thinking and planning, and it would start from the reduction of raw materials, the wastage in production, delivery, transportation by influencing the usages and emissions, and then change the behaviours of using and recycling. If every cost decreases, the direct financial benefits will be obvious and help company to sustain future rapid growth. And the returns must outdistance the cultural “put in”.

### *Gain stronger innovation orientation (0.133)*

The value of organizational cultural changes is to build up a strong culture to enable the members and help the whole organization reach the success. Here, in order to manage creative people, gain stronger innovation orientation should play an important role with regarding the PSS development. With the cultural strong support, companies could be more confident and ambitious in research and design, and become motivated to start up their independent developed products, and one-up services.

### *Input friendly (0.124)*

It means that the cultural activities should respect to the Four SPs and concerns more about the renewable material and energy in reform. Through only few partners of the questionnaire have strengthened this point of view, it still takes the leading position by checking the numbers with Output friendly. Because they believe that it relates to the usage of raw materials, infrastructure, and even some manufacturing problems which violated to SP1, SP2, and even SP3. Moreover, making use of appliance and office supplies, necessities of enterprise activities could be a symbol and signal to every staff that PSS has been addressed and popularized everywhere, and as an excellent model to give guidance.

### *Output friendly (0.102)*

It was outpointed by the input friendly, but earned most of the supports and widespread respect. That is why output friendly should be respected as well, and it happens in using phase with over consumption and wastes of daily works, like water, papers, inks, electricity, etc. Therefore every activity of managing culture ought to take Sustainability Principles into account.

### *Satisfy customer needs (0.102)*

Refer to the argument of Michael A. Gillespie, there are four broad characteristics of organizational culture that impact on customer satisfaction, and in this survey, the concrete activities of cultural changes are supposed to consider the existing customer factor: every action should not militate against the satisfaction of customers, because it is the leverage of enterprise existence.

### *Enhance employees' life and working quality (0.026)*

It is a pity that the point of Enhance employees' life and working quality has graded and got lowest scores, however, the purpose of designing cultural changes is supposed to create better working environment and go to great lengths to make personnel work better with better feelings.

## 4.2.2 Activities

According to the priorities, the first activity – Strengthen executive support and performance management (0.475) scored well, therefore, it is the best activity to help develop PSS, and the rest of two activities played in a similar level.

### *Strengthen executive support and performance management (0.475)*

After integration of every weight, the executive support has been prioritized, and we could say that executive support has been required by new PSS system and cultural changes. In this way, establishing the vision for the change management process, and a structure which will be used to support the PSS system is crucial, and this might take the form of steering committee, leadership group, as well as guiding coalition (Heathfield 2013). And to some extent, it indicated that the highest paid person could rule the decision easier, in another word, the popularizing of PSS can not live without formal support as well as the influence of leadership.

### *Practice effective communication (0.295)*

Before multiplying by the weighing which comes from criteria and sub-criteria, communication also got a great of respects. The cultural changes need communication to involve all the staff in changing their thinking, behaviours, and engaging in plans to meet the goal, but not

everyone interested in communication, and experts do not have enough confidence on this with regarding to criteria. However, we could also put it in mind, and attempt to make it as an affiliated activity to play a role, and broader internal and external communication channel might keep them front of mind, engagement with wider community.

#### *Training and continuous learning (0.223)*

The refreshed values and behaviours are supposed to be introduced into education and training programs so that their importance is constantly reinforced. And so is the knowledge as well as skills which would be necessary for developing PSS. Therefore, although it is at the bottom of the ranking, it should not be neglected at all.

### 4.3 Additional findings

By comparing the prioritizing results coming from different background of testing group -- which has been divided into school group (9 persons) and company group (10 persons), I got some additional findings. And the weights and overall priorities come from each testing group could be found in Appendix F and Appendix G.

Firstly, two group shares similar standpoints in comparing the importance among the criteria, and company men scored higher on economic issue, and lower on environmental and social affairs.

Secondly, company men concerned much more about the financing benefits (0.316) than school staff did (0.151).

Thirdly, scholars in university placed emphasis on training and continuous learning; however, different with scholars' viewpoint, company personnel believe that communication is crucial.

### 4.4 Brief Summary

According to the analyses above, sub-research questions have got definite answers.

**Sub-RQ1: What criteria to pursue in order to prioritize the cultural changes to develop PSS?**

The results suggest that when people prioritized the three actions, the most important was related to pursuing “economic benefits”, and regarding “Increase opportunities and competitiveness”.

**Sub-RQ2: What activities to prioritize in order to make the best culture to develop PSS?**

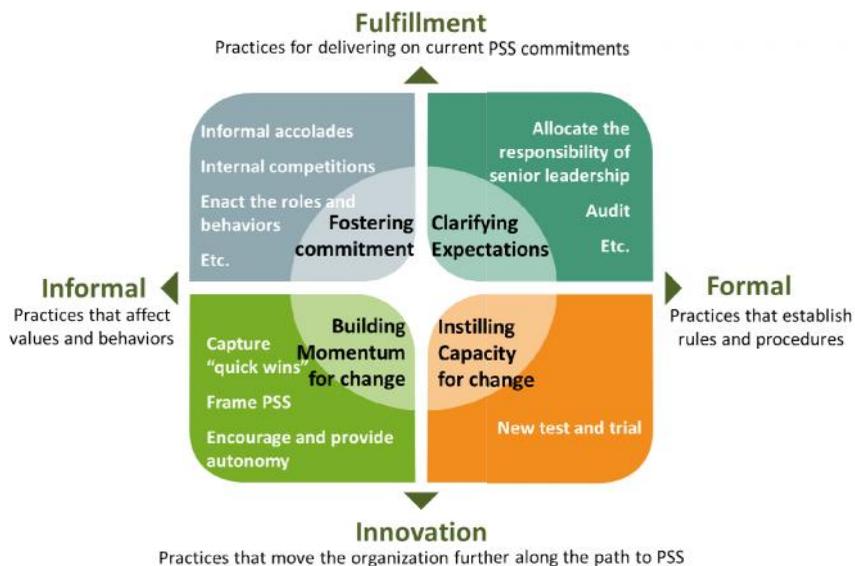
The results suggest that when companies required cultural changes to help develop PSS, the most prioritized action is to “strengthen executive support and performance management”.

## 5 Discussion

### 5.1 Discussion of results & answers to research question

#### **RQ: What cultural changes to take to help develop PSS for organizations?**

Depending on all above studies and survey, it carries out a prioritized cultural change for organizations to help develop PSS: strengthen executive support and performance management which represents the “Behaviour” level of Ruth Mugge’s path to make cultural changes.



*Figure 5.1: A portfolio approach to embedding PSS*

Consequently, in order to deep into this activity and discuss more practices for organizations who pursue PSS development and have identified a need to strengthen their culture to support PSS, this discussion is going to propose a portfolio of practices to help develop PSS by managing organizational culture. And the portfolio could vary on two dimensions relating to the intent and approach, which comes from the practices of embedding sustainability in organizational culture (Bertels et al. 2010). In their study, the “Fulfillment” practices are targeted at delivering on current PSS commitments or

implementing current PSS initiatives, and refine the normal way in the area. The “Innovation” practices aim at figuring out ways to do things differently or better. The “Informal” approaches aim to establish and reinforce shared values and shared ways of doing things that align with PSS. And the “Formal” approaches take attempt to guide behaviour through rules, systems as well as procedures.

From Figure 5.1, we could see that there are four quadrants represent different types of practices that can be explored to embed PSS into organizational culture. The quadrant which depicts the informal practice is “Fostering Commitment” when aiming at fulfilment, and it is “Building momentum for change” when aiming at innovation. And the formal practice aims at fulfilment is “Clarifying expectation”, and aims at innovation relates to “instilling capacity for change”.

In relation to the research question and support the goal of “strengthening executive support and performance management”, the following discussion will obey this portfolio approach, and aim to figure out action planning as well as sub-activities for actions (See Figure 5.2).

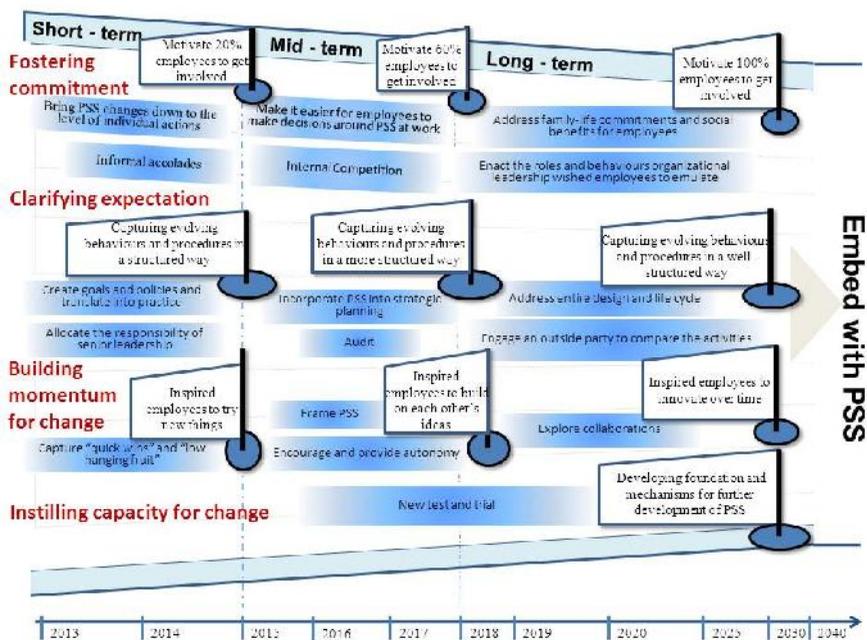


Figure 5.2 Action plan for embedding PSS

## 5.1.1 Fostering Commitment

Action	Explanation for action	Possible activities	Resources	Indicators
Short-term: 1-2 years				
<ul style="list-style-type: none"> <li>● Strategic goals: Motivate 20% employees to get involved with the PSS development by providing executive support and encourage those who are making efforts on PSS practice.</li> </ul>				
Bring PSS changes down to the level of individual actions (Bansal 2003)	Allow employees to align their values with their job (Hart 2005)	<ul style="list-style-type: none"> <li>● Encourage employees to bring their personal behaviours into workplace (Ethical Corporation 2009)</li> <li>● Advocate to include PSS targets in everyone's job description</li> </ul>	<ul style="list-style-type: none"> <li>● Personnel</li> <li>● Chief executives</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Informal accolades	Rewarding individual efforts which would help build commitment to sustainability (Smith & Brown 2003, Angel et al. 2008)	<ul style="list-style-type: none"> <li>● Awarding additional training resources for energy, water and waste reduction (Goodman 2000)</li> <li>● Recognizing employees at staff meetings publicly (Bertels al et. 2010)</li> <li>● Holding celebrations (Doppelt 2003, Willard 2009)</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> <li>● Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> <li>● Amount of funding</li> </ul>
Mid-term: 3-5 years				
<ul style="list-style-type: none"> <li>● Strategic goals: Motivate 60% employees to get involved with the PSS development by providing executive support and encourage those who are making efforts on PSS practice.</li> </ul>				
Make it easier for employees to make decisions around PSS at work (Bertels al et. 2010).	Providing support for employees to make choices at work as well as their personal lives which might affect the creative environment.	<ul style="list-style-type: none"> <li>● Provide grants for PSS projects launched by employees.</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Time</li> <li>● Grants</li> </ul>	<ul style="list-style-type: none"> <li>● Numbers of project</li> <li>● Amount of funding</li> <li>● Percentage of returns</li> </ul>

Internal competitions	Keep positive frames on the competition can be a motivator between business units to motivate PSS performance (Ethical Corporation 2009, Bertels et al. 2010, NBS 2010).	<ul style="list-style-type: none"> <li>● Organizational internal competitions on identifying new ideas between business units to motive PSS development</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
<p>Long-term: &gt;5 years</p> <ul style="list-style-type: none"> <li>● Strategic goals: Motivate 100% employees to get involved with the PSS development by providing executive support and encourage those who are making efforts on PSS practice.</li> </ul>				
Address family-life commitments and social benefits for employees	Leaders reinforce a “Prevention-oriented approach” in quality improvement (Blackburn Rosen 1993), and see employees as a whole person and part of the community.	<ul style="list-style-type: none"> <li>● Provide Personal health and safety services to employees</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> <li>● Amount of funding</li> </ul>
Enact the roles and behaviours organizational leadership wished employees to emulate (Bertels al et. 2010)	People are far more likely to try out new behaviours if they see them modelled by others they respect and admire. (Wirtenberg 2008)	<ul style="list-style-type: none"> <li>● Demonstrate leadership by “walking the walk” and “talking the talk” (Bertels al et. 2010)</li> <li>● Back up colleagues and employees when they prioritize PSS</li> <li>● Prioritize PSS in discussions and decision-making</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> <li>● Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> <li>● Amount of funding</li> </ul>

*Table 5.1: Action plan of Fostering commitment*

## 5.1.2 Clarifying expectation

Action	Explanation for action	Possible activities	Resources	Indicators
Short-term: 1-2 years				
● Strategic goals: Capturing evolving behaviors and procedures in a structured way				
Create goals and policies and translate into practice	Set the PSS goals as the organizational level as well as the business level (Camilleri 2008).	<ul style="list-style-type: none"> <li>● Set PSS goals at the business unit and departmental levels</li> <li>● Implement code of conduct (Andersson et al. 2005)</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Allocate the responsibility of senior leadership	Senior leadership always has strong signals (Wei 2004), and allocation of responsibility could be assigned on the PSS agenda.	<ul style="list-style-type: none"> <li>● Assign responsibility for PSS to the CEO and other senior leadership</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Mid-term: 3-5 years				
● Strategic goals: Capturing evolving behaviors and procedures in a more structured way				
Incorporate PSS into strategic planning (Bertels et al. 2010)	Combine PSS with all functions, not as a single issue.	<ul style="list-style-type: none"> <li>● Emphasize sustainability as a strategic priority</li> <li>● Integrate PSS throughout existing management system (Allenby 2000)</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Audit (Annandale et al. 2004)	Examine the systems over time.	<ul style="list-style-type: none"> <li>● Internal regular audits</li> <li>● Create audit executives</li> <li>● Reports on processes</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Long-term: >5 years				
● Strategic goals: Capturing evolving behaviors and procedures in a well-structured way				
Address entire design and life cycle (Laszlo 2003)	Consider the entire design of PSS, including everything from	<ul style="list-style-type: none"> <li>● Address the economic, environmental, and social</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of</li> </ul>

	materials, production, packaging, distribution, use, and disposal.	<ul style="list-style-type: none"> <li>● impacts</li> <li>● Invest in technologies of PSS (Bierly et al. 2008)</li> <li>● Reduce requirements of developing PSS (Mehalik 2000)</li> </ul>	<ul style="list-style-type: none"> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● positive feedback</li> <li>● Amount of funding</li> </ul>
Engage an outside party to compare the activities	Hiring independent personalities to conduct assessments.	<ul style="list-style-type: none"> <li>● Corporate with third-party</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Third-party</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>

*Table 5.2: Action plan of clarifying expectations*

### 5.1.3 Building momentum for change

Action	Explanation for action	Possible activities	Resources	Indicators
Short-term: 1-2 years				
<ul style="list-style-type: none"> <li>● Strategic goals: Inspired employees to try new things.</li> </ul>				
Capture “quick wins” and “low hanging fruit” (Dubose 2000)	Started with quick wins which require less resource and result in readily benefits, but after being exhausted the low hanging fruit, employees would have the motivation to develop a more structured plan for moving to the next state. (Dubose 2000)	<ul style="list-style-type: none"> <li>● Start with small success</li> </ul>	<ul style="list-style-type: none"> <li>● Resources</li> <li>● Funding</li> <li>● Chief executive</li> <li>● Personnel</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> <li>● Amount of resources</li> </ul>
Mid-term: 3-5 years				
<ul style="list-style-type: none"> <li>● Strategic goals: Inspired employees to build on each other’s ideas.</li> </ul>				

Frame PSS (NBS 2010)	Frame PSS issue from particular perspective	<ul style="list-style-type: none"> <li>● Frame PSS as high financial payoff (Andersson &amp; Bateman 2000)</li> <li>● Frame PSS in language (Bertels et al. 2010)</li> <li>● Frame PSS as the right thing to do (Bansal 2003)</li> <li>● Frame PSS as innovation (Bertels et al. 2010)</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>
Encourage and provide autonomy	Encourage employees to be positive to develop their own solutions and implement with flexible.	<ul style="list-style-type: none"> <li>● Encourage research and experiment</li> <li>● Encourage self-started project</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Funding</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of funding</li> </ul>
<p>Long-term: &gt;5 years</p> <ul style="list-style-type: none"> <li>● Strategic goals: Inspired employees to innovate over time.</li> </ul>				
Explore collaborations	Industries supposed to band together to develop best practices. (Adriana 2009)	<ul style="list-style-type: none"> <li>● Knowledge sharing with regulators, stakeholder groups</li> <li>● Create partnerships with universities</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Personnel</li> <li>● Time</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>

*Table 5.3: Action planning of building momentum for change*

#### 5.1.4 Instilling capacity for change

Action	Explanation for action	Possible activities	Resources	Indicators
Long-term: >5 years				

● Strategic goals: Developing foundation and mechanisms for further development of PSS.				
New test and trial	Undertake new initiatives and practices to find way for further development of PSS.	<ul style="list-style-type: none"> <li>● Executing pilot project</li> <li>● Welcome ideas, proposals and suggestions all the time.</li> </ul>	<ul style="list-style-type: none"> <li>● Chief executives</li> <li>● Knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Amount of positive feedback</li> </ul>

*Table 5.4: Action planning of instilling capacity for change*

In addition, communication, training and learning should not be ignored, and they could appear and play different role with executive support. In communication perspective, the actions planning might include:

- Include information in company newsletters, on bulletin boards, or in memos (Bertels al et. 2010);
- Host internal workshops, conferences or trade shows (Bertels al et. 2010);
- Tell stories. Stories that present the company as further along the journey could inspire people to live up to the ideal. (Hagen 2008);
- Join organizations together and exchange information about efforts to develop PSS with cultural changes, etc.

In Training and learning perspective:

- Invite industry leaders to speak to employees can inspire new sustainability initiatives (Molnar & Mulvihill 2003);
- Establish processes to learn from failure (Hagen 2008);
- Recognize external information (Anderson & Bateman 2000), etc.

And some more recommendations have been attached in the Appendix I, includes Team-based PSS development, Logic model for PSS, and Learning Community of PSS.

## 5.2 Validity & Feedback

### 5.2.1 Validity

#### *Samples*

Both coverage and sample size of this study is insufficient, especially lack of excellent senior management and professor due to the difficulties of investigation. Therefore, in the future survey, it is supposed to increase the scope and capacity of samples. And the different background and positions of participations could be addressed to create distinctions.

#### *Variables*

This study is lack of the thinking of complex mechanisms and multiple influencing factors because of the contradictions and complicity, for example the criteria and sub-criteria haven't coved everything, and at the same time, they are too broad to strength the orientation of any perspective. And also lack of the comparison of pressure, emotional atmosphere, and different culture characteristics of different countries etc.

#### *Questionnaire Design*

The expression of the questionnaire is not accurate enough, and the design has unreasonable points. And the channel of sending, and calling back is not so good, and it has taken much more time than expectation.

#### *Research Approach*

The shortcoming of this survey is that the result is static and idealized, it haven't been experimented in the real world, and most of the actions in the planning come from literature and proposing. For the suggestion, it might be a dynamic research by long-term observation, comparison and test.

### 5.2.2 Feedbacks

#### *Experts*

During this phase, I collected a few feedbacks and additional comments around the questionnaire from non-structured interview with three experts and trade e-mails with others.

### ***5.2.2..1 About the Questionnaire Design***

“Probably, ask the background of the participant to create better classification of the answers”

“Probably, consider the short, medium and long term of economic benefits, and what the differences will be”

“Probably, make up more specific activities, for example, for executive support, the activity could be that the CEO of the company spends one hour each week engaging with employees; the communication activity could be a newsletter or blog or social media - based activity each week that employees spend 1 hour reading or engaging; the training activity could be one hour spent in training in a week. This way the activities would become more concrete, and that makes it easier to make a decision about which is more valuable.”

“A bit difficult to imagine about how the sub-criteria could work”

“It is possible to include collaboration, shared language and co-design (from the beginning of the process), in order to engage participation and good communication in the innovation process of PSS”

“Criteria looks good, but they will so academically into real business application or environment.”

“I know with surveys you have to generalize a lot, that being said, I found it difficult to answer the questions without knowing more about the company and the product and service they are offering”

“It was also difficult because I didn’t know whose perspective I was answering from – all stakeholders would have a very different perception of what’s important”

“Maybe more simply Number could be used, and it is enough to judge two objects by 1, 2, 3”

### ***5.2.2..2 About the topic***

“From company’s perspective, they might want revenues all the time to keep they survive; from idealistic perspective, we would always want to be innovative and creative...”

“I think one of the realities about companies is ‘money’ ‘money’ and ‘money’. I don't speak very honestly when I talk to business persons; rather find a moderate way to invite them thinking ‘just a little bit is much better than nothing or minus’. I believe in order to design a nice PSS for a company, we need to focus more on socio-ecological aspects, and as a result it would be a big return to the company.”

“I think this is too high wall to invite them...Firstly, we need to talk in their language: Money.”

“It is hard to distinguish the importance and its intensity of satisfy customers’ needs, and enhance employees’ life and working quality, it’s not 1 or the other 1. They should go ‘hand-in-hand’ and have ‘happy’, because employees are more likely to lead to satisfy customers.”

“PSS is a very broad spectrum of things. For the questions, in some cases I would say, ‘A is much more important than B’, and in others I would say ‘B is much more important than A’”

“Based on existed research, ICT communication and sharing platform somehow have and having showed their value on culture innovation in medium and large scale of enterprise.”

“The culture change needs more internal approach in systemically like combination of E,C,T together, and the external ought to involve in competitors, stakeholders and knowledge sourcing, etc.”

“Green inputs on producing a vehicle in manufacturing phase, but negative output in use phase, and on contrary, huge wasted inputs on create a green energy car for green using. Which is more sustainable? Maybe only from a Life Cycle view could answer the question.”

### *Interview*

Talking with Wu – one of the managers from Midea – a Chinese electronics manufacturer is significant to get well understanding of the current situation of organizational cultural attempt as well as the acknowledge of PSS.

In order to upgrade the organizational culture, his group has produced a short video to introduce their company and daily works, and every member played a part in the play with evident pride.

And the most crucial measure is relate the Product-Service providing with individual's career development, and everyone in his team has the motivation that we are equally in facing the opportunities, and you could climb to the same height of your leader as long as you pay the same efforts. In addition, generous rewards rouse one to heroism.

He paid much attention to the continuous professional training, but what it accomplished was not a patch on that it had planned. And most of the training is usually enforceable by him; so he worried about their emotional rebound will bring negative effect, and further the possibility of training totally divorce with the product and service development makes him headache.

Personally, his favourite work is "humanistic care" to his men, he concerned a lot with matters in their family, physical condition of themselves and he remembers all their birthday to send flowers and card. Moreover, he engaged a guide to participate in union activities, and community services.

### *Workshop*

In the following step, it took forty minutes to communicate with a five person team from Midea. They work for the marketing investigation of one electronic product. I introduced what PSS is, why it is important, how it works, and who will be involved in, and then knew that they have touched upon the practical content of PSS, but there is no motivation to make it become systematically knowledge, formulate a common statement and rise to strategy in the whole organization. Afterwards, as a promoter, we brainstormed the possible cultural change actions under execute support dimension, communication dimension, and also training dimension for their team to get PSS be recognized. Some details and outcomes will be given in Appendix.

## 6 Conclusion

This thesis investigates the possibility for cultural changes to help develop Product-service System by using AHP technology mostly, and some other methods to give assistance.

This study will not be a single solution for managing culture which contributes to PSS in an enterprise, and each idea might be explored separately, and every effort might be built for current issues in every specific company. In addition, this study is not a culture changes planning, but a sustainability wish about PSS development, hope that it might contribute to other uses we cannot foresee at this present moment.

### 6.1 Key findings

According to the investigation, the prioritized activity in managing culture is “Strength the execute support and performance management” comparing with communication and training in order to develop PSS. Companies should pay more attention on it than ever before, and researches should deep into the interrelationships and functions. When the chief executive provides sufficient support and go for PSS development, he will virtually establish an entire executive support system for the whole organization, and think culturally to show PSS perspective around.

According to the prioritizing, this study verified that “Economic benefits: Increase opportunities and competitiveness” gained the highest weights in judging the activities to develop PSS. Therefore, development is the absolute principle that is the key to resolve all problems; any organization should seize all opportunities to accelerate its own development.

According to the basic research, the link between PSS development and cultural changes really exist, especially well-managed culture could contribute to the satisfaction of customers, promote employees’ performance, and bring about more profits.

According to the practice of AHP, it is well-worked for the prioritization and decision-making in this study, easy and effective. It might be used in a broader relative research to deep into PSS development, for example, strategic planning, resource allocation, source selection, business alignment, programme selection and much more applications.

## 6.2 Future work

### *Applied to the PSS development and other possible changes*

PSS is an inevitable trend of industrialization and modernization, in marching to the successful application and continuous promotion of it, company requires more sufficient supports and preparation. And by using cultural changes and other counselling approach, they could enhance the performance of personnel, and hereby, decrease the cost and underlying obstruction. This article focuses on how to managing culture, and based on the prioritized activity to indicate a direction, and deep into more technologies that could be used to provide a reference to further research and specific practice.

### *Applied to the preparation of the organizational cultural changes*

Get well understanding of the cultural changes could better know the potential risks, and this study could contribute to the preparation for the changes. The preparation is not only about the resources, but also about the mental preparation for the personnel. And companies could go to their lengths to opt good changing timing to satisfy the needs of PSS and cultural changes, comply with the law of development, stimulate the atmosphere of changing, make their staffs get consensus. So we hope that this article could make some sense to preparation of organizational changes.

### *Applied to create a more harmonious enterprise culture*

No matter the leadership or any other associate may not avoid going through the changes of organizational cultural, because it might not be static over time. Trough this research about cultural changes, its function, and possible actions, leadership could get some information to create a comfortable learning climate.

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# Appendix A: Questionnaire

## Questionnaire for “Exploring Culture Changes to Help Develop Product-service System”

Dear Scholar,

Thanks for your participation. This questionnaire (including 11 pairs of questions) has used Analytic Hierarchy Process (AHP), and contributed to my Master Thesis “Exploring culture changes to help develop Product-service System (PSS)”. The purpose of the study is to make consensus and decision that: **Which activities to prioritize in order to make the best culture to develop PSS.**

Please respond on this document directly, choose any of the answers given below and put marks. Firstly, make a pairwise comparison-- *which is more important: A or B?* Then give the respondent to say *how much more important (1-9)*. The explanations of the intensity numbers are on the right. (Note: If it is almost equally for the two elements, please just choose”1”.)

- *Example: A is extreme importance when comparing with B.*

Intensity of importance	Definition
1	<b>Equal importance</b>
2	Weak or slight
3	Moderate importance
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very Strong
8	Very, very strong
9	Extreme importance

Example	Intensity of importance									
<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	1	2	3	4	5	6	7	8	9

In addition, if you would like to add some other information or leave a comment in any of the questions, I will be totally glad to read and appreciate to take them into account.

### Part 1

In order to prioritize activities that contribute to manage culture to develop PSS, we divided the prioritize criteria into three dimensions according to the dimensions of sustainability, and these criteria could also be considered as benefits which should be achieved through the implementation of activity, they are: Economic, Environmental, and Social, respectively.

**Question 1** Please perform pairwise comparisons with criteria and put a mark on a more important criteria for companies to develop PSS, in addition, how much more important?

Criteria		Intensity of importance								
<input type="checkbox"/> Economic Benefits	<input type="checkbox"/> Environmental Benefits	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Economic Benefits	<input type="checkbox"/> Social Benefits	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Environmental Benefits	<input type="checkbox"/> Social benefits	1	2	3	4	5	6	7	8	9

## Part 2

**Question 1** Under the criteria of **Economic Benefits**, which sub-criteria is more important? Please make pairwise comparison, and how much more important?

- Financial Benefits: direct economic figures, namely, monetary benefits of companies, products, and other stakeholders.
- Increase Opportunities and Competitiveness: better service performance and flexibility with less risk.
- Gain Stronger Innovation Orientation: form positive and strong environment of innovation and creativity.

Sub- Criteria		Intensity of importance								
<input type="checkbox"/> Financial Benefits	<input type="checkbox"/> Increase Opportunities and Competitiveness	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Financial Benefits	<input type="checkbox"/> Gain Stronger Innovation Orientation	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Gain Stronger Innovation Orientation	<input type="checkbox"/> Increase Opportunities and Competitiveness	1	2	3	4	5	6	7	8	9

**Question 2** In many of today's leading enterprise, business decisions are based on more environmental issues than before. Under the criteria of **Environmental Benefits**, which sub-criteria is more important? And how much more important?

- Input Friendly: use renewable materials and energy.
- Output Friendly: guide consumption and minimize waste.

Sub- Criteria		Intensity of importance								
<input type="checkbox"/> Input Friendly	<input type="checkbox"/> Output Friendly	1	2	3	4	5	6	7	8	9

**Question 3** Under the principle of **Social Benefits**, which is more important?

- Satisfy Customers’ Needs: fulfill customers’ requirements and let them be acknowledged and recognized.
- Enhance Employees’ Life and Working Quality: have better working environment and be healthier (physical & mental), employees could perform better themselves.

Sub- Criteria		Intensity of importance								
<input type="checkbox"/> Satisfy Customers’ Needs	<input type="checkbox"/> Enhance Employees’ Life and Working Quality	1	2	3	4	5	6	7	8	9

### Part 3

In this part, we proposed three activities which should respect to the criteria above and will be prioritized in order to make best culture to develop PSS. Please make pairwise comparison within them under each condition—the sub-criteria, and help make decisions. The activities are:

- Strengthen executive support and performance management: Executives provide behavioral support to change others’ behaviors, and also reward to their new ideas and new attribute. For example, CEO of the company spends 1 hour each week engaging with employees.  
In the following, it will simply be called “**Executive Support**”.
- Practice effective communication: Keeping employees informed about the culture changes and PSS development process, and telling employees what is expected of them. And the specific activity might be a newsletter, blog, or social media-based activity that employees spend 1 hour reading and engaging each week.  
In the following, it will simply be called “**Communication**”.
- Training and continuous learning: Teaching new behaviors and employees need to equip with new skills. And every staff should accept 1 hour training each week.

In the following, it will simply be called “**Training & Learning**”.

#### **Question 1**

Which activity is better regarding to sub-criteria “**Financial Benefits**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 2**

Which activity is better regarding to sub-criteria “**Increase Opportunities and Competitiveness**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 3**

Which activity is better regarding to “**Gain Stronger Innovation Orientation**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 4**

Which activity is better regarding to sub-criteria “**Input Friendly**”.

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 5**

Which activity is better regarding to sub-criteria “**Output Friendly**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 6**

Which activity is better regarding to sub-criteria “**Satisfy Customers’ Needs**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

**Question 7**

Which activity is better regarding to sub-criteria “**Enhance Employees’ Life and Working Quality**”?

Activities		Intensity of importance								
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Communication	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Executive Support	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9
<input type="checkbox"/> Communication	<input type="checkbox"/> Training&Learning	1	2	3	4	5	6	7	8	9

Hereby, I am extremely appreciated for your participation and important opinions again.

Thank you!  
Best Regards.

Liu, Mengqiong

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## Appendix B: The experts list

<b>Experts</b>	<b>Profession</b>	<b>Organization</b>
Aaron Lewis	MSPI 2012;	Company
Anthony W. Thompson	Ph.D.; Consulting	BTH,
Babak Kianian	Research & Teaching Assistant	BTH
Björn Tenland	MSPI 2012;	Company
Carolina Villamil	MSPI 2012;	Company
Chen, xi	MSPI 2012;	Educational Institution
Farnaz Motamediyan	MSPI 2012;	BTH
Darcy, Yin	Manager;	Company
Klas Albertsson	Manager Technology Platform Soft Products	Volvo CE
Lisiana Nurhadi	Lecturer of Method of Sustainable Product-service System Development	BTH
Mark Simmons	Industrial Designer	Avaya
Massimo Panarotto	Ph.D.;	BTH
Nonond Nopparat	MSPI 2012;	Company
Pia Lindahl	Ph.D.; Lecturer of Method of Sustainable Product-service System Development	BTH
Sabine M.	MSPI 2012;	Company
Shahryar Eivazzadeh	Research & Teaching Assistant	BTH
Snovo Bai	MSPI 2012	Company
Yurie Makihara	MSPI 2012;Consulting	PricewaterhouseCoopers
Zhang, yan	MSPI 2012	Volvo CE

## Appendix C: The fundamental scale of absolute numbers

Intensity of Importance	Definition	Explanation	Reciprocals
1	Equal Importance	It is almost equally for the two activities to contribute to the objective.	
2	Weak or slight	Activity <i>i</i> over activity <i>j</i> very slightly through experience and judgment	$\rightarrow 1/2$ Activity <i>i</i> less than activity <i>j</i> very slightly
3	Moderate importance	Activity <i>i</i> over activity <i>j</i> slightly through experience and judgment	$\rightarrow 1/3$ Activity <i>i</i> less than activity <i>j</i> slightly
4	Moderate plus		$\rightarrow 1/4$
5	Strong importance	Activity <i>i</i> over activity <i>j</i> strongly through experience and judgment	$\rightarrow 1/5$ Activity <i>i</i> less than activity <i>j</i> strongly
6	Strong plus		$\rightarrow 1/6$
7	Very strong or demonstrated importance	Activity <i>i</i> over activity <i>j</i> strongly through experience and judgment Its dominance demonstrated in practice.	$\rightarrow 1/7$ Activity <i>i</i> less than activity <i>j</i> strongly
8	Very, very strong		$\rightarrow 1/8$
9	Extreme importance	Evidence favoring Activity <i>i</i> over activity <i>j</i> is of the highest possible order of affirmation	$\rightarrow 1/9$ Activity <i>i</i> less than activity <i>j</i> strongly

**Note** Reciprocals: If the activity *i* has one of the above non-zero numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value.

## Appendix D: Pairwise Comparison Matrix of Sub-criteria

**Table 1: Pairwise comparison Matrix for sub-criteria with respect to**

Environmental Benefits	Input Friendly	Output Friendly
Input Friendly	1	2
Output Friendly	1/2	1

### Environmental Benefits

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.667 \\ 0.333 \end{pmatrix}; \quad \lambda_{\max} = 2; \quad C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0;$$

$$R.I. = 0 \text{ (Statistical Abstracts)} ; \quad C.R. = \frac{C.I.}{R.I.} = 0 < 0.1$$

$$\text{Final Weights: } \begin{pmatrix} 0.667 \\ 0.333 \end{pmatrix} * 0.186 = \begin{pmatrix} 0.124 \\ 0.062 \end{pmatrix}$$

**Table 2: Pairwise comparison Matrix for sub-criteria with respect to Social Benefits**

Social Benefits	Satisfy Customers' Needs	Enhance Employee's Life and Working Quality
Satisfy Customers' Needs	1	4
Enhance Employee's life and working quality	1/4	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.8 \\ 0.2 \end{pmatrix}; \quad \lambda_{\max} = 2; \quad C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0;$$

$$R.I. = 0 \text{ (Statistical Abstracts)} ; \quad C.R. = \frac{C.I.}{R.I.} = 0 < 0.1$$

$$\text{Final Weights: } \begin{pmatrix} 0.8 \\ 0.2 \end{pmatrix} * 0.127 = \begin{pmatrix} 0.102 \\ 0.026 \end{pmatrix}$$

## Appendix E: Pairwise Comparison Matrix for Activities

**Table 1: Pairwise comparison Matrix for the activities with respect to Financial Benefits**

Financial Benefits	Executive support	Communication	Training & Learning
Executive support	1	4	3
Communication	1/4	1	2
Training&Learning	1/3	1/2	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.630 \\ 0.218 \\ 0.151 \end{pmatrix}; \quad \lambda_{\max} = 3.108; \quad C.I. = \frac{\lambda_{\max} - n}{n-1} = 0.054;$$

$$R.I. = 0.52 \text{ (Statistical Abstracts)}; \quad C.R. = \frac{C.I.}{R.I.} = 0.103$$

$$\text{Final Weights: } \begin{pmatrix} 0.630 \\ 0.218 \\ 0.151 \end{pmatrix} * 0.211 = \begin{pmatrix} 0.133 \\ 0.046 \\ 0.032 \end{pmatrix}$$

**Table 2: Pairwise comparison Matrix for the activities with respect to Increase Opportunities and Competitiveness**

Increase Opportunities and Competitiveness	Executive support	Communication	Training & Learning
Executive support	1	2	1
Communication	1/2	1	1
Training & Learning	1	1	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.413 \\ 0.260 \\ 0.327 \end{pmatrix}; \quad \lambda_{\max} = 3.054;$$

$$C.I. = \frac{\lambda_{\max} - n}{n-1} = 0.027; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0.052$$

$$\text{Final Weights: } \begin{pmatrix} 0.413 \\ 0.260 \\ 0.327 \end{pmatrix} * 0.334 = \begin{pmatrix} 0.138 \\ 0.087 \\ 0.110 \end{pmatrix}$$

**Table 3: Pairwise comparison Matrix for the activities with respect to Gain Stronger Innovation Orientation**

<b>Gain Stronger Innovation Orientation</b>	Executive support	Communication	Training & Learning
Executive support	1	1	1
Communication	1	1	3
Training & Learning	1	1/3	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.319 \\ 0.460 \\ 0.221 \end{pmatrix}; \quad \lambda_{\max} = 3.136;$$

$$C.I. = \frac{\lambda_{\max} - n}{n-1} = 0.068; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0.130$$

$$\text{Final Weights: } \begin{pmatrix} 0.319 \\ 0.460 \\ 0.221 \end{pmatrix} * 0.133 = \begin{pmatrix} 0.042 \\ 0.061 \\ 0.029 \end{pmatrix}$$

**Table 4: Pairwise comparison Matrix for the activities with respect to Input Friendly**

<b>Input Friendly</b>	Executive support	Communication	Training & Learning
Executive support	1	4	4
Communication	1/4	1	1
Training & Learning	1/4	1	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.667 \\ 0.167 \\ 0.167 \end{pmatrix}; \quad \lambda_{\max} = 3;$$

$$C.I. = \frac{\lambda_{\max} - n}{n-1} = 0; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0$$

$$\text{Final Weights: } \begin{pmatrix} 0.667 \\ 0.167 \\ 0.167 \end{pmatrix} * 0.124 = \begin{pmatrix} 0.083 \\ 0.021 \\ 0.021 \end{pmatrix}$$

**Table 5: Pairwise comparison Matrix for the activities with respect to Output Friendly**

Output Friendly	Executive support	Communication	Training & Learning
Executive support	1	3	3
Communication	1/3	1	1
Training & Learning	1/3	1	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.6 \\ 0.2 \\ 0.2 \end{pmatrix}; \quad \lambda_{\max} = 3;$$

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0$$

$$\text{Final Weights: } \begin{pmatrix} 0.6 \\ 0.2 \\ 0.2 \end{pmatrix} * 0.062 = \begin{pmatrix} 0.037 \\ 0.012 \\ 0.012 \end{pmatrix}$$

**Table 6: Pairwise comparison Matrix for the activities with respect to Satisfy Customers' Needs**

Satisfy Customers' Needs	Executive support	Communication	Training&Learning
Executive support	1	1/3	2
Communication	--	1	3
Training&Learning	--	--	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.249 \\ 0.594 \\ 0.157 \end{pmatrix}; \quad \lambda_{\max} = 3.054;$$

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0.027; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0.052$$

$$\text{Final Weights: } \begin{pmatrix} 0.249 \\ 0.594 \\ 0.157 \end{pmatrix} * 0.102 = \begin{pmatrix} 0.025 \\ 0.061 \\ 0.016 \end{pmatrix}$$

**Table 7: Pairwise comparison Matrix for the activities with respect to Employees' Life and Working Quality**

<b>Enhance Employees' Life and Working Quality</b>	<b>Executive support</b>	<b>Communication</b>	<b>Training &amp; Learning</b>
Executive support	1	4	4
Communication	1/4	1	4
Training & Learning	1/4	1/4	1

$$W_i = \frac{1}{n} \sum_{j=1}^n \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} = \begin{pmatrix} 0.643 \\ 0.255 \\ 0.101 \end{pmatrix}; \quad \lambda_{\max} = 3.217;$$

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} = 0.108; \quad R.I. = 0.52; \quad C.R. = \frac{C.I.}{R.I.} = 0.208$$

$$\text{Final Weights: } \begin{pmatrix} 0.643 \\ 0.255 \\ 0.101 \end{pmatrix} * 0.026 = \begin{pmatrix} 0.017 \\ 0.007 \\ 0.003 \end{pmatrix}$$

## Appendix F: Prioritizing results for activities from School

<b>Criteria</b>		Economic Benefits (0.630)		Environmental Benefits (0.218)		Social Benefits (0.151)		<b>Overall priorities</b>	
<b>Sub-Criteria</b>	Financial benefits (0.151)	Increase opportunities and competitiveness (0.347)	Gain stronger Innovation Orientation (0.132)	Input Friendly (0.164)	Output Friendly (0.055)	Satisfy Customers' needs (0.121)	Enhance employees' life and working quality (0.030)		
<b>Activities</b>	Strengthen executive support and performance management	0.081	0.134	0.049	0.104	0.035	0.034	0.016	0.453
	Practice effective communication	0.038	0.059	0.030	0.029	0.010	0.071	0.011	0.248
	Training and continuous learning	0.024	0.154	0.054	0.031	0.011	0.016	0.003	0.293

## Appendix G: Prioritizing results for activities from Company

<b>Criteria</b>		Economic Benefits (0.687)		Environmental Benefits (0.186)		Social Benefits (0.127)		<b>Overall priorities</b>	
<b>Sub-Criteria</b>	Financial benefits (0.316)	Increase opportunities and competitiveness (0.152)	Gain stronger Innovation Orientation (0.219)	Input Friendly (0.093)	Output Friendly (0.093)	Satisfy Customers' needs (0.106)	Enhance employees' life and working quality (0.021)		
<b>Activities</b>	Strengthen executive support and performance management	0.217	0.063	0.051	0.061	0.055	0.026	0.015	0.488
	Practice effective communication	0.059	0.050	0.128	0.011	0.015	0.063	0.005	0.331
	Training and continuous learning	0.040	0.040	0.040	0.022	0.023	0.017	0.002	0.184

# Appendix H: Action list

## **Executive support**

Encourage intrapreneurship and set up “Founder Award”

Engineers could vote on dynamic Top20 list of project items over time

Engineers could choose to develop their own project

Set up pioneer department or group

Better infrastructure and creative space

Huge cash reward

20% more free time

Offer psychological guidance

Reduce hierarchy and underlying rules

CEO check out the group processing unregularly

## **Communication**

Set up personnel football team

Sharing platform

Parents-child Campaign

More victory meeting and party

I-cloud sharing and updating

Welcome clients to visit

Invite the family member of employees to participate in the party and visit

Shadow help

Make event poster in public resting area

Gesture Approach

### **Training & Learning**

Train the trainer

Outward Development (Outward bound)

Community services

Internal design class

App for quick searching includes internal and external

Invite to forerunner to give lecture

Set up Theme days for service

Every staff give others training about his advantage

Choose the most beautiful smile

Change the role of trainer and learner

Cooperate with university

# Appendix I: Other Recommendation

## **Team-based PSS development**

Refer to the “Unleashing Teams” from the Compassion Capital Fund (CCF), Team-based Performance Management (TBPM) seeks continuous improvement through a cycle of goal setting, action and evaluation, this could work in concert with PSS, and it transforms with creating greater value. In addition, the ultimate goal of TBPM is to improve services by making meaning out of the information gathered, this point happens to have the same views with PSS as well.

Five steps for preparing for develop PSS (CCF)

Identify the anticipated change of developing PSS. In order to share the vision and make sure the leadership, a clear written statement about the action and general intention should be formulated and widely spread. Therefore, in this phase, the organization should guarantee that they have already shared the value, defined the vision and mission, and made the strategic plan and definite leadership.

Assess the willingness and readiness for developing PSS. Because one of the most difficult challenges is individual might respond by feeling threatened when facing to changes, it is entitled to give assessment. And in this phase, the organization should set up alignment from the top down to develop PSS, and it includes everyone recognize the need for developing PSS, everyone agree to support PSS.

Determine competencies and skills available and identify the gaps in between. A lot of tools could be referred here to assess and help create a culture of team-based development for PSS, such as Kirton Adaptive Inventory which is more focus on project management, Ken Blanchard Preferred Leader Assessment which is to discuss general leadership, 360 degree feedback survey which could be used for self-assessments, and Educational Leadership Toolkit which has taken team climate into account.

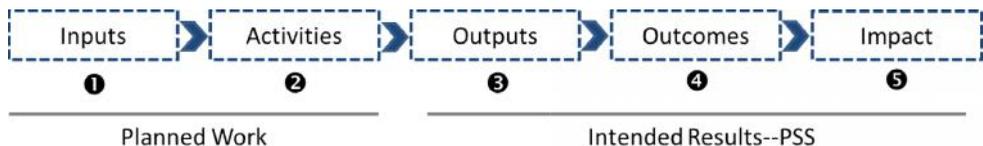
Identify potential risk and prevention mechanism. In a system, risks could be hidden everywhere, finances budget vacant, supplies shortage, administrative failure, exceed the time limit, resource squeezes, and even natural disasters, etc. In that case, the risk management as well as risk

mitigation plan which is according to the intensity of impact and probability could enable the organizations to cope with uncertainty by taking steps to protect their viral assets and resources (Nonprofit Risk Management Center).

Develop support and additional plan. Allowing the probability of risks, the executive support should make a series of reasonable planning, such as rewarding plan, communication plan, etc., and it is better to summarize the experiences with change in the past.

## **Develop a Logic Model for PSS**

Logic Model has been drew up by W.K. Kellogg and it used for bringing together planning, evaluation, and action.



*Figure Logic Model of develop PSS*

① **Inputs:** the resources used to direct toward developing PSS, including human resources, financial and community resources, etc.

② **Activities:** here, activities are process, tools, technology, and intentional actions which are used to bring about the intended program changes - PSS; after accessing to those resources, you could develop PSS.

③ **Outputs:** direct products of activities above, after accomplishing the activities, then you will have delivered the products and services you planned.

④ **Outcomes:** the specific changes of participants' behaviour, skills, knowledge, and anything else in PSS development; after delivering the products and services as planned, and then there will be benefits for the clients, community systems, or organizations served by the program

⑤ **Impacts:** the very long-term outcomes of the intended or unintended consequences of developing PSS in an organization.

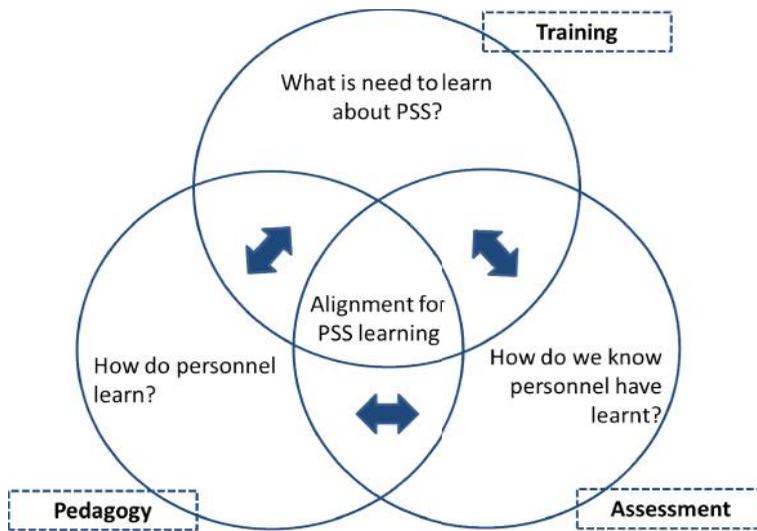
## **Learning Community of PSS**

As affiliated and additional programmes of Execute support in cultural changes, communication and learning issues will also be discussed as an alternative to contribute to PSS development. And here we proposed to build a learning community for communication and learning about PSS.

The communication and training should be designed to personnel to explore their interests, potential and aspiration for their capacity of work and personal career. For communication, generally, it could be consist of team communication, downstream communication, and external communication. When planning meetings with groups, the first step is to decide on the purpose, gather the background information, facilitate meeting, deal with sensitive issues, and manage group dynamics and conflicts.

And for training, the very first step should understand the purpose of training and learning, then design and implement the training, but evaluate cannot be neglected. The assessment comes from different sources, the trainer, other staffs, and also learner self.

This study advocates building a learning community. Internet technologies will make it possible to build a virtual community who serve a common learning goal, and share knowledge, experience, expertise in learning PSS as well as putting it into effect. As the members of the learning community, trainer and leadership could take the lead in fostering a sharing culture, learning with their staffs, and encouraging their works and achievements. And at the same time, learner could reflect their feeling directly, and trainer also gets the chance to update their knowledge, and keep contact with person in same business or occupation. With the e-forum and blog, leaner-learner as well as trainer-leaner interaction might be extended anywhere and anytime outside the training room and working atmosphere. In this way, a learning community of PSS could combine with the communication and training, it might be a method to remove tired and sick, and learn more independently as well as positively.



*Figure “Trinity” of PSS Training (CDC-HKEAA Committee)*