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**Enterprise Risk Management in innovation Process-
The risk comparison between Small to Medium- Sized
Enterprise and Multinational Corporation**

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Abstract

Risk management, it is fairly a significant topic for companies that whatever the big or small to medium- sized company. The risk category was identified and classified by economists and financial experts and relevant literatures, such as financial risk, market risk, operational risk, technological risk, etc. The main risk also classifies systematic and unsystematic risks. For all kinds of companies, a potentially more important value is the use of risk management which is to help ensuring companies' ability and awareness to fund their investment opportunities and carry out their long-term strategic plan.

Innovation management is also an important topic for companies and top managers in day- to day management. In order to compete with another rival in fierce global business market, companies always seek the solution to improvement performance in different perspectives of manufacturing or service and management. Innovation process contains many uncertain factors that influence the final result of work, not only is a big corporation, as well as the small to medium- sized enterprises constrain the risk to reduce the losses in innovative period. Therefore, all companies in product and services sectors consider that understand the antecedents and consequences of innovation and entrepreneurship is critical because technological change has been shown to be related to improvements in economic performance at the firm, industry, and national level.¹

There are mutual influences in risk and innovation management. Companies increase value and make profit, which need continual innovation to obtain and maintain their competition. On one hand, it is obvious that companies want to capture many resources to support the research and development actives, and the resources include financial and intelligence fortune, companies must understand how to minimize the degree of risk impact. On the other hand, through the different ways or new approaches control risk, companies can improve efficiency of major innovation process. Hence, it is necessary that to define and manage diverse risks in innovation

¹ Link and Siegel (2003)

period which plays an important role of developing in global network.

Via the thesis, it will introduce and research the follow questions that what risks are supervised by company when company undertakes in innovation process or monitoring an innovation project, are there different risk controlling approaches between small and medium- sized companies and big multinational corporations, what monitoring instruments are utilized in these different scale of companies, what are limitations that different size enterprises manage and control the risks. Based on the above questions, I choose an empirical case of the Daimler AG that represents some basic rules and management concepts giving support for junior managers' decision- makings in risk management which compare variation of enterprise with innovation- driven factor.

Key words: enterprise risk management, management of technology and innovation, product life cycle

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List of Abbreviations

ART	alternative risk transfer
BI	business intelligence system
BSC	Balanced Scorecard
COSO	Committee of Sponsoring Organization of the Treadway Commission
CSR	corporate social responsibility
ECB	European Central Bank
EFQM	European Foundation for Quality Management
ERM	enterprise risk management
ERP	enterprise resource planning
FASB	Financial Accounting Standard Board
FDI	Foreign Direct Investment
GAAP	Generally Accepted Accounting Principles
GRMC	Group Risk Management Committee
HGB	Handelsgesetzbuch
IAS	International Accounting Standards
IFAS	International Financial Accounting Standards
IT	information technology
KPI	key performance indicator
M&A	merger and acquisition
MNEs	multinational enterprises
NPV	net present value
R&D	research and development
ROCE	return on capital employed
ROE	return on equity
ROI	return on investment
ROS	return on sales
SMEs	small to medium- sized enterprises

TCO	Total Cost of Ownership
TQM	Total Quality Management
TRIPS	Agreement on Trade- Related Aspect of Intellectual Property Rights
WACC	Weighted Average Cost of Capital
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

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1. Introduction

Chance and risk stand at the opposite sides of the fortunes which the higher risk investment might be to bring you more returns. Thus many investors expect themselves getting returns from their inputting and neglect the danger and loss of wide risks in real business world. Many times, the worldwide financial crisis generated the enormous influence to impact world economy, and following the government, professionals and various institutions to re-construct the system and framework of economy. Reviewing the year of 2008 financial crisis and followed the Eurozone sovereign crisis, risk management is definitely a significant topic and always on agenda in the world economic research and debate. Also from the financial crisis and European debt crisis had been found that the management of information quality and financial data that was a weakness of modern business world. Therefore, companies, governments and even individuals need new and advanced method which effectively prevented, manages and handles various risks.

Technology developing and successive innovation are the central force of a company that wrestles with his rival. On perspective of innovation management that technology risk and market risk should be definite and managed by management board. Many companies fail to yield benefit which though technology improved due to in a weak risk assessment and controlling during in innovation and new product and service researching and developing period.

To entry different markets, different scales of company also adapt different method and strategy to withdraw risk factors in innovation process. The big companies, like Multinational Corporation (MNCs) should avoid the risks from globalization network and international economy fluctuation; on the other hand, the small to medium- sized companies and family firms should focus on national and regional economics and access to sufficient resources, such internal managerial uncertain factors will affect the small to medium- sized enterprise (SMEs) or family firm in a long- term growth. However, both side of those, either big corporation or small enterprise assesses and

controls risks; it is clear that management activities associate with higher corporate risk exposures.

The thesis consists of five parts. The part 1 introduces briefly risk and innovation management respectively as well as how they are important in day- to- day management. Part 2 and Part 3 give details that how to manage risks and innovation from the theoretical to practice perspectives. Part 2 explain purpose, function of risk management in enterprise- level, what classical theory and method are to identify and reduce enterprise risks as well as provide practical example of Daimler AG how to manage enterprise risk. The third part introduces the process of technology and innovation management in industrial level. Managerial process and business model concerned about market capacity, customer's taste and business environment at the early stage of technology and innovation management. To break ice if enterprise decides to execute strategy of innovation, technological and product life will be considered by top managers and researchers. In the part 3 of section two of main process management consists of planning controlling, performance controlling and strategy controlling, which are within managerial procedures in quality, procurement, supply chain and cost management. In the section 3 of part 3 will analyse the risks of technology and innovation management in varying size of enterprises. The Part 4 of dissertation presents a case study which based on Daimler AG annual report and analyses the purpose and intention of corporate of management in technology and innovation within management report and global business regulation.

The research method of thesis includes literature and theory review and empirical case study combined qualitative information collection and quantitative survey.

2. Enterprise risk management

Company considers about risks that reduces business breakdown with some uncertain factors and expects added value while the company controls risks under some appropriate methods. In the late 1990s, consultants and risk management professionals started to challenge this “silo approach” to risk management. The challenge originates from the question of how risk management adds value for corporations.²For some companies and managers, the object of risk management is not the source of value creation. The traditional view and idea were doubted and challenged. So many economists and institutes rethink method and approach of risk management. R. M. Stulz (1996) and C. L. Culp (2002) provide ideas that talk about rethinking risk management and the revolution in corporate risk management; they concluded forward popular views and tried to find alternative risk management ways. DeLoach’s Enterprise- Wide Risk Management (EWAM) and the work “Enterprise Risk Management- Internal Control- Integrated Framework” of Committee of Sponsoring Organizations of the Treadway Commission (COSO) launched separately in 2000 and 2004. DeLoach’s EWAM played an important role and affected the formulation of the COSO ERM framework as well as the framework of COSO had been developed by corporation PriceWaterhouseCoopers (PWC) and Deloach.³

²Harrington S.E, Niehaus G. (2002): Enterprise Risk Management: The Case of United Grain Growers. Journal of Applied Corporate Finance 14: 71-81

³Per Henriksen, Thomas Uhlenfeldt(2006): Contemporary Enterprise- Wide Risk Management Frameworks, Copenhagen Business School Press

2.1 Why a company controls risk

Last 20 years has the business and financial environment enormously changed associated with new technology application wide in the world. Main financial market in the world designed and introduced many complicated financial instruments which called “derivatives”. Many corporations, especially like multinationals and large financial institutions such as Banks and insurance investors, actively participated in purchasing these treasuries. The scope and mission of corporate in market practical circumstance increased risky degree that required companies and institutions update the theory and guidance of corporate risk management. For example, in many companies take into consideration of the mission of corporate risk management, once managers concerned mainly with smoothing out bumps in the earnings trajectory that a path of an object which given forces or strength action, has become protection of the firm’s “franchise value”- that is protection of all the firm’s major sources from whole global business network of future earnings growth power.

Agency problem and asymmetry of information are also factors that have an influence on enterprise risk management. From Enron scandal case to WorldCom accounting scandal case illustrated a serious question that is the necessity of managerial behaviour in internal corporate management which need and must monitored by outsiders and public. That is a typically legal risk for investors that will due to information asymmetries reducing the future company’s capital raising and earnings. As a consequence, several firms started to recognize their risk management activities so as to implement a comprehensive approach to risk management. Also the policy makers in many nations developed item corporate governance to reinforce rules and standards of company’s financial information exposure for investors in order to increase degree of transparency between public corporation and investors especially the foreign and potential investors. This is because corporate governance ensures that managers create value of corporation for the owners and external individuals through internal control. Therefore, ERM (Enterprise risk management) concept is one of the important ideas

for managers who monitor and control risk in business operation in order to maximize firm value. The approach is also called Integrated Risk Management (IRM).⁴

Not only encourage managers to carry out a company's strategic investments, but also risk can play a role in persuading outsiders to provide financing for such investments on advantageous terms. As Clifford W. Smith argues that it is not only the firm's bondholders and creditors who appreciate risk management; reducing the probability of financial trouble but also helps reassure the firm's other corporate "stakeholders" such as employees, suppliers, and regulators, who are generally provide new resources or supervise capital efficiency in a particular economy sector or business entity. And there is another important stakeholder group- the insider of the company, namely the manager itself- that is likely to benefit significantly from enterprise risk management (ERM). At least in aspect of theory, the more predictable corporate earnings and cash flow stream that results from ERM should strengthen their confidence of pension plan and employment payment in the future; and with the reduction of uncertainty in operation and management, managers should be willing to work for less money. In other words, good managers should be encountered sudden and immediate problem and be measured the fact that their performance in dealing with those unexpected trouble.

For example, the German Auto giant, Volkswagen Group had suffered in Diesel gate scandal, last year VW reported that the group due to cheating on diesel emissions test in American market, the car maker has set aside €16.2billion to pay costs associated with scandal, which included fine and buying back or repairing diesel cars, however, the VW management board received Bonuses option with high payment €63 million that had sharply criticized by outsiders, despite the carmaker lately announced it would withhold a portion of bonus payments for now, but could award them at a later date.

Managers do a better job of reflecting managerial skill and effort for company and

⁴Christian Laux (2004): Integrating Corporate Risk Management, J.W. Goethe- University Frankfurt am Main

company owners. As Clifford W. Smith also believed that the reducing of uncertainty may be a mixed blessing for less competent managers. Thanks to the development of derivatives and incentive system, we now have a set of market conduct that allow us to isolate those things that are outside the executive's control and take them off the table.⁵To sum up, management reflects two group interests of conflict that closely relate to agency problem which include managers and stakeholders and managers and company owners. Thus, enterprise- wide or strategic risk management has significant potential to add value by strengthening managers' incentives to invest for the long-term project and by reducing uncertainty for key stakeholders of corporate and keeping responsibility towards whole corporate.

⁵Clifford W. Smith, Neil A. Doherty(1993): Corporate Insurance Strategy, Journal of Applied Corporate Finance, pp4- 15

2.1.1 Reducing the cost of capital utilizing

Financial theory distinguishes between systematic risk and unsystematic risk. The two kinds of risk premium depend on investors whether can eliminate risks factors via diversification of investing instrument in market. Investors can reduce the amount of unsystematic risk while they bear by diversifying their holdings. Systematic risk is the risk that remains after such diversification is fully implemented. If diversification opportunities are widely available to investors, systematic risk is the only risk for which they must be compensated.

By definition, diversification by the firm, its investors or individuals cannot reduce the system risk. But investors can control their own exposures to systematic risk by adjusting their already holdings of risky assets and cash or by using derivatives such as futures, forwards, or swap contracts. By holding a larger fraction of cash on hand or by hedging instrument with futures, forwards, and swaps, investors can to a large extent to limit their systematic risk damage, but at the same time, in some specific economics circumstances, firm or shareholders require to align themselves with managers to enhance portfolio instead of cost of reducing their expected returns.

From academic theory suggests that some companies face their large exposures to reconstruct capital holdings like interest rates, foreign exchange rates, or commodity prices can increase their market value by using derivative securities to further reduce their costs in exposures. The theory emphasis that companies reduce the variability of corporate cash flows and reduce various costs associated with financial distress.⁶

However, in practices, managers seek to implement risk management and set a goal that is reducing earnings fluctuations or reducing fluctuations in firm value to effects the direct or indirect costs of company. For example, the elimination of costly lower-tail outcomes that is designed to reduce the expected costs of financial trouble while preserving a companies' ability to exploit any comparative advantage in risk- bearing it may have. When decision- makers decide to eliminate or minimize the cost of

⁶René M. Stutz(1993): Rethinking Risk Management, Journal of Applied Corporate Finance, pp8-25

corporate, managers should do not consider all risks they can hedge, but they should worry about what risks they had created. Hence valuation aims to reduce uncertainty in investing, and standard approaches that often introduce uncertain do not serve us well. They hope to create an intrinsic value.⁷

By managing risk of corporate can be used to change both a company's length of capital structure and scale of capital ownership. By reducing the potential of financial risk, manager has the awareness that both increase debt capacity and proportions and to facilitate larger equity stakes for management. In other words, company utilize debt and equity financial instrument to switch the financial strategies to reduce their variance costs.

To manage risks in a corporate comprehensive level, it also can reduce the possibility of financial distress. By reducing the firm's total risk, risk management leads to financial distress less likely. On corporate- level perspective of risk management considers successful business that contributed to a stable and predictable profit increase associated with rare financial distress. If an awful return of event were to create in a volatile industry and investors felt that uncertain about the company's future if the company had dominate in the business sector or industry, then customers, suppliers, or employees might alter their financial behaviours, worsening the impact on initial negative side. Even more, the negative and instable shock was generated by multinationals or public corporations, investors, like shareholders or debt holders, may defect, they doubt that the corporation's ability to provide excellent product and service in a future. Investors set a negative view of the corporation result in the corporate increasing capital cost in financial market. The rating companies also will give a negative view for corporation that reflects the corporation has no strong operating performance in view of heterogeneous development in main business area which will influence the corporation raising money with short- and long- term in capital and bond market.

⁷Stephan Penman (2015): Valuation: The State of the Art, Schmalenbach Bus Rev (2016) 17, pp.3- 23

2.1.2 Increasing the value of corporation

Value is the function of risk and return.⁸The explosion in popularity of “enterprise-wide” risk management in the early 1990s need not have happened or at least not the way it did. The spark in this case was provided by sensational press accounts of the “great derivatives disasters”, the fate of Barings and Procter& Gamble.⁹

The early stage of corporate risk management produced policies and procedures with no clear link to the corporate mission of maximizing value. But as the risk management revolution has folded over the last decade, the result has been “convergence”- convergence of various perspectives on risk management once dividend by extreme differences in vocabulary, concepts and methods; convergence of organizational processes for managing an extraordinary variety of risks; convergence of risk management products offered by completely separate financial industry and sectors like insurance and capital markets; and finally, convergence of risk management with the quest for the corporate holy grail of optional structure.

The author Christopher L. Culp developed convergence concept and called Alternative Risk Transfer (ART). He defined ART as the large and growing collection of “contracts, structures, and solutions” provided by insurance companies and/ or reinsurance companies (a group referred to as insurance companies or “insures” that enable companies to transfer or finance some of their risk in non- traditional ways.) ART forms represent the foray of the insurance industry into the corporate financing and capital formation process that were once the near- exclusive domain of commercial and investment banks.¹⁰

A comprehensive approach to corporate finance being with a risk management process and strategy that aims explicitly at maximizing the value of the firm.¹¹

⁸PatchinCurtis, Mark Carey(2012): Risk Assessment in Practice, The Committee of Sponsoring Organization of the Treadway Commission

⁹Christopher L. Culp(2002): The Revolution in Corporate Risk Management: A Decade of Innovations in Process and Products, Journal of Applied Corporate Finance,14(4) pp8- 26

¹⁰Christopher L. Culp(2002): The Art ofRisk Management: Alternative RiskTransfer, Capital Structure, and TheConvergenceof Insurance and Capital Markets, New York: Wiley

¹¹C.W. Smith, R.M. Stulz(1985): The Determinants of Firms’ Hedging Policies, Journal of Financial and Quantitative Analysis, pp391- 405

A comprehensive approach needs management to consider the full of range of available risk management products, including well- established risk transfer instruments, like interest rate and currency derivatives. The approach to corporate finance means taking account, and full advantage, of the convergence accomplished in the last decade.

As above mentioned that companies monitor and control risks which in order to reduce the capital and financial distress cost. Secondly, companies also appear to maximize the corporate value through risk management. However, how to achieve the objective and goal?

The goal of the program is to reduce earnings fluctuations or to reduce fluctuations in firm value.¹²The purpose will vary from different firm, but the fundamental goal of risk management is to maximize shareholder value. It is unambiguous that the benefits and costs of risk management vary by firm this is because of risk management strategy must be tailored to the individual company. For example, for some companies, they target in a particularly level of earnings or lower net cash flow fluctuations will increase the value of firm. For another, the value- maximizing strategy is targeting a range of market price fluctuation in market value of the firm or equity price of shareholder.

Hence the decision of risk management depends on risk management policy that relate to degree of uncertainty about future earnings and firm value in the currency capital market.

According to Christopher L. Culp summarized that risk management can help companies increase their expected net cash flows mainly in the following ways:¹³

1. By reducing the expected costs of financial decisions caused by a downturn in cash flow or earnings, or a short- fall in the value of assets below liabilities.

Although such costs include the out- of pocket expenses associated with any formal or informal reorganisation, more important considerations are the diversion

¹²Lisa K. Meulbroek(2002):A Senior Manager's Guide to Integrated Risk Management, pp56-70

¹³Christopher L. Culp(2001):The Risk Management Process: Business Strategy and Tactics, New York: Wiley

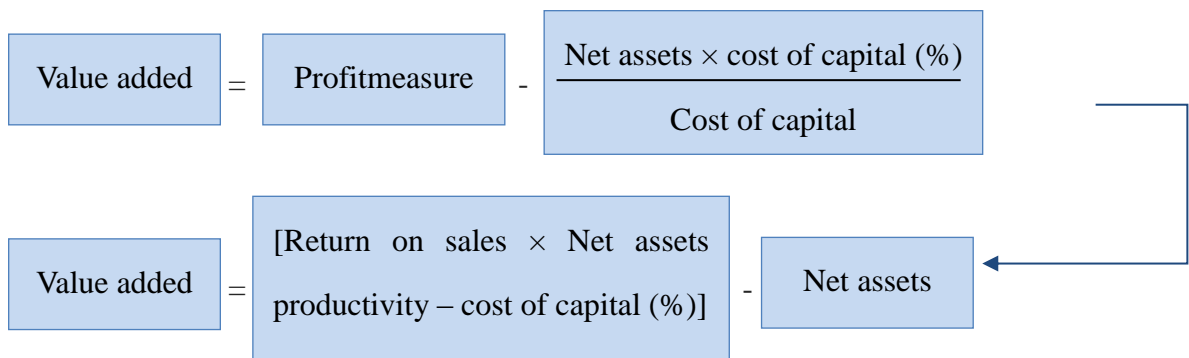
of management time and focus, less of valuable investment opportunities, and potential alienation of other important corporate stakeholders (such as customers, suppliers, and employees) that can stem from financial trouble.¹⁴

2. By reducing expected tax liabilities when the firm faces that rise with different levels of taxable income.
3. By reducing potential conflicts between company's creditors and stockholders, including the possibility that "debt overhang" results in the sacrifice of valuable strategic investments.
4. By reducing the possibility of corporate underinvestment that arises from unexpected depletions of internal cash when the firm faces costs of external finance that are high enough to outweigh the benefits of undertaking the new investment.¹⁵

At this list suggests value- increasing risk management has little to do with reported earnings or variance cash flows. For some companies, the main contribution of risk management is likely to be its role in minimizing the probability of financial distress. For example, the Daimler Group calculates the value- added method through its model to provide the foundation of measurement of value- based management.

Graph 2.1 Calculation of Value Added¹⁶

Value added = Profit measure- Net assets× cost of capital (%)



(Source: www.daimler.de/investoren, Daimler AG Annual Report 2015)

¹⁴Christopher L. Culp (2002): The Revolution in Corporate Risk Management: A Decade of Innovations in Process and Products, Journal of Applied Corporate Finance, 14(4) pp8- 26

¹⁵Hubbert, R (1998): Capital Market imperfections and investment, Journal of Economic, March pp193- 225

¹⁶Daimler AG Annual Report 2015

2.1.3 To optimize corporate capital structure and present value

Come back to above paragraph discussion, the alternative risk management (ART) is one of the last decades of innovation method in risk management, from confluence of risk management as a process to risk management product, it plays an important role for the optimal risk management strategy and affect a firm's capital structure, intensive system and operational process. To a financial executive, risk management implies a range of concerns, from making the corrective capital adjustment to the discount rate for a capital budgeting problem and to the principal invested in a pension plan.

On the corporate finance perspective sees defined- benefit pension fund liabilities as corporate debt, with members having a claim on the firm similar to other creditors, and fund investments as corporate assets with collateralize the pension obligation. Corporate can be expected to manage pension funding and investment to maximize benefit to shareholders. In doing so, they will take into account tax deductibility, as well as the fact that minimum funding standards are often mandated by law or regulations. The new accounting treatment of pensions in the United Kingdom- a vision of which is now being considered by the Financial Accounting Standards Board (FASB) in the United States – will make these shortfalls more transparent to interest parties, particularly investors, rating agencies, and regulators.¹⁷ For defined- benefit funds, there is an incentive to maximize the tax advantage of pension funds by investing in assets with the highest possible spread between pre- tax and post- tax period; there is also an intensive to maximize the tax benefits, which through a new incentive method- a defined- contribution funds was created by some USA companies those got rid of defined- benefit pension funds. This is an approach highlights the high- risk nature form of book- reserve or pay- as- you- go provision for private firms.¹⁸ A definition contribution plan regarded as an investment strategy that is

¹⁷Robert C. Merton(2006): Allocating Shareholder Capital to Pension Plans, Journal of Applied Corporate Finance, pp15-24

¹⁸Black, F(1990): The Tax Consequences of long-run Pension Policy, Financial Analysis Journal, pp17-23

permitted by portfolio management to maximize returns and sink cost for employees those near retirement.

It requires that company provides clear information and clarify pension investment policy in annual report under accounting standards for the public while limiting the costs and risks of retirement with operating strategy, and ensure that outside investors and rating agencies understand risks in incentive system and efforts to deal with them. Another issue of value- based risk management is the relationship between net present value (NPV) and cost of capital, how the managers think and control them in enterprise- risk area.

First of all, according to corporate finance defined, net present value (NPV) is the present value of future cash flows minus the present value of the cost of the investment, namely, that is:

$$NPV = - \text{cost} + PV$$

In other words, the concept of net present value (NPV) depends on two elements, the present value of future cash flow and the costs in investment. Based on Modigliani and Miller assumed that in a perfect capital market, a stock corporation cannot create value through the risk transfer decisions, instead, value is determined only by real investment decisions. Hence, a firm's risk is determined by the operational investment program. The net present value depends on the risk- adjusted required market rate of return. The rate is called discount rate.¹⁹Specially, the irrelevant theory emphasis that financial policy which is not matter for positive transaction costs of financial distress and both individuals and companies can borrow capital with same rate, non- neutral taxes and in the presence of agency problems.

To sum up, it is to extent the Modigliani and Miller's theory of corporate risk management by arguing that the value of corporate and a particularly capital structure. It means a company cannot change the total value of its debt- equity capital by changing the proportions of its capital structure. The company's overall costs of capital also cannot be reduced as debt is substituted for equity, even if debt capital is

¹⁹Christian Laux(2004): Integrating Corporate Risk Management, J.W. Goethe- University Frankfurt am Main

cheaper than equity. The reason is that the remaining equity capital becomes more risky.²⁰ The expected return of corporate will be captured by long or short net expected payoff.

Suppose that a company decide to introduce a project which need both equity and debt finance. How to calculate the cost of equity capital and debt capital? How a company to evaluate the future cash flow during the project in completing time? To access cost of capital in a project, a company needs to set up three things:

- The risk- free rate: R_f
- The market risk premium: $R_m - R_f$
- The enterprise- risk: β

Then the costs of equity capital and debt capital respectively are:

$$C_e = R_f + (R_m - R_f) * \beta$$

The formula is under Sharp's capital asset pricing model (CAPM), from the company's perspective that the company's expected return is the risk- depended cost of equity capital.²¹

$$C_b = C_b * (1 - t)$$

The cost of debt is the company's borrowing rate, the formula is debt benefit of the debt capital after corporate tax. C_b stands cost of debt of corporate. Generally, interest is tax deductible at corporate level.²² If a company uses both the capital of equity and debt, it will be calculated by weighted average cost of capital (WACC), so it is the average cost of capital which is weighting of its cost of equity and cost of debt.

Therefore:

$$WACC = [E / (E + B) * C_e + D / (E + B) * C_b * (1 - t)]$$

Based on the WACC formula, $E / (E + B)$ is the proportion of total value of equity and $B / (E + B)$ is the proportion of total value of debt. WACC targets on the capital

²⁰David Hillier, Stephen Ross, Randolph Westerfield(2011): Corporate Finance: The European Edition, McGraw-Hill Higher Education

²¹David Hillier, Stephen Ross, Randolph Westerfield(2011): Corporate Finance: The European Edition, McGraw-Hill Higher Education

²²David Hillier, Stephen Ross, Randolph Westerfield(2011): Corporate Finance: The European Edition, McGraw-Hill Higher Education

structure and it is calculated before taxation.

For example, if a multinational corporation evaluates a project in overseas, the overall costs of capital the sum of the costs of each financing sources, weighted by the proportion of that financing source in the company's total capital structure. Basically, the two rules of thumbs are:

- 1) The internal rate of return (IRR) must be superior to the hurdle rate for a project to be acceptable.²³

The IRR is the interest rate which equates the corporate present value of both cash flows of investment and the costs of investment. The interest rate of return yield is generally compared with a required rate of return. It also called hurdle rate that is the firm's cost of capital.

To consider again the pension fund, pension assets can be a significant proportion of total corporate assets. And pension assets are an equity- heavy asset portfolio can be one of the main source of total volatility on the left side of the balance sheet.²⁴The pension liabilities are debt on the balance sheet right side. Though collateralized by the pension assets, they are an obligation of the firm and that are part of the leverage or gearing of the firm.

- 2) The present value, obtained by discontinuing the cash flow of all future, after the tax payment by company can be increased through the reduction of risks that affects the capital structure. Thus it is useful to calculate taxable profits and tax liabilities separately before calculate the net cash flows of a project.

According to the case of Daimler AG financial position, the income statement, and the statement of cash flow help outsider users understand the group's situation and changing of financial year, and partial of financial data were draw conclusion in a table of Exhibition 2.1 Daimler AG key financial figures that show the Daimler AG management report in financial and capital structure management in practice.

²³Belkaoui Ahmed(2001): International Accounting, Quorum Books

²⁴Robert C. Merton(2006): Allocating Shareholder Capital to Pension Plans, Journal of Applied Corporate Finance, pp15-24

First of the important financial figure is earning before interest and taxes (EBIT), which summarized earnings before taxes and financing costs and it also measured the ability of profitability of company. The divisions contributed to high operating profit in 2015 due to significantly positive earnings and low expenses and negative impact on non-operating sections, especially in division of Mercedes- Benz Cars, the new vehicles result in return on sales (ROS) a dramatic increased to 9, 5% with higher expected sales contract. Mercedes- Benz Vans brought positive earnings due to the strong growth of sales rate for the V- class and the new product Vito, which the product improved material efficiency and positively impacted on market share and goodwill for the group. The financial service division of Daimler AG posted EBIT with return on equity (ROE) to 18, 3% in 2015, lower than 2014 with 19, 4%. The main reason of earnings increasing is that earnings surpassed by contract volume and positive foreign exchange rates effects. But the ROE was impacted by additional offset expenses associated with the expansions of business operations. Because of ROE is that relates on net income and relevant expenditures.

In real business activity, examples of costs are fixed corporate bond interest and income taxes. In the long run business activities, all costs are variable. Accounting costs usually fit into a classification that distinguishes product costs from period costs. Product costs are the total production costs incurred during a period in industrial level- materials, direct labour, and manufacturing factors overhead- and are reported on the income statement as costs of goods sold. It records into other operating expenses. Both variable and fixed costs are included in product costs. Period costs are allocated to time- span period: they are called selling expenses, and general administrative expenses. One period cost would be the company chief executive's salary.²⁵In the Daimler Group, the system of board of management remuneration consist fixed base salary and the annual bonus of the target remuneration with a long- term incentive effect (PPSP), which made

²⁵David Hillier, Stephen Ross, Randolph Westerfield(2011): Corporate Finance: The European Edition, McGraw-Hill Higher Education

up approximately 42 % of the target remuneration. The base salary was increased by an average of 3% annual financial year.²⁶

Table 2.1 Daimler AG Key Financial Figure²⁷

	Year	Year	14/15
In millions of EUR	2014	2015	% change
Revenue	129,872	149,867	+15
EBIT	10,752	13,186	+23
Net Profit	7,290	8,711	+19
Free Cash Flow of the industrial business	5,479	3,960	-28
Net Liquidity of the industrial business	16,953	18,580	+10
R&D expenditure total	5,680	6,564	+16
Capital expenditure total	6,490	8,559	+32
Value Added	4,416	5,675	+29

(Source: Daimler AG Annual Report 2015)

From the statement of income and the statement of cash flow also exhibited the costs, taxes and the liquidity of capital in Daimler group. The income statement shows costs, expenditures and taxes in industrial level. Daimler AG reported that the consolidated costs and expenses included cost of sales, selling expenses, general administrative expenses and research and non- capitalized development costs. The costs of sales were caused by personnel expenses and depreciation of equipment and plant, the selling costs were increased by marketing expenses and personnel costs. IT system development was main driven in general administrative expense, and the fuel- efficient system and drive safety system were main costs for research and non- capitalized development costs. Variable costs and expenses change the Group's revenue and net profit as well as the output from company.

²⁶Daimler AG Annual Report 2015

²⁷Daimler AG Annual Report 2015 and Fact Sheet for Q4 and Full Year 2015

2.2 How to control risks

From theoretical ideas to practice, companies find method to solve enterprise- risk. To consider enterprise- risk management, there are many modern financial theories, contains vary important philosophy and ides to develop risk management. In practice, many companies and enterprises also contribute risk management experience when they deal with cases in real business world. Specially, there is some differentia in different size of companies managing risk. Multinational enterprises and small to medium- sized enterprises focus on the distinguishing factors and design a different method to monitor and control risks. So that from product, service to process assistance confronts different risks between small to medium- sized enterprises (SMEs) and multinational corporations (MNCs) which those companies characterize systematically a risky list. Therefore, to control risk, we need to review what risk is and what risk management is. Risk defined as internal and external uncertainties events, or circumstances that the company must understand and manage effectively when it is executing its business strategies to achieve company's objectives and create value for stakeholder and financial maximizing the corporate value. Risk management can be defined as the process that company utilize serious of method and technique to eliminate, control, monitor and report pure risk, in order to enhance benefits and avoid potential threatening detriment or loss.

Based on the characteristics of list these companies can draw on a vision that is to identify, analyse, assess, and plan risks in a whole risk management system.

2.2.1 Theoretical perspective on enterprise risk management

To take risk management concepts that are inclusive: the capital structure irrelevance proportions of Modigliani and Miller (1959), the capital price asset model (CAPM), the Arbitrage Pricing Theory (APT). The CAPM and ART are alternative models of risk and return. The Fama- French and Chahart's factor models are now frequently used by financial analysis. Under these theories, the models and proportions recognized assumptions that what and how to do in risk management. Those theories also provide ideas to guide companies and managers enforcing their risky awareness in day- to- day management and developing their ability to control and reducing impact of risk. Many professional financial institutes and associations also provided and published research report in enterprise- wide risk management. The Committee of Sponsoring Organizations of Treadway Commission (COSO) provided first and updated work of Internal Control- Integrated Framework which indicated companies, organization and governance to improve performance and effectively control internal uncertain events. The consultant company KPMG published research work that instructed public governance for customers.

In real day- to- day management, many companies select several method and instrument to management risk.

The Daimler AG presents a part of risk management method within its annual report to simulate risk and chance analysis and report. The Daimler Group sets up risk management system that includes early risk identification, assessment, handling, and risk monitoring. The corporation also adapts COSO internal control ideas which designs and introduces risk management system under the line of internal control framework with regarding to financial and accounting report process.²⁸The Group Risk Management Committee (GRMC) defines and designs risky conditions for the group- wide internal risk management system and reviews the internal risk management process based on the business performance.

²⁸Daimler AG Annual Report 2015

The graph 2.2 and 2.3 concluded the Daimler group's general risk management process within the COSO framework.

Graph 1.2 the Risk Management Process



(Source: the Committee of Sponsoring Organizations of the Treadway Commission (COSO), 2012)

Graph 2.3 the 2013 COSO Framework & SOX Compliance



(Source: the Committee of Sponsoring Organizations of the Treadway Commission (COSO), 2013)

The Daimler Group focuses on environmental, industrial risks and financial risks which are arising from global financial, legal risk as well as compliance risks and reputation risks these are key internal risks of enterprise with local legislation. Therefore, the corporation also emphasis that the management board keeps his eye on local risks which within economy and ecology areas of responsibility and enhance transparency of corporate environmental report to facilities company's all products in all around of the world.

2.2.2 Integrating strategies and managing corporate risks

The process of risk assessment can compare with two different scales of enterprises that are multinationals enterprises (MNEs) and small to medium- sized companies (SMEs). Companies collect information and then assess the data based on in- and external feedbacks. The managerial process must proceed with each component to conduct whole system of enterprise- wide risk management.²⁹The exhibition 2.4 shows the description of 6- steps risk management framework that draws on COSO 2004 Integrated Framework and COSO 2013 newly released Internal Control Framework. The content of control system is accomplished with logical strategic decisions, operations and relating to internal control principles with compliance. The system is designed and applied in corporate- level that must consider different sized enterprise and the basic framework is to suit the enterprises' size and capacity as well the framework of internal control should be easy to understand by users.

Graph 2.4 Six- Step of Risk Management



(Source: COSO, 2012)

²⁹Patchin Curtis, Mark Carey, Risk Assessment in Practice, www.coso.org, October 2012

The internal risk management framework indicated six steps of whole concept. That can be seen as graph 2.4 the procurement of decision- makers. It provides guidelines for managers and risk analysts who assess risks and construct strategic and tactical ideas for day-to- day management and avoid uncertainty.

To illustrate the graph, the system consists of six steps. Step one is objective setting, to give a clear overall objective or mission in risk management framework; the second step of system is identification, the management board discusses and confines risks and uncertain factors in a precise period and scope of strategic target; the next step is to assess risks based on above two preparations of risk control, according to COSO 2013 Framework described that risk assessment to map 17 principles which developed methodology and approach for SOX compliance program. Content of assessment relied on company's financial disclosures and risky history in a specific time. Generally the assessed information is consolidated by company and compiled into financial statement and the management report in a year. The fourth step is risk response that is management professional knowledge and judgment and rich managerial experience to construct a risk reaction mechanism which contain number of reliable information available for board of management and supervisory board. The next comprehensive step is taking action to plan and classify risks in an individual situation. It is points of implement and risk execute after systematically evaluation. This stage is the significant step which underlies four steps forward and also requires high quality information and relevant principles support. The last step is monitoring activities, it means the internal risk management or internal auditing department composes material and documentation of entire risk management process regarding to financial accounting and corporate governance standards to contribute and ensure the holistic risk control and review within enterprise- wide risk management system. In the central of the framework of internal control system is information and communicating feedback. According to COSO framework 2013 provide the principles that explain the information and communication are users' relevant information, communicates

internally and communicates externally.³⁰The information and communicating feedback can conduct with an IT- based integrity program in order to enhance the information quality and improve the transparency of communication surroundings. The corporation can use technology support to find optimal solutions for all information demanders of business community.

An alternative way of internal risk management process is to implement a control self-assessment (CSA) program as part of the company's ongoing risk evaluations within its monitoring activities function. For example, the management board and Audit Committee of supervisory board of Daimler AG selected an internal control system which called "four- eyes principle" (dual accountability) that established preparing segregation of duties in the context of financial statements and authorization for relevant IT accounting systems.³¹It regards to corporate accounting process and the main legal entities. The program examines regularly enterprise- wide risks then constitutes results of self- assessment documentation and report in a global IT system. At the end of process in an annual cycle of year, the selected external audits and corporate internal audits confirm the control information regarding to corporate accounting process and corporate governance standards.

³⁰J. Stephen McNally(2013): The 2013 COSO Framework and SOX Compliance, June 2013

³¹Daimler AG Annual Report 2015

2.2.3 The challenge of enterprise risk management

The weakness of COSO management method is the framework to guide enterprises managing risks in enterprise- level, which it is less authority that governed from early stage to the end of in- and external business activities. The shortage of powerful management method will be neglected by some SMEs or Multinationals (MNEs). COSO's enterprise risk management (ERM) does not dig much deeper into the subject, some guidance of risk management framework have not been made explicit relations to business activities. Enterprise risk management is a part of culture in an organisation and enterprise, but it is just a part of making decision in whole group, it nor isolated the all information from strategy, planning or day- to- day decision making and management.³² An example is in financial crisis, COSO framework regarded as a communication tool in risk management for organisation, government, all business communities, and also non- profit organisation. However, the costs were failed to manage risk. For example, a company has business travel by air and managers finally landed lately in destination due to the weather reason, unfortunately managers missed following business conference and activities. Given the natural and unanticipated costs management cannot allocate risk and reduce the extra costs and unexpected expenses. In the real world, the costs financial crisis resulted in costs of bankruptcy in companies and high unemployment rate, and in Eurozone, the social costs and high socio- welfare of government generated costs of fiscal budget in Portugal, Ireland, Spain, Greece and Italy. In Asia, the government in order to overcome impact on the financial crisis and then invest fixed assets in public goods and infrastructure. The result was in several years late, there was high inflation in domestic market and the price or asset bubble disturbed and distorted the real economy in many Asian countries.

Another issue is when a country's overall corporate governance is weak, voluntary and market corporate governance mechanisms have more limited effectiveness. The business practices have shown that good corporate governance is a means to create a

³²Larry Rittenberg, Frank Martens (2012): Enterprise Risk Management- Understanding and Communicating Risk Appetite, www.coso.org, January 2012

sound business environment of ethic, transparency, responsibility and trust, in order to support investment, financial stability and sustainable economic growth.³³ In this perspective, the corporate governance is an organisation's management culture that represents a part of different managerial style and attitude to achieve objectives. For example, in an organization, the management board sets up various goals to pursue value added among the amount of risk, which is called "Risk Appetite". Risk appetite should be enough to guide actions across the organisation.³⁴ And business performance can be increased if capital and resources are allocated more effectively, reflecting the balance of risks and rewards in a more integrated and dynamic fashion. In that respect, corporate governance can be considered as a milestone in modern enterprise risk management.³⁵ However, the principles of corporate governance maintained many recommendations from early governing versions. The essential components of a corporate governance framework must need multi-sides system coordination that is responsible for improving the cross-border consciousness on supervising objectives and governing subjects, which include The Company Law in the EU, The latest G20/OECD (Organization for Economic Cooperation and Development) Principles of Corporate Governance, the OECD Guidelines for Multinational Enterprises, Committee of the Sponsoring Organizations of the Treadway Commission (COSO) Framework, and the Convention on Combating Bribery of Foreign Public Officials in International Business Transactions.³⁶ There is no single principle or model for good corporate governance, and also these complexities of principles and guidelines introduce some new business issues and bring greater additional clarity to others. Some principles are appropriate for larger than smaller enterprises.³⁷ It is suggested that good principles of corporate governance consider to all companies, not only the larger corporations or the international enterprises, but also the smaller and micro

³³Global Trends in Corporate Governance, www.deloitte.com, Dec 2015

³⁴Larry Rittenberg, Frank Martens (2012): Enterprise Risk Management- Understanding and Communicating Risk Appetite, www.coso.org, January 2012

³⁵IBM, Risk Appetite: A Multi-faceted Approach to Risk Management, April 2008

³⁶Global Trends in Corporate Governance, www.deloitte.com, Dec. 2015

³⁷G20/OECD Principles of Corporate Governance, www.oecd.org/drf, Sep. 2015

firms. The process of supervision and governing must be suitable for understanding of all business communities, which include financial and non-financial standards and requirements. For example, many companies consider their managerial strategies that link to manage operational, compliance and financial risks in a long-term objective, this quality of corporate governance affects the administrative costs for corporation, enhance the confidence of investors, and reduce the costs of capital in financial market. Therefore, corporate governance monitors not just the individuals and the principles and framework create transparency and well-function in market.³⁸

³⁸G20/OECD Principles of Corporate Governance, www.oecd.org/drf, Sep. 2015

3. Corporate innovation management

Innovation culture and innovative environment in corporation are a significant perspective that cultivates new ideas and knowledge among operation as well as entrepreneurial inspiration initiate innovation procedure.

However, investment of innovation or research and innovation (R&D) is full range of risks and uncertain factors during the corporate innovation process. It is fail to precast concrete formulations at all that companies can ensure their innovative product and service whether success in the market or how long the innovation will complete and launch the product or service into market, although companies can utilize market survey or interview to establish a forecast software to estimate the volume and capacity of potential and target market. The opportunity cost is a significant element for companies while the management board making decisions, particularly is small to medium- sized enterprises, which consider and determine an investment opportunity within the propriety. Given scale and properties of companies, they make decision carefully and consequently, there is an opportunity cost associated with every available option in every decision problem.³⁹Hence, it is necessary that top managers establish clear and state- of –the –art innovation strategies as a reference in day- to- day management.

To analyse and manage technology and innovation, first of all, we need to know and understand what technology is and what innovation is. According to Oxford Dictionary of English defines that technology is the application of scientific knowledge for practical purpose, especially in industry. The range of definition demonstrates that a variety of different perspectives on technology exist.⁴⁰It contains the process used to change inputs into outputs, the application of knowledge to perform work and the application of science, especially to industrial or commercial objectives.

The definition of innovation is the action or process of innovating; it includes a new method, idea, product or service, etc. Here there is another term should be clearly

³⁹Erik Angner (2012):A course in Behavioral Economics, Palgrave Macmillan, p30

⁴⁰Margaret A. White, Garry D. Bruton (2007):The Management of Technology and Innovation, p17

distinguished that invention is the action of inventing something, typically a process or device. Invention tends to a new thing that is originated with knowledge and other sources by individual or organization. It creates a discovering from the physical world or patent of invention.⁴¹The action of innovation is based on the invention and it changes or reforms capacities and resources available with new ideas and concepts.

⁴¹Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, p19

3.1 Focus on the management of technology and innovation

Comparing with all kinds of companies and organisation are in different business filed, the successful corporation has an absolute leadership or dominate market shares in his business area. In order to achieve the goal, there are two ways for companies, one is cost reduction and another is improvement of quality in his product and service. Both the two activities of business motivation and performance require technological and innovative change.

Also nowadays there is a trend in product and service or business process innovation that is sustainable development for companies. Innovation and technology change or improvement will bring chance and drift in business area to enterprises, and sustainability is an initial thinking and favourable reaction in operations during day- to-day management and corporate long- term strategic management.

For example, the automaker Daimler Group has strong ambition to be the global leadership in automobiles industry. To achieve goal, the group introduces and develops corporate strategy which combines the interest of business and society. Daimler manufactures premium vehicles (include cars, trucks, vans and buses) to meet different high demands and requirement of consumers and traders, therefore, Daimler group demonstrate innovative capabilities and technological solutions associated with four main management areas. The group emphasized that the central business field will be enhanced and is more effective and intelligent in cars division. The business performance and profitable increase relies on technological drive with sustainable thinking for each new model of vehicles. Daimler group desires the product and service with passion, security, environment friendly for all generations. To fulfill the target of corporation, it is significant that the group- wide innovation and technology management system is to be conducted.

Here also another corporation, the BASF SE, is the one of the world biggest corporation in Chemical industry, the group believes that innovation and research and development are an important engine for corporation growth. Innovation activity and research and

development (R&D) based on efficient and effective management system in technological perspective facilitate BASF group maintain strong power and competition in the main business field and keep a long- term successful path to ensure the production and product safety as well create value for local community and society. In conclusion, technology and innovation deeply impact on our life, the influence of technology as well appears in activities for business and society.

3.1.1 The reason of management of technology and innovation

Value creation is core of reason for innovation management. Not only are the Daimler AG and BASF SE in automobile and chemical sectors, but also is another large corporation Bayer AG, the world- wide leader of German Life Science and Chemistry believes that knowledge- drive innovation generates great benefit for the corporation which lead to Bayer to be one of the biggest technical and life science Corporation in the world in 150 years.

Company brings into innovation as a basic strategy of company in a long- term success. The group insists on lasting innovation and enhancement of R&D investment in core business area. Also the corporation focus on the excellence Know- how transaction to high quality product and commercialization. According to newly released Bayer AG annual report stated that the group between 2011 and 2015 increased the research and development (R&D) investment and spending around €1, 4billion to €4, 3 billion.⁴² Particularly is in Consumer Health and Crop Science divisions, the volume of investment was occupied a large percentage of whole R&D investments, were 66 percent and 27 percent respectively. As an outstanding life science corporation, Bayer AG reconstructed and integrated operations- based structure,⁴³ the new leaders were appointed in pharmaceuticals, consumer health and crop science three divisions in January 2016. The behaviour of change management enhances operational responsibility and accountability of decision- making for the innovation of corporation which plays an important role within result of innovation in terms of the innovation culture in management board.

Comparing with large enterprise, the SMEs play an important role with a dynamic and strong force in the market. The SMEs also concern innovation and create new product and service that participate in domestic or global market, they anticipate high portfolio from innovation to ahead occupy a competent position. According to a research of European Commission (2014) reported that there is more than 20 million SMEs in the

⁴²Bayer AG Annual Report 2015

⁴³Bayer AG Annual Report 2015

EU area represent majority of business activities, small to medium-sized enterprise (SMEs) are the backbone of Europe's economy.⁴⁴ These SMEs are a key driver for economic growth, work opportunities and employment, innovation and technology improvement and social integrating. Therefore, SMEs contribute to huge energy for national and regional economy.

However, the sources access to SMEs is an obstacle and these sized enterprises face tough situation. The European Central Bank (ECB) released a survey on the access to finance of enterprises (SAFE) in 2014 and the survey was conducted jointly with the European Commission. The report mainly provided evidence and investigation on changes in the financial situation, financing demand of small and medium- sized enterprises (SMEs) and access to external financing and capital resource of SMEs in the euro area, and compared it with that of large multinational enterprises.⁴⁵ The context of survey showed how access to financing was a problem for SMEs among euro area countries, the interest expenses for SMEs increased by 3 percent according to the report. By contrast, 23 percent large enterprises indicated that there is a decline in interest expenses.⁴⁶ But there are some differences of situation and circumstance across euro area countries, such countries in euro sovereign crisis, like Spain, Ireland, Greece as well as French were worse than Germany, Dutch or Austria. The SMEs contract to multinational corporations (MNCs) that have the activities in business and production area, however, SMEs lack the flexibility and adaptability to instantly deal with the change and requirements in market.⁴⁷

⁴⁴European Commission, www.ec.europa.eu

⁴⁵European Central Bank, Survey on the Access to Finance of enterprises in the Euro Area, Nov.2014

⁴⁶European Central Bank, Survey on the Access to Finance of enterprises in the Euro Area, Nov.2014

⁴⁷Philipp Walter Sauter (2014): Managing Dispersed Innovation in SMEs, p19

3.1.2 The method of management of technology and innovation

From idea and concept finding to plan designing and instructing of project is crucial element for managing technology and innovation of corporation. Technology management is linking engineering, top- class pilot team or group, and management disciplines to plan, design, develop and implement technology capability to shape and accomplish the strategic and operational objectives of an organisation.⁴⁸ Innovation management defined as a comprehensive approach to managerial problem solving and action on integrative problem solving framework, and an understanding of the linkages among innovation streams, the tendency of developing wave, instructive system and group and team evolution. The top managers are artists, architects to criticize, construct, and implement innovation policies by an organisation or individuals.⁴⁹ The senior managers know what challenge is in innovation and technology application in project that instruct managers to execute investment with entire value chain. Hence the top managers need to find what influences area in management of technology and innovation.

Table 3.1 the area of influence management of technology and innovation

Product and operations procedures	Socio- technological system design, product quality and responsibility, market share and customer taste
Group and team co- operations	Management board, decision- making process, external research institution
Resourcing management	Financial system, supply chain management, Human resource

⁴⁸National Task Force on Technology, 1987

⁴⁹Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, p23

Competitors behaviour	Patent, license, Intellectual property right protection, Data and information protection
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(Source: based on Francesca Ricciardi, 2013)

These areas can affect companies' innovation and technology management and there is also a long- term effect on business performance of enterprises. The Table 3.1 illustrates what areas influence companies' innovation and technology management. That is a system view to provide idea that analyses variants of operational environment. It can be seen as a managerial chain from inputs, transformation to outputs. It also includes internal and external factors which impact on innovation capabilities. There is also a study of possible impacts on business network on the organisation's innovation capabilities.⁵⁰ The study of 3.2 explained innovation in business network playing a functional role and as a consequence of mimetic process for decision- makers. For example, the leadership or entrepreneurship is in managerial prestige.

Table 1.2 Possible Impacts of Business Network on the Organisation's Performance

	Positive Impacts on Business Networking	Negative Impacts on Business Networking
On Innovation Capabilities	Access to valuable Resources: national division of innovation hub and labor; risk sharing	conflict of culture, intelligence collection;
On Social Role	social responsibility and corporate reputation and image	illegal behaviour and unfair power of occupation;

⁵⁰Francesca Ricciardi(2013): Innovation Process in Business Network, pp8- 10

On Financial Strength	Better financial credit ratings, mutual finance help	weakness of partnership, transaction cost, financial principles misunderstanding
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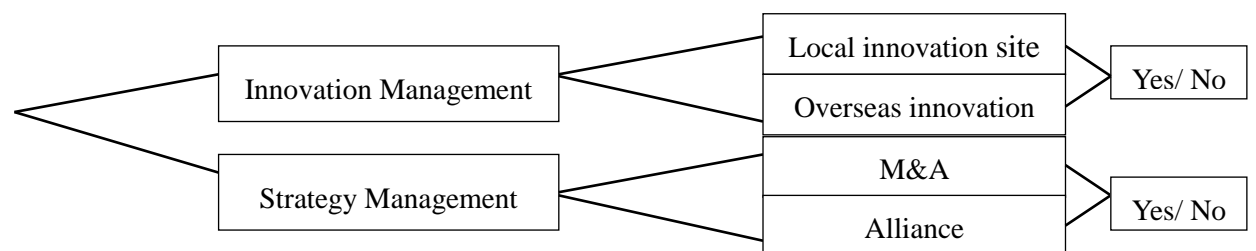
(Source: based on Francesca Ricciadi, 2013)

To find impact factors of management of technology and innovation, the following step is what method can manage innovation capabilities and eliminate influences in technology field.

First of all, a decision tree is a graphical or visual perception to show what actions available for decision- makers and whether decisions rational are in period of innovation. For example, a simple decision tree is based on yes or no questions and in innovation management, it associates the opportunity cost with valuable resource in investment and cooperation. With computer and IT technology development, managers are allowed to utilize decision support system which analyses commercial data and tremendous information to assist decision- making within an organisation.

However, decision tree is a simply and single way to discuss and analyse the inputs, like nominative behaviour and examine ideas and find alternative ways, but there is no feedback for decision- makers and also lack of systematic evaluation for measuring decisions. The graph 3.1 shows an example of simple decision tree.

Graph 3.1 Example of simple decision tree



(Source: own compilation)

The Balanced Scorecard (BSC) is another tool to manage innovation capabilities.

The basic concept and approach helped students in such monitoring, assessment

performance of study.⁵¹The Balanced Scorecard lately were developed and introduced by Kaplan and Norton, which regarded as an instrument to apply in controlling and corporate strategy management. The Scorecard consists four parts: financial, customer, internal business process and employee leaning and growth. The perspective of management in technology and innovation was compiled the Balanced Scorecard method into total quality management (TQM). Firstly, European Foundation for Quality Management (EFQM) developed the European TQM- Excellent Model in 2000 and managing the European Quality Award Process.⁵²The basic perspective of Excellence Framework focuses and supports performance- related assessment within the overall organisation's (whatever the types they are large, small, public or private) development. The basic Excellent Model is a framework that referred to Balanced Scorecard (BSC) for monitoring Key Performance Indicators (KPIs), ISO 9001 securities of Quality Management System and ISO 6000 guidance for Corporate Social Responsibility (CSR).⁵³The Model provides mission and vision that encourages the cooperation, collaboration and innovation that we will need to ensure the goal is achieved.

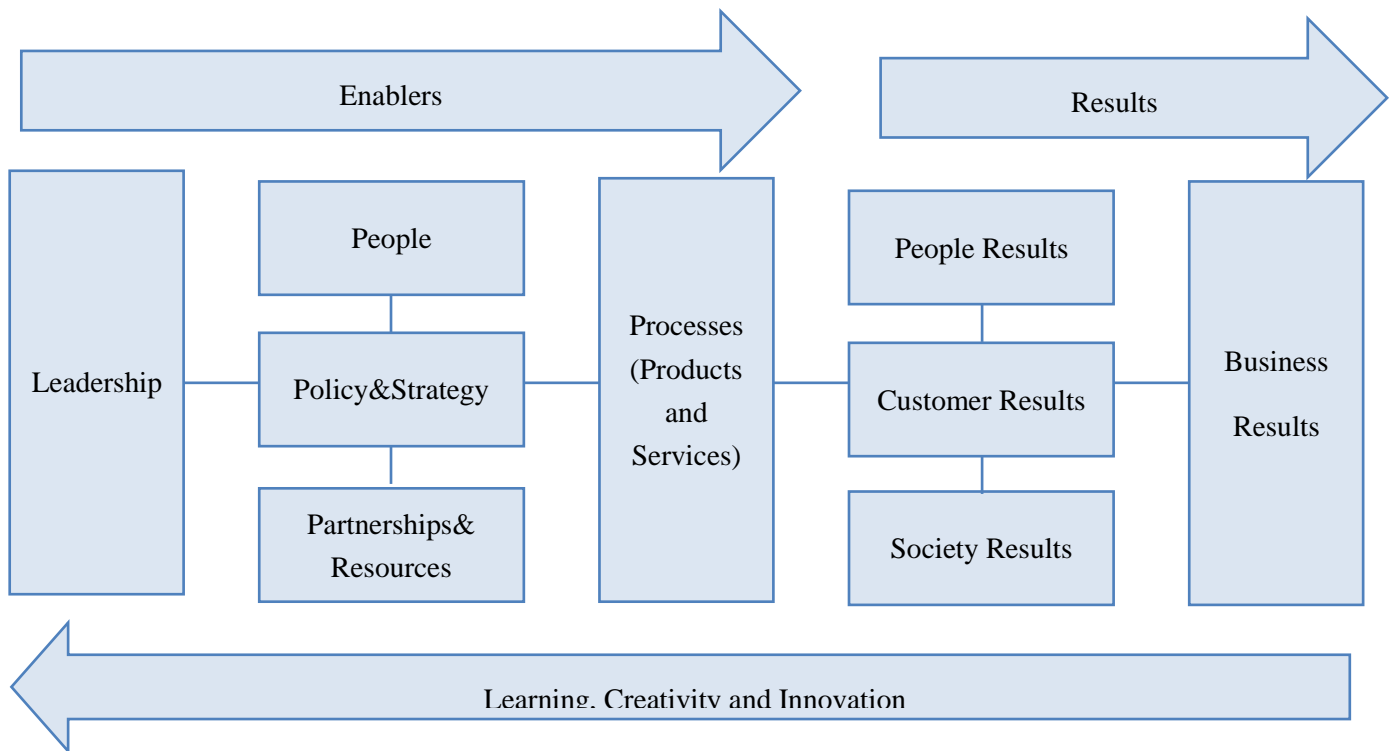
The foundation of concept is based on nine criteria and focus on four key aspects of performance: achieving of business, customers, people and society. The target of quality management provide a control system and citation of business eco- system, which considers not only pure business or commercial function, but also thought about cooperation and coopetition that reflected on innovation and business operation in a new economic world and global trading system. The results of assessment will through leadership, policy and strategy, partnerships and resources activate. Finally, the innovation and learning help the entire process improved. The exhibition 3.2 EFQM model displays systematic EFQM Excellence Model (it registered a Trademark).

⁵¹Kaplan R., D. Norton(1996): The Balanced Scorecard, Cambridge, MA: Harvard Business School Press

⁵²EFQM: the European Quality for Management, www.efqm.org,

⁵³EFQM Model@ www.efqm.org,

Graph 3.2 the EFQM Excellent Model®⁵⁴



©EFQM 2012 (Source: www.efqm.org.)

The EFQM Excellent Model utilizes “Enablers” and “Results” to designate two main criteria. The Enablers are criterion that is combined five key elements while an organisation developing business activities or undertaking an obligation. The Results criterion is the results of an organisation’s achievement that are considered with demand of people, customer, and society and achieved outstanding expectations of business community.

There are some key terms need to be defined and explained.

- **Leadership:** the definition of leadership is that the action and motivation of leaders who lead, organise, and develop a group or an organization to involve in certain activities. The Excellent framework enables leaders to develop missions, visions and values in a role of management style; the second perspective of model provides an idea that leaders have a flexible and timely reaction with customers, people and the society.

⁵⁴An Overview of the EFQM Excellent Model, ©EFQM 2012, www.efqm.org.

- Policy and strategy: the definition of strategy in Balanced Scorecard is that follows vision and mission as a plan of action to make decision, which in order to generate benefit in long- term and achieve overall objectives for company. In the EFQM Excellent Model, policy and strategy are based on the information from measured performance, learning, creative and innovative behaviours.
- Partnerships and Resources: partnerships is defined as external partners by the framework which defined resources as internal sources and both them was planned, collected, organized by the companies or organisation. The procurement is a significant procedure in the Excellent Model, which manages external partners, finances, and suppliers as well as manages the internal resources, such knowledge, information and technology.
- Processes: the definition of processes is that a period when time, capital, material and knowledge input to product and service, in order to generate and maximize value for people, customer and other stakeholders of entire business community. The processes bridge forward actions to satisfy demand of afterward results.
- Results criterion: the results include people, customer, society and business results. According to the document of EFQM explained that the Excellent Model sets performance indicators to measure segment of results in specific areas, and there are also clear targets for key results that are in line with business and social performance. An excellent and sustainable business results over at least three years.⁵⁵

This complex model plays a role that helps users understanding the implication of strategy and what goal and intention of organisation they want to achieve, whatever these are SMEs, multinational corporations, or non- profit organisation. Now the new EFQM Excellent Model released in 2013, it added and supplemented new concepts that drove organisation to understand what the cause and effect relationships is between the groups optimizing management and value creation. The Model as well

⁵⁵An Overview of the EFQM Excellent Model, www.efqm.org,

enables to a holistic overview of an organisation's current level of excellence and priorities which improve or maximize the organisation's impact.⁵⁶For SMEs, the Model uses these criteria and 22 sub- criteria for allocation of SMEs Award.

An otherwise of the Balanced Scorecard and the EFQM Excellent Model have limitation. One of the obvious questions is can the Excellence Framework satisfy all the business community and organisation. Especially in operating or practical execution, it is an internal strategy and self- assessment framework, how to measure effects by outsiders and how to supervises the process of assessment in SMEs or Multinational Corporations, there is no a precise answer at the moment.

Another issue of the Excellent Model is that the framework is a current self- assessment model, how to strength the excellence results in the future for stakeholders, although the EFQM Excellent Model tries to prove idea long- term strategy in learning and innovation area.

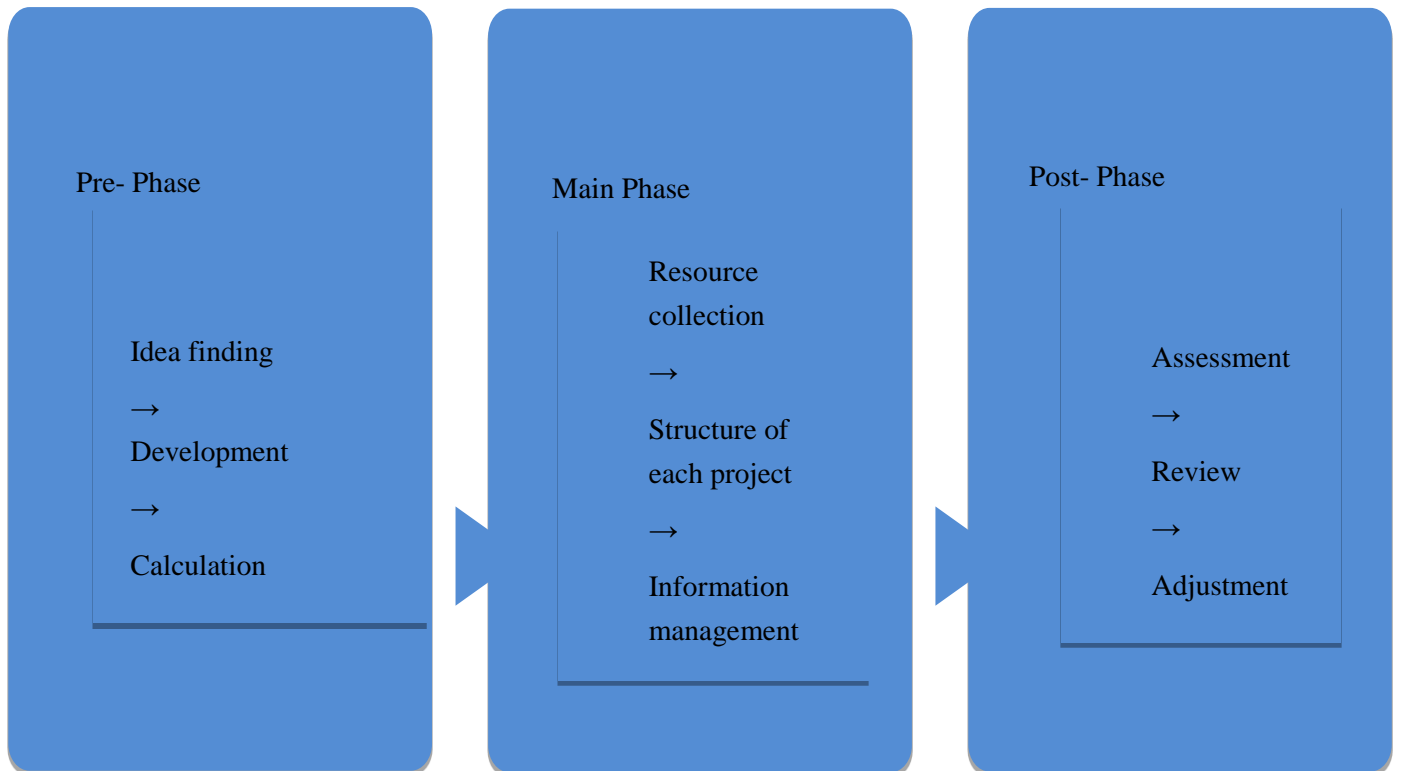
⁵⁶An Overview of the EFQM Excellent Model, www.efqm.org.

3.1.3 The process of management of technology and innovation

Based on above tools of management, the next step is find appropriate strategies to management process of innovation and technology.

Management strategy is the effort by a company to set up vision and mission and then analyse business environment within company's strengths and weakness. Specific in innovation and technology management is that enterprise in order to maintain the sustainable competitive advantage, managing process of innovation and technology achieves requirement and target in innovation and technology management. Hence, decision tree and Balanced Scorecard (BSC) are useful tools to help company competing managing assignments. Administering the process of innovation and technology management is a goal that ensuring quality of innovation and technology management, enhancing the knowledge and information transformation from input to output procedure, and effectively operating in procurement from research and development (R&D) department can reduce the cost and expenditure of innovation management and additionally can satisfy researchers and engineers' self- requirement and confidence. Management can from internal and external perspectives optimize and control process of innovation and technology management. The managerial elements include: product and service data like quality of product, material, delivery data, full-time or part- time employment and staff dada, financial and investment information. The quality of data and information can utilize the EFQM Framework examination by companies. The Three- phase indicates managerial plan of management of technology and innovation, which responds to Scorecard among innovation stage and enterprises are responsible to investment and research and development (R&D). With increasing degree of digitalization in information quality and data management or IT applied in business and commercial networks, the internal management process is to be efficient. The inhibition 3.3 is the process management of innovation and technology in internal perspective.

Graph 3.3 three phases of management of technology and innovation



(Source: Manfred König, Rainer Völker, 2002)

This Three- phase of management in technology and innovation is based on industrial innovation, ⁵⁷which embarks early stage, mid- stage and late stage. It is an internal managerial method that requires a transparency and smooth communication through the whole organisation while command and control by top managers in the process of management in innovation and technology, in the meanwhile, it also need employees, engineers and suppliers coordination. The goal of three phases intends to determine and manage each process of management simply and insistently reaction among all participants within the organisation. This internal innovation of managerial process instructs and restricts product and service innovation.

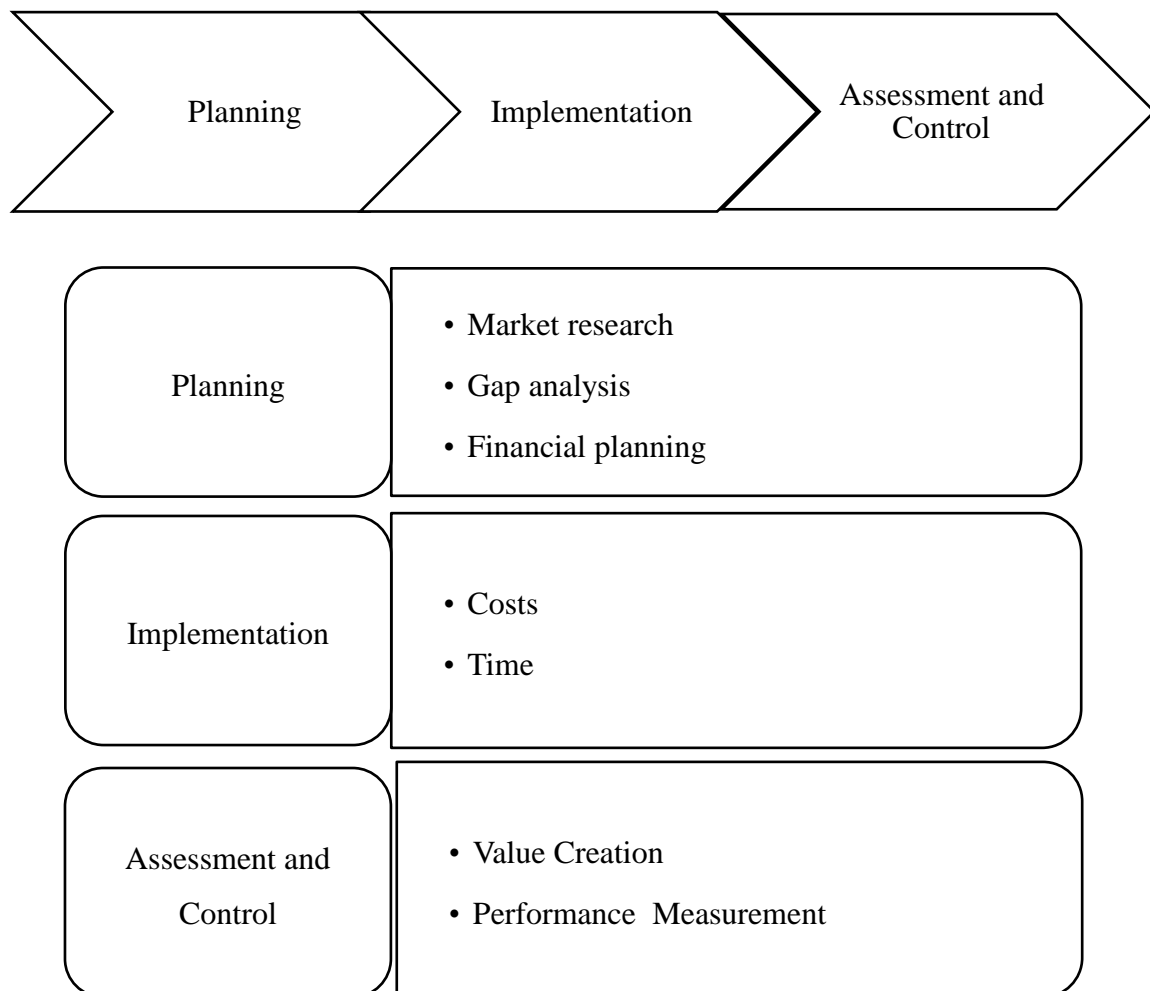
Innovation and technology strategies need plan, implementation and assessment and control three steps. It is connected and linked to above the Three- phase of management process. The strategies bring concepts forward to precise vision and market- orientation structure for managers. The concepts are determined by product and service quality, degree of customer satisfaction and innovation ability of enterprise. The central

⁵⁷Manfred König, Rainer Völker (2002): Innovationsmanagement in der Industrie, Carl Hanser Verlag, pp96- 98

termination of market- orientation reduces possibility of market direction loss in the future.

Another side is process- orientation management with the concepts, which concentrated on quantity, time, manufacturing costs, quality and information accomplished. That is a necessary action of management in innovation and technology procedure that concluded in view of external management process from beginning to end. In implementation process, the options of managing will be benefit from technology updating in the long- run with new generation product.

Graph 3.4 the external process of management of technology and innovation⁵⁸



(Source: Margaret A. White, Garry D. Bruton, 2007)

The Exhibition 3.4 External process of management illustrates that the management

⁵⁸Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, p45

classifies and concerns three areas of innovation and technology managing, which includes planning, implementation and assessment, to correspond the factors of object, perspective and state of dimensions or extent. Enterprises manage actively the issues technology and innovation, particularly for start- up and small firms will grow fast at the beginning stage of product or service in the market.

- The planning of process management

From market- orientation considers the planning process there are three perspectives. First of all is market dimension of product and service, hence here the enterprises need to think about two questions, one is: Should the target market need innovation? The other one is: How realize the innovation in segment market?

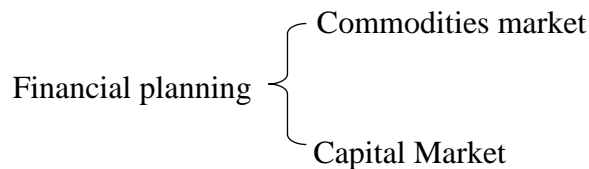
The questions of market research perspective can structure the managerial layer of producing organization. For example, the radical innovation is that characterized by departure on from tradition way and style, technology that caused a dramatic change in the way.⁵⁹It introduced a functional way of costs reducing and managerial layer changing. The change will decrease time in innovation of product or service.

Also the information and data collection are crucial for planning process of innovation and technology.

Secondly, the information exchange from internal to external organisation and data gathering is a way that analyse the market capability and customer behaviour to target consuming group. This is a basic process to find gaps between product and service suppliers and customers. Information and data collection are also the process that minimizes risks of technology and market, reducing costs of research and development, translation of customer taste and the direct communicating with external stakeholders. The third factor is that finance plan considers structure of capital and the methods of financing. The purpose of financial planning is that enterprises have good ideas and sound investment decision in product or service market with high expectation of future return and sales volume, however, the poor financial planning impact operational

⁵⁹Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, p40

process in innovation and technology management. The result of innovation is failed to finance plan level for investment budget. Hence, financial planning is a long- term strategic plan that provides opportunities for companies to added corporate value by increasing revenues and positive net present value (NPV), but as well presents other opportunities that developed quality of product and broadened and extended options and value chains in new market.⁶⁰In industrial level of financial planning considers fixed assets, like materials, machinery and equipment, current assets, such as cash flow or stocks, shares or bonds in capital market. The relationship between financial planning and market is:



Enterprises had involved and complicated managerial system of innovation and technology. As a part of element in management process, the financial planning is also related with technology and product life cycle. This is because of finance source and industrial business generate mutual influences of product and service area, and the product life cycle provides reference for enterprises when they manage technology improving and portfolio increasing. The core financial ratios against planning and life cycle are return on capital employed (ROCE), return on investment (ROI), return on sales (ROS) and return on equity (ROE). The next part will illustrate the life cycle and innovation and technology management.

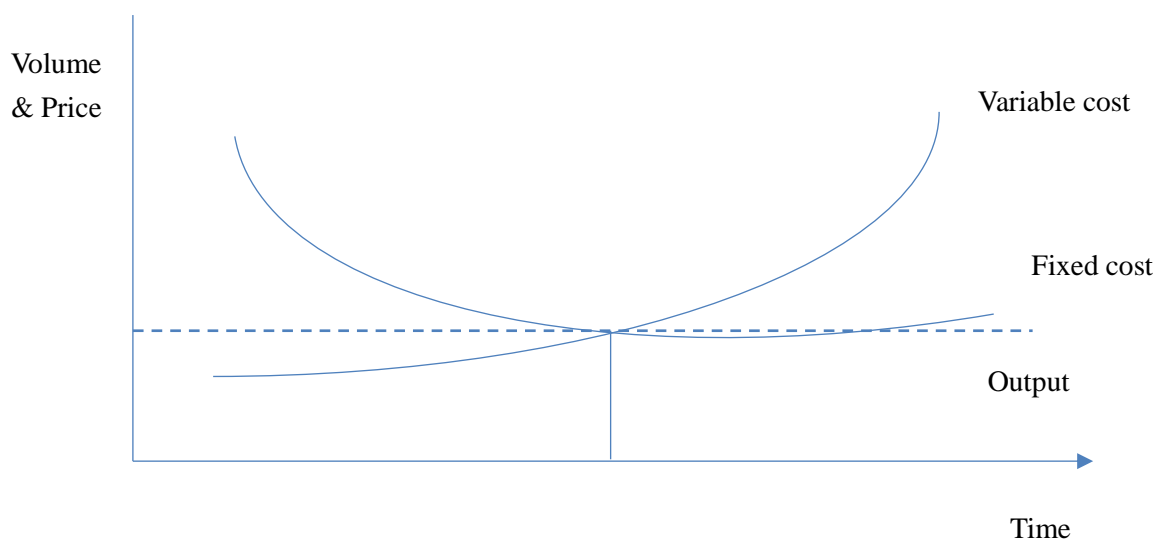
- The implementation of process management

The motivation of enterprises undertakes innovation and R&D events in order to obtain competitiveness in domestic and international market. In industrial- wide management focus on innovation and technology agenda that include two factors: production and cost, these factors reflect on time, cost of trading, and volume and price. In a typical business organization, cost is generally considered the domain of the accounting

⁶⁰Tony Davies, Tony Boczko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp375- 381

department. It presents relevant economic figures, index and notes to outsiders, such as banks, bond holders, investors and suppliers. The information is based on accounting standards, for example International Financial Accounting Standards (IFAS), International Accounting Standards (IAS), Generally Accepted Accounting Principles (US- GAAP) or HGB. The exhibition 3.5 Production- Cost- Function shows the relationship between cost and production.⁶¹

Graph 3.5 Production- Cost- Function



(Source: based on Paul G. Keat, Philip K. Y. Young, Stephen E. Elfle, 2014)

There are two questions of innovation and technology management in execution of process.

What costs require top managers to be limited and monitored in managerial process of innovation and technology?

And how will the costs influence management in technology and innovation?

The two questions have an effect on quality of innovation and technology management and how long and when product and service are to introduce market. The cost- product function embedded technological and product life cycle, different costs will expand financial stress for enterprises that generated negative influence of duration in product

⁶¹Paul G. Keat, Philip K. Y. Yong, Stephen E. Erfle (2014): Managerial Economics: Economic Tools for Today's Decision Makers, 7th Edition, Pearson Education, pp280- 293

and service lifelong.

The relationship between product and cost in economic analysis is cost function simply expressed the production function. The production – cost function applies to Short- run relationship. In economic theory, the relationship between diminishing returns and marginal costs represents a key link between a firm’s short- run production function and its short- run cost function, because it is the law of diminishing returns that gives the short- run cost function its distinctive non- linear form.⁶²The numerical relationship between production and cost in the shot- run presented companies using the variable input which is determined by the number of units and the unit price. The total cost depends on execution time. For example, in the structure of innovation and technology management, enterprise undertakes a project, a new product researching or a software program developing, each unit outputs is determined by the unit input and unit price under the running- time in day- to- day operation. The Total- Cost- of- Ownership (TCO) concept is a total costs analysis framework, in innovation management, company employs three inputs: labour, material and capital. The firm operates in a short- run production period that labour and material are variable costs and capital regard as their fixed cost.

There is also a function of cost management or budget limits in implantation process if enterprise in practical day- to- day management of research and development (R&D) period. That is forecasting technique. The preceding methods provide insights of short- term trends in innovation and technology changing in product and service market; as well it is a relative perspective that provides overview of business process management within hidden costs in ongoing business operation and how to execute business tactical and strategic planning in following stage.⁶³In R&D department, forecasting technique compasses engineering, leaders of research team to complete project and inspects important questions and problems in innovation and technology management. This part

⁶²Paul G. Keat, Philip K. Young, Stephen E. Erfle (2014): Managerial Economics: Economic Tools for Today’s Decision Makers, 7th Edition, Pearson Education, p279

⁶³Paul G. Keat, Philip K. Young, Stephen E. Erfle (2014): Managerial Economics: Economic Tools for Today’s Decision Makers, 7th Edition, Pearson Education, pp159- 182

will be introduced in next section.

- The assessment and control of process management

Once the strategy is implemented, the enterprises make sure that their strategy is working, and then management board can set targets and objectives in controlling process to measure innovation performance. The last phase of process management in innovation and technology management is assessment and controlling that plays a significant role in evaluation the result of research and development performance and ensures the quality of innovation in product or service. After the implementation phase, management can set checklist or performance- measurement through serious business indicators to generate value for enterprises. Evaluation is comparison of actual outcomes and control is adjustments when action of innovation and technology management cannot match and coordinate with enterprises' resource capacity and long-term developed strategy. Therefore, decision- makers make decisions in investment, R&D, management areas, which need innovation- controlling process.

The control process will be restarted the planning process, and examined the appropriate areas of key innovative factors. Under investigation of innovation controlling, the controller or manager assesses what main challenges are and what questions and problems exist in technology and innovation management. Here management can introduce three questions: the first is what factors generate positive and negative influence in process of innovation and technology management. Secondly is which factors have been isolated and detached among innovative- performance- indicators.⁶⁴ The last one is how improve transparency of innovation and reduce information costs after assessments and controlling. To measure innovation program, top managers can image and consider conditions of resources and portfolio planning. The standards can refer to total quality management (TQM Framework) and the aspects of performance- measurement concentrate on financial and non- financial indicators and quantity performance model in industrial and service sectors.⁶⁵ From process of

⁶⁴Manfred König, Rainer Völker (2002): Innovationsmanagement in der Industrie, Carl Hanser Verlag, pp168- 169

⁶⁵Norbert Klingebiel (1999): Performance Measurement, Gabler Verlag, pp22- 30

planning, implement to evaluation and control, top managers conclude some questions according to qualitative research. These questions described but did not guide top managers in all situations of managerial process in technology and innovation.

Table 3.3 summary of questions in management of technology and innovation

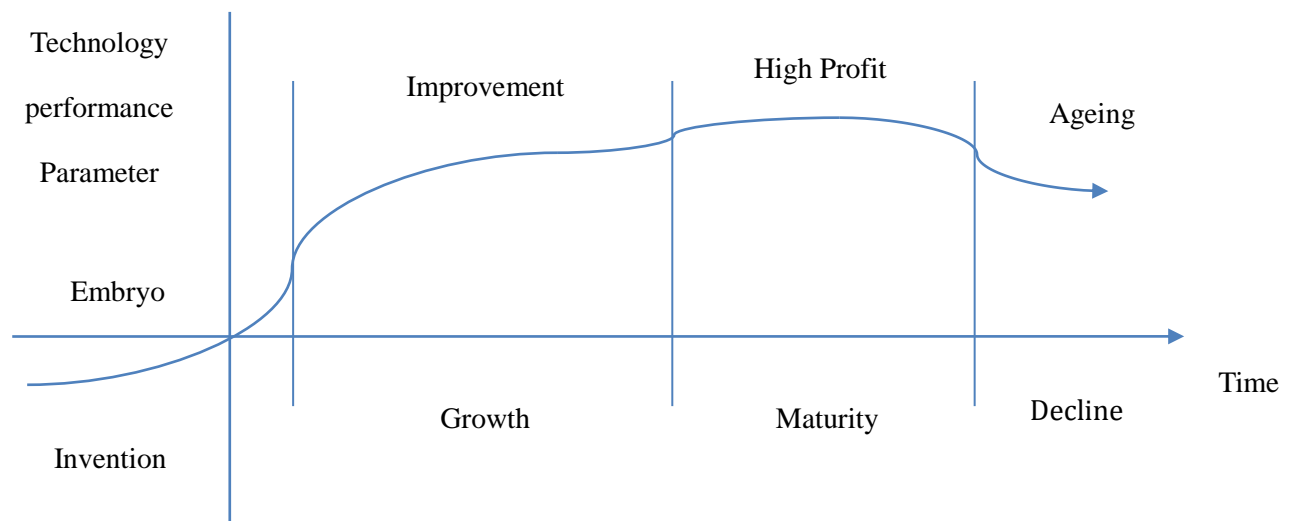
Phase	Questions
Planning	<p>Should the target market need innovation?</p> <p>Which type of innovation should a firm focus on?</p> <p>How realize innovation in segment market?</p>
Implementation	<p>Are the primary external efforts during the process of development of technology and innovation to be obtained?</p> <p>What costs require top managers to be limited and monitored in managerial process of innovation and technology?</p> <p>How will the costs influence management of technology and innovation?</p>
Assessment and Controlling	<p>Which factors generate positive and negative influence in process of management of technology and innovation?</p> <p>Which factors have been isolated and detached among innovation-performance indicators?</p> <p>How improve transparency of innovation and reduce information costs after assessment and controlling?</p>

(Source: own compilation)

3.2 Implementing management of technology and innovation

This section will be provided details about management in technology and innovation that is based on above implement procedure. To execute strategy of process in innovation and technology management, the Technology and product life cycles are a pair of compass guiding the innovation and technology management.

Graph 3.6 Technology Life- Cycle



(Source: R. Forster, 1986)

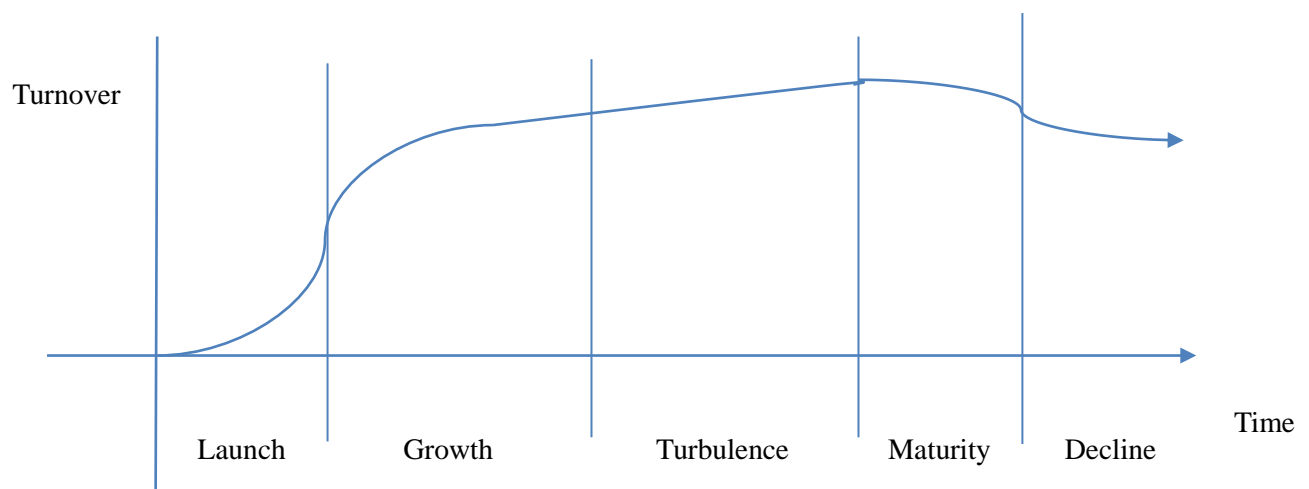
The technological life cycle is also called the S- curve.⁶⁶The S- curve has four stages: Invention, growth, maturity and aging. Initially, innovation in a domain occurs and new products and processes are introduced as firms seek to translate that know- how into the marketplace and create value for both companies and customers.

However, the trail of technical capability is declined in aging time. The embryonic phase includes the invention and application of new technology in material or the new art of product through innovation process. Improvement is the main growth phase for enterprise, which the process directly related to the technology applied in manufacturing and operational management. During the maturity stage, the enterprises enjoyed high value and profitability when the enterprises have smoothly done the first two phases. However, throw the maturity phase, the technological value touched proof

⁶⁶Forster, R(1986): Innovation: The Attacker's Advantage, New York: Summit Book

of growth and wealth of innovation brought few benefit in the market. In the aging phase, there is a decline in the utility of the technology. The technology is to be as modification of the S- curve tail taken place by market competitors. From this period, company must collect information and gather team to prepare a new generation product.

Graph 3.7 Product Life- Cycle



(Source: Tony Davies, Tony Boczko, Jean Chen, 2008)

The product life cycle (PLC) looks like the tracking of movements of sales, and therefore profits and cash flows, which the product life cycle applied in industrial level with a long period from preparing stages to product manufacturing and at the end stage of maturity of technology. The cycle consists of five stages: start- up, growth, turbulence, maturity and decline. In the entire cycle of product is market share changing and the volume sales and market intensity are compatible with technology maturity of product life cycle.⁶⁷In innovation and technology management, at the each stage of cycle different levels of business risk will be faced at the industry or sectors of industry level, and individual product level with political, economic, social, technological and environmental conditions that under such components of legal pressures or fierce

⁶⁷Tony Davies, Tony Boczko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp561- 568
50

competition. The product life cycle can utilize two methods of analysis, one is Product-Market- Portfolio- Analyse, and another one is Technology- Portfolio- Analyse. They are long- term planning and controlling method, which applied in management of technology and innovation, on the contrary is budgeted planning that is regarded as a short- term management planning process with top-down- planning and bottom- up- planning method.⁶⁸The top- down and bottom- up planning applied in technology and innovation management, it is successful in managerial process of budget plan with a certain time period. The part of planning method is a tactical or operational plan that associated with functional and organizational different perspectives. The functional perspective includes market force, resources, product and professions or human resource factors. The organisational perspective considers subsidiaries, the form of department and unity of organisations.⁶⁹

Product- Market- Portfolio- Analyse is based on concept of product life cycle and then contributed to Boston Consulting Group (BCG) matrix. The BCG matrix shows the changing positions of portfolios of product within a company by considering the two dimensions of market share and market growth. It is a classical market and portfolio analyzing instrument which illustrates the relative market share of a company with a portfolio of products in the BCG matrix in its comparison with the rate of market growth and potential market opportunities and threatens. The Boston Consulting Group introduced the BCG matrix for portfolio analysis for investors and top managers, whose can optimize financial planning and realizes or focus on reducing risks and ensuring interests and return of investment.⁷⁰The BCG matrix has four fields: question markets (or problem children), stars, cash cows and dogs. The basic premise underpinning the matrix is that the greater the market share a product or service has, or the faster the market for a product growth, the better it is for the position of company. It is possible to use the BCG matrix to visualize the position of products, in order to assess appropriate

⁶⁸Harald Ehrmann (2007): Kompakt- Training: Balanced Scorecard 4. Auflage, Friedrich Kiehl Verlag, pp65- 70

⁶⁹Jürgen Weber, UtzSchäffer(2014): Einführung in das Controlling, 14. Auflage, Schäffer- PoeschelVerlag, pp331- 336

⁷⁰Tony Davies, Tony Boczko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp565- 570

market strategies.⁷¹ It is varying nature of a company's portfolio of products and services that directly affects the levels of risk faced by a company throughout the life cycle of technology or product. Product life cycle and BCG matrix confronted the strategies of segmental market and portfolio management, and at the same time, remained attention for sourcing effectively using and restrained expenses and expenditures of resources within manufacturing and research and development areas. The market growth rate in the BCG matrix relates to the sales volume growth of the product life cycle, as products move from their introducing or launch phase matching the box of questions markets (or problem children), to growth (stars), maturity (cash cows) and decline phase (dogs). For example, in question market represents a new start-up product (or service) beginning at the embryo- phase and requiring high levels of resources and investment for market research, market entry, massive investment for development and research of new product, marketing campaigns (like advertising, promotion, or social media and online- marketing) and operations.

However, the technology and product life cycle and BCG matrix also weakness exist. The life cycle focus on technology or product time and lifespan, it lacks the indeed content of input in each phase of life cycle, for example, costs of labour, material, or capital, how affects life cycle in technological improvement and product manufacturing procedure in each phase. Another issue of life cycle is the technology or product life cycle was difficult to identify the exact lifespan of technology or product during market changing, it described only a condition of product, it neglects the macro and micro economic environmental altering. The critical perspectives of BCG matrix are two reasons: one is financial situation of whole group in the matrix cannot take into account the scale of enterprise in the industrial level and sectors of industry. Especially is the situation in SMEs, this is because the basis of strategy considers that cash and cash equivalents from sales of products and services. However, total cash flow of the firm includes adjustment for capital spending and new financing, it will frequently negative

⁷¹Tony Davies, Tony Boczeko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp567- 570

and usually the SMEs have tough conditions in financing situation, while the firm is already in a maturity market. It is important that how further survival and successful in market and create profit and positive cash flow for enterprise, there is no answers. The second question is the BCG matrix only focus on product and service in a single market, the sustainable consideration of another market strategy and further competitive product and service will not represent in the matrix. It is difficult to express how the operating cash flow generated by operating activities in different countries and marketplace. This is because cash flow is not profit, and it is determined by the economic and financial condition of company, sometimes when a company considers an aggressive goal in the target market and from investing activities will have an effect on changing in cash flow and balance of portfolio in different marketplaces. Thus it is necessary that a supplemental tool help enterprise implement and complete technology and innovation management.

It is not only Balanced Scorecard (BSC) as an important measurement instrument in corporate management but also a serious of Key Performance Indicators (KPIs) are regarded and identified as important performance measurement tool in corporate management. Key Performance Indicators (KPIs) is significant operative point in management and controlling process. KPIs integrated financial and non- financial indicators to compile an entire system of performance and profile measurement in management report, which include monetary factors and other operative core factors, like value added, price and cost of product, total quality in product lifespan or market share and customer degree of satisfaction.

In the phase of innovation and technology management, one of the performance indicators can be formulated as:

$$\text{Performance- indicator} = \text{Output quantity} / (\text{R\&D costs} * \text{time})^{72}$$

The management of innovation and technology with performance- indicator instructs the undertaking project or the completing tasks in managerial process of innovation and

⁷²Manfred König, Rainer Völker (2002): Innovationsmanagement in der Industrie, Carl Hanser Verlag, pp169- 171

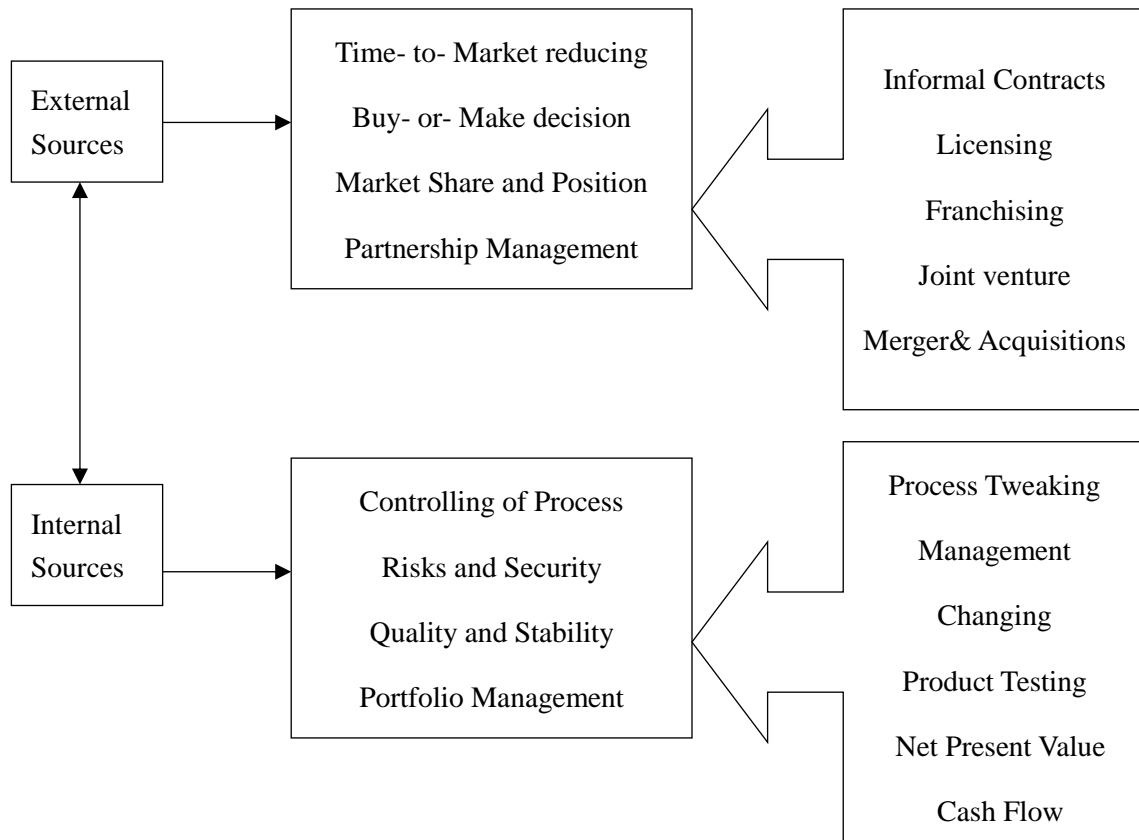
technology can be measured by above performance- indicator. The output includes product and service. The complex implementation of management of innovation and technology is drawn up the graph 3.8 of integrated process and as the example is Daimler AG performance measure system and gives an explanation of what key performance is. The important financial indicators are measuring company's operating financial performance. The measure of operating profit at the divisional level is EBIT (earnings before interest and income tax). EBIT thus reflects the division's responsibility for profit and loss, in addition to EBIT and revenue, are the free cash flow of the industrial business, investment, and research and development expenditure.⁷³ The profitability of industrial divisions of Daimler AG assessed by return on sales (ROS) and net assets' productivity results in return on net assets (RONA). RONA is an indicator that assessed if the exceeded value creation for group's shareholders. ROS and RONA are the significant financial indicators for the Daimler in industrial business performance, and the financial measure of profitability for Daimler financial service is return on equity (ROE). Beside the corporate financial performance indicators, the Daimler Group also utilized various non- financial indicators to help corporation that evaluate and manage whole group. Of particular in aspects of performance measurement are the unit sales in automotive divisions, which the group used as the basic indicators for the group's capacity and Human resources, and workforce numbers.⁷⁴ Furthermore, with environmental issues and sustainable thinking are increasingly important for companies, as a successful auto manufacture in European area and the world, Daimler AG stands CO₂ emissions of product quality management list. Non- financial indicators are also used to determine the remuneration of the members of management board. Beside these factors, integrity and compliance are important criteria used in a group's annual goal as an agreement for managers and also in target- achievement assessment.⁷⁵

⁷³Daimler AG Annual Report 2015

⁷⁴Daimler AG Annual Report 2015

⁷⁵Daimler AG Annual Report 2015

Graph 3.8 Integrated implementation of management of innovation and technology



(Source: based on Norbert Klingebiel, 1999; Manfred König, Rainer Völker, 2002)

Key performance indicators (KPIs) combine efficiency performance- level and effective performance- level in technology and innovation management area, the key indicators set serious significant factors up in technology and innovation management. The components of performance- indicator include monetary and non- monetary perspective within effective performance- level and efficiency- performance level. The efficiency- performance level is the state of work performed by total energy and workforce in an efficient way. For example, financing capacity is an important monetary indicator for enterprises, such as financial planning, financial statement and financial reporting in a financial year. Non- monetary indicator includes the necessary material and resourcing utilizing in wide costs condition of preparing phase. The effective- performance level emphasizes a successful and instant producing for available

product and service in market position.⁷⁶ For example, the Time- to- Market is a typical non- monetary concept of effective- performance level. It calculates the time that end-product will be introduced into marketplace. The monetary performance indicator involves the net present value added (NPV) and the performance of enhancing shareholder value.⁷⁷ The relationship between input and output conclude and comprise the internal and external management of high demands of technology and innovation process. In the non- monetary of performance measurement system, the prototype of structure of technology and innovation is product test. The quality test is a central process for new technology application of product, it involves material tests, functional tests (software and hardware function, spare and equipment testing with business requirements), and quality testing by the end- users. In real business, the internal and external sources in effective- performance level measured enterprises' demand and ability of economic value added in industrial business and the sources have a forecast function in efficiency- performance- level.

⁷⁶Norbert Klingebiel (1999): Performance Measurement, Gabler Verlag, pp79- 81

⁷⁷Norbert Klingebiel (1999): Performance Measurement, Gabler Verlag, pp 81- 82

3.2.1 The theoretical perspective on management of technology and innovation

Many research and literatures focus on SMEs and MNCs innovation management or researcher and development (R&D) management in global or international stage.

According to the European Commission (2003 and 2010) and Small Business Association (2013) defined that SMEs are smaller than MNCs in scales, sales and total assets,⁷⁸ and particularly in the depression period of financial and economic crisis, the liquid in capital market was serious and scarce, the situation had been identified by most Member States of the European Union (EU) and Eurozone, access to finance for business remains a major challenge, especially for SMEs.⁷⁹ In that case, SMEs engage in international R&D activities, however, the barrier of condition restricts the SMEs paces of moving in innovation area. For example, the researchers Macro Zeschky and Oliver Gassmann investigated that how small to medium- sized enterprises coordinate global dispersed research and development (R&D) activities, the authors emphasized that international R&D is no longer confined to large multinational corporates (MNCs) but has also limited too small to international mid- sized enterprises, however, that is a major challenge for SMEs which naturally faced several limitations of resource relative to MNCs, particularly in overseas R&D tasks.⁸⁰

The bulk of global R&D is done by MNCs. Such research and data source are focused on technology- based on MNCs with a global R&D experience.⁸¹ Due to size and scale advantage, MNCs can capture resource easily than SMEs. For example, the researcher Persaud (2005) reported that with the phenomenon of increasing trend of cross- country merger and acquisitions (M&A) was accompanied with global improving in information technology (IT) system. MNCs began to locate R&D activities to international locations of R&D from the mid- 1980s.⁸² Companies with local R&D

⁷⁸Phillip Walter Sauter(2014): Managing Dispersed Innovation in SMEs, p19

⁷⁹European Commission (2010): An integrated Industrial Policy for the Globalization Era Putting Competitiveness and Sustainability at Centre Stage, SEC 2010

⁸⁰Phillip Walter Sauter(2014): Managing Dispersed Innovation in SMEs, PhD Dissertation, p43

⁸¹Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, p45

⁸²Persaud, A(2005): Enhancing synergistic innovative capability in multinational corporations: An Empirical Investigation, Journal of Product Innovation Management, 22(5), pp412- 429

exhibit an inclination for local market, resources, and know-how with specification of innovation projects in order to facilitate coordination with local production facilities or research institutions.⁸³ The rational criteria are to be independent support for MNCs in local position away from the parent company.

To study innovation and technology management in SMEs and MNCs, there is much of advanced literature focus and summarizes theories or model from strategic perspectives or organizational management and R&D partnership management. The Table 3.3 List of research area of technology and innovation management summarizes and shows study works of literature.

Table 3.4 List of research area of technology and innovation management

Relevant Topic	Relevant ResearchArea
SME Management and Innovation	Differences to Large MNCs, Innovation in SME, International SMEs and Family Firms Entrepreneurship and Technology Change
Global R&D Management	Drivers of global R&D, Organisational Structures, Global R&D in SMEs
R&D Partnerships Management	Drivers of R&D Partnerships, Open Innovation, Types of Partnerships, Coordination mechanisms

⁸³Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, p50

Sourcing and Network Management	Supply Chain Management, International Trade and Foreign Direct Trade (FDI), Merger and Acquisition (M&A) Management
---------------------------------	--

(Source: Philipp Water Sauter, 2014)

Such literature studied from process perspective that defined innovation is a coincidental event, temporal and dynamic activity, so it needs regular and repeat actions or steps to manage these operations in order to achieve goal, so that process can be conceptual as a serious continual actions from beginning to end.⁸⁴ St. Gallen business model is a point of view from business model angle explaining and analyzing innovation and technology change.⁸⁵ With application of Business- Intelligence system (BI) and big data management, the digitalization changes the demand of individuals and organisation, information technology (IT) enables to innovation and technology a new level in business environment.

The process- oriented perspective focuses on studying the economic effects of the actions of an entrepreneur.⁸⁶ Innovation, entrepreneurship and technological change are not sequential concepts; each is a process that builds upon, as well as affects, the other two.⁸⁷

From behavioural economics perspective explains action and reaction of decision-makers under risk and uncertain and what choice they make. And entrepreneurship is an inspiration that accelerates and encourages enterprises innovation in industry. For example, a supply- side theory of entrepreneurship emphasized the role of the entrepreneur in production and distribution of goods and services. One of the famous figure, J. H. von Thünen (1785- 1850) clearly appreciated the difference between

⁸⁴Limberg T. (2008): Examining Innovation management from a fair process perspective, GablerVerlag, p14
⁸⁵Osterwalder A., Pigneur Y. (2010): Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Hoboken
⁸⁶Stevenson H., Jarillo J. (1990): A Paradigm of Entrepreneurship: Entrepreneurial Management, Strategic Management Journal, 11(4), pp17- 27
⁸⁷Albert N. Link, Donald S. Siegel (2007): Innovation, Entrepreneurship, and Technological Change, Oxford University press, pp3-4

management and entrepreneurship. He maintained that the effort of an entrepreneur working on his own side of the field was different from that of a paid substitute (manager). In the same way what the entrepreneur brought about by mental effort in comparison with the paid manager is comparison for his industry, diligence, and ingenuity.⁸⁸

Another view, a demand-side theory of entrepreneurship emphasizes the role of entrepreneur in changing the nature demand for existing goods and services by introducing new goods and services or combinations of existing goods and services.

The economist Joseph Schumpeter (1883- 1950) viewed that the entrepreneur plays a central role in new combinations of factors of production, the entrepreneur becomes the motive force of economic change. The entrepreneur is a key figure for Schumpeter because he is the *persona causa* of economic development.⁸⁹ The point of view from Schumpeter stated the entrepreneurial function switches from supply side to demand side. As a summary of Schumpeter's theory is the carrying out of new combinations we call "enterprise"; the individual whose function it is to carry them out, we call "entrepreneurs".⁹⁰

⁸⁸ Albert N. Link, Donald S. Siegel (2007): *Innovation, Entrepreneurship, and Technological Change*, Oxford University press, p19

⁸⁹ Albert N. Link, Donald S. Siegel (2007): *Innovation, Entrepreneurship, and Technological Change*, Oxford University press, pp22-23

⁹⁰ Albert N. Link, Donald S. Siegel (2007): *Innovation, Entrepreneurship, and Technological Change*, Oxford University press, p25

3.2.2 The tool of managerial innovation- strategic and tactical planning

Merger and acquisition (M&A) is one of the ways to achieve the goal of research and development as well as a company to find external partners to constitute alliance in cross- industry. Nowadays open innovation is a new way for companies to open up sources and integrate external networks in order to establish and manage research and development (R&D) department in an advanced position.

Cross- border M&A along reached US\$716 billion in 2004 (UNCTAD, 2006)⁹¹, in recent report of World Investment 2015 released that the gross value of cross- board M&A deals increased in 2014 by 34 percent, hitting \$900 billion, considerably above the recent annual average (\$775 during the year 2010- 2014), despite the global FDI inflows declined in 2014. The number of global foreign direct investment (FDI) fell by 16 per cent to \$1. 23 trillion in 2014, and especially in developed countries, overall the FDI flows to these countries declined by 28 per cent to \$499 billion.⁹²Merger and acquisition (M&A) came in waves in overall business activities and MNEs are main force in global merger and acquisition activities. The number of MNEs deals with values larger than \$1 billion increased to 223 cases- the high number since 2008, from 168 in 2013, the average value of these deals was almost \$3.4 billion, compared with 2.9 billion in 2013.⁹³The larger MNEs were more willing to engage in global and cross- board business operations with their considerable cash reserves. However, the management of cross- border R&D is a tough assignment for companies. Internationalization is more complex than localization of R&D management. The extra costs of international coordination must be balanced by synergy effects such as decreased time- to- market, improved effectiveness, understood the needs of local markets and enhanced learning capabilities.⁹⁴

The strategic motivation of enterprises to find partner in order to:

⁹¹Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, p47, (UNCTAD: various years): World Investment Report

⁹²World Investment Report 2015, UNCTAD

⁹³World Investment Report 2015, UNCTAD

⁹⁴Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, p48

- a) Know- how and high skilled workforce obtain
- b) Local market barrier reduce
- c) Network and Suppliers consolidate
- d) Potential market share and customers enlarge
- e) Potential Competitiveness improve

Research and development (R&D) is a high risk and time costing activity for companies, full of uncertainty in market and unpredictable customers require companies fulfill long- term vision in technology and innovation strategy. Therefore, the company concerns about a market- orientation or customer- orientation R& D management.

Market- orientation research and development (R&D) implies two things at the same time: to face the needs of the existing market and to ensure long- term innovative behavior in potential market, the entrepreneur realizes the tendency of market and customer in a not yet mature market, a typical example is the Apple company early providing iPhone product and App service. Customer- orientation research and development (R&D) management is driven by the needs of domestic and overseas customers. Companies focus on the known customers while market- orientation has illustrated the capability of existing market and customers' tastes. One of the business examples is that automakers manufacturing cars in different nations with vary customers' taste. In European countries, the majority of customers are fond of fuel- efficiency and energy- saving cars. However, in Chinese market and Gulf States sell large- sized cars better than small- sized cars and this type of car is popular for customers. Thus automakers according to different tastes of customer research and produce a variety of car model in these countries. The enterprises except successful results in R& D activities and obtain a sound sales result in market, it depends on the target and motivation that enterprise wants to achieve, such market or business are necessary. Therefore as one of the important strategy of technological need, many companies consider of a strategic alliance.

A Strategic alliance is a partnership of at least two or more corporations or business units to achieve strategically significant objectives that are mutually beneficial and obtain sufficient assistance.⁹⁵ The nature of the partnership can vary widely, but they are less than merge and acquisitions (M&A). These are costs that arise each firm monitors and evaluates the partnership to ensure that its goal are accomplished from the coordination. One way to classify strategic alliance is by the degree of formality.⁹⁶ This is critical point because of it sometimes determines the costs and risks involved with the alliance. The formal form of alliance is joint ventures and franchise agreement. Joint Venture is common to participate in international business operation. In research and development (R&D) activities, particularly in global cooperation, two or more companies or institution combine their equity and form a new group. Each part will provide the specific know-how and resources, like technological experts, skilled engineering, top managers, stable suppliers and financial resources. Also the Joint Venture will share the local networks and infrastructures. For example, the BASF SE nowadays has equity investments in global business and international market, the BASF Group intend to improve effective and efficiency of research and development (R&D) in technology and innovation area, the MNEs constructs the global knowledge and economy network, which combines more over 600 universities, research institutions and enterprises. This equity investment networks include: the Unique Excellent Program with now 15 world-class universities in all round word, for example, the “Catalysis Research Laboratory” was established in University Heidelberg, an excellent university in Germany and also other nine foreign universities, the contract of cooperation has connected the BASF SE and these top universities to accomplish innovative and creative project.⁹⁷ Also another program is executed in Nord America with University of Harvard, which two parties BASF SE and University of Harvard established Postdoc – Center “North America Center for Research on Advanced

⁹⁵Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, pp212- 215

⁹⁶Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, pp212- 215

⁹⁷BASF SE Annual Report 2015

Material". The BASF- research and development staff can utilize this laboratory to develop new chemical product or substance and find solutions for agricultures and groceries with top colleges from University of Harvard.

However the joint venture form has risk between two or more parties of contract. The disadvantage is that agency problem is likely to appear in a joint venture activity through a lack of goal congruence. The Joint Venture may originally have been set up with specific policies relating to market and customers, such as project investment, target and time of innovation, stakeholders' interest and the level of dividend for large public corporation.

Another type of formal alliance is a franchise agreement. In franchising form, company may exercise a degree of control over an overseas company's use of its brands and trademarks through contract or agreement. For instance, the fast food companies McDonald's and KFC chains are typical companies that use this form to realize their expansion of business chain. The contract between two business parties typically specifies the time period and geographical region where the franchisee has the right to conduct these activities. As with trademark licensing, franchise form involves similar administrative costs and costs of set- up and monitoring.

Open Innovation nowadays is new and creative innovation method. The open innovation concept based on observations mainly from high- tech industries. Henry Chesbrough is the originator of open innovation concept, and the open innovation was defined by him as "At its root, Open Innovation assumes that useful knowledge is widely distributed, and that even the most capable research and development (R&D) department must identify, connect to, and leverage external knowledge sources as a core process in innovation."⁹⁸Open innovation implements new organizational methods, which cross the geographical limitation and integrate inter- and external technical and innovative source and talent. According to Gassmann and Enkel introduced open innovation is a decision that can be taken to opt for outside- in open innovation or

⁹⁸Chesbrough, Henry(2006): Open Innovation: A New Paradigm for Understanding Industrial Innovation, Oxford: Oxford University Press, pp1- 12

inside- out open innovation, or a mixed approach that combines outside- in and inside out activities.⁹⁹For instance, a traditional way is a company from outside organisation or institute obtained knowledge and innovative ideas and then integrated them in the internal management. The merger and acquisition (M&A) is a typical outside- in method. Crowdsourcing is a new way that a large number of different groups or individuals (crowd) engaged in workshop or campaign about a specific topic, problem and shared ideas (outsourcing) through internet and online- platform. The form is called crowd creation or co- creation.¹⁰⁰The massive information and ideas from the specific topic are spread by internet and online users. Many companies now utilize this form to gathering interesting ideas and excellent concepts to develop their product or services, such as BASF SE, Adidas Group, and Lego Group. For example, BASF SE has introduced Creator Space™ online program as an innovative and interactive platform, in order to attract people from all parts of the world sharing their ideas, experience, and suggestions about life conditions in cities, renewable and smart energy, as well as food and nutrition.¹⁰¹ Through the online program, the BASF group and customers, business partners and employees of the BASF SE have positive interactions to share and exchange separate situation in differences of location and condition on the open space. The Adidas Group regard open source as a corporation's operation strategy of innovation and investment. According to the latest corporate presentation of investor relationship detailed that open source is Group's future collective fortune and collaborative open innovation to the world's connection, work together with creative collaborate, athlete communities and cooperation with innovation partners. They are strategic initiatives.¹⁰²The open innovation strategy is to strength conventional brand Adidas in continual successful in sport and leisure market and maintain competitive position with ongoing stream of new ideas that beyond the expectation among creators. Also open innovation is a sound way that the group listen to voice from

⁹⁹Oliver Gassmann, Ellen Enkel(2004): Towards a Theory of Open Innovation: Three Core Process Archetypes, R&D Management, 36(3), pp.223- 228

¹⁰⁰Reiner Clement, Dirk Schreiber(2015): Internet- Ökonomie, Springer Gabler Verlag, pp278- 287

¹⁰¹BASF SE Management Report(2016): Intelligent Energie Ein Weißbuch des Creator Space™

¹⁰²James Carnes(2016): Adidas Corporate Investor Relationship Presentation: Open Source, July 2016

customers, suppliers, other strategic partners and other special group of interests (like athletes, sport clubs or associations). Hence the Adidas Group selects some partners to construct a business strategic relationship. For example, the Group cooperates with the BASF SE as a digital printing and bio- chemical partner to design and manufacture shoe product. With IT and digital giant Google and Runtastic cooperation establishes the Adidas Group a digital communicating network of digital space.

The Danish company LEGO Group also concentrates on open innovation and early established online platform with customers and other partners. As a successful and enjoy a great reputation of toy manufacture, the LEGO Group provide not only the product for children, but also create playing and leaning culture for young children and adults. For instance, LEGO Club® is a digital community for Lego fans with 4-13 year old children. The LEGO Group directly communicates through the LEGO Club® platform via print magazines and digital content and Emails. Currently there are 5.7 million members registered in the digital platform across 18 countries.¹⁰³ And Lego adult fan communities referees as adult fans of LEGO and register in LEGO® Uses Groups (LUGs). The LEGO® Users Group is one of form of LEGO® Communities and it act as forums where the Lego enthusiastic adult fans and supporters share their experience and ideas through blogs, photos, and discussions on the digital communities. The LEGO Group and the LEGO Adults fans of LEGO (AFOLs) built mutually a digital channel for the LEGO Group and LEGO adult enthusiasts with public relationships and interacts each other. The AFOLs provides not only activities such as business events, public exhibitions and review new of LEGO product, but as well as invited adults to take part in LEGO product suggestions and design selections on the LEGO Adult Fans of LEGO crowd sourcing platform.¹⁰⁴ Now there are more than 500,000 members register in the digital communities.

There is no doubt that digital model and IT network facilitate companies and all

¹⁰³The LEGO Group: A short Presentation 2016, www.LEGO.com/aboutus.

¹⁰⁴The LEGO Group: A short Presentation 2016

around the world internet users communication and collect ideas through business process and model innovation. The crowd sourcing accelerates open innovation with all participants under the different background, different culture and language. The open innovation can reduce time costs and some disadvantages like geographical distance and space. Hence, there are two obvious advantages in open innovation form: One is the ability to collect exceptional talent and specialized idea and easy to challenge some traditional and conventional business custom.¹⁰⁵ Secondly is open innovation collaborate business planning, product ideas and share knowledge in networks, it is freedom and increase flexible in work place and also encourage entrepreneurial culture an intensive innovation.

Many companies benefit from open innovation, however, open innovation has also issues and challenges. Open innovation relies on internet and IT network to communicate and connect with outsider users and talent, information security is the biggest element for companies. Secondly, open innovation is not a sole procedure of researcher and development (R&D), it needs internal management and monitoring by individuals (such as research institution and company). Therefore, open innovation can be also regarded as a strategic alliance in a form of inside- out.¹⁰⁶ For example, a company owns patent and processes knowledge and technological source, through open innovation company can integrate external customers and suppliers to invest in one project or technology- based company. The company intends to through open innovation improve the quality of own patent and optimize the knowledge- based innovation process.

¹⁰⁵Darrell K. Rigby(2015): Management Tools 2015: An Executive's Guide, Bain & Company, pp32- 35

¹⁰⁶Oliver Gassmann, Ellen Enkel(2006): Open Innovation, Die Öffnung des Innovationsprozesses erhöht das Innovationspotenzial, Zeitschrift Führung + Organisation (ZFO), 75(3), pp 132- 138

3.2.3 The risks and obstacles in management of technology and innovation

Multinational corporations or enterprises (MNCs or MNEs) are a dynamic participant in global business and international marketplace. A multinational corporation (MNC or MNE) is faced with the same opportunities and problems as the domestic corporations, however sometimes the enterprises were in a hostile condition in overseas market. It must concern risk and chance in foreign market and seek to achieve goal that is profit optimization. Nowadays the situation is particularly in emerging market, like Brazil, China, Chile, India or ASEAN nations. In doing so, such multinational corporations face new challenges and risks in these countries. These risks involve factors such as exchange rate fluctuations, different taxation system and government regulations, and transaction costs and tariffs. Also the enterprises faced some soft obstacles, like language, culture, and ethic of business and trading. The other hands, small to medium-sized enterprises (SMEs) also play an important role in international business and trade. Globalization tends to network connection effectively and closely, it is not just opportunities for MNCs, but also many SMEs capture this chance and opportunity to move into overseas market.

According to multinational corporations and small to medium- sized enterprise own different resources and networks in the business activities, thus the two kinds of companies need the risk- list that checks in innovation process.

Firstly, summarizing general risky conditions and then comparing risks and chance between MNCs and SMEs are in business area which finds opportunities in market. Secondly, concluding obstacles in MNCs and SMEs and what are key issues in the stage of innovation activities.

Common risks are similar to large corporation and small firms, also some international companies and family firms. Generally, the risks include market risk, operational risk, financial risk, legislation and regulation risk and natural risk or catastrophe risk. But there are two specialize issues in technology and innovation management for SMEs, one is stable innovation team and lack of rich experience engineers for research and

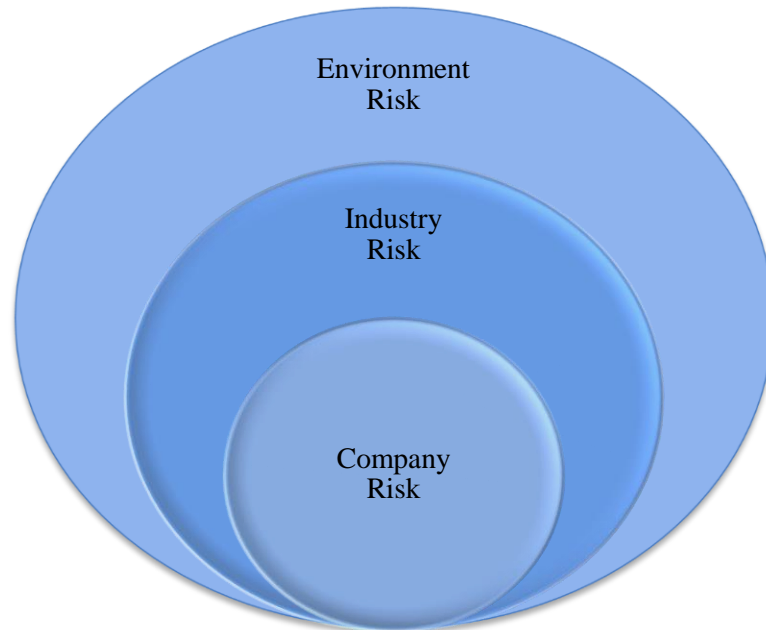
development activities, another issue is lack of reliable successions of management board, it is difficult to maintain a stable managerial style in top managers and also there is agency problems among managers, engineers and the owners of firm, this problem is particularly in family firm and international SMEs. The example is management in LEGO Group and Faber- Castell companies to compare with BASF SE. The typical risks in small to medium- sized enterprises (SMEs) exist, following as: operational risk, key personal risk, company risk and financing risk are involved in strategic and operative levels which influence enterprise' s business performance and value creation. These special risks can affect day- to- day operation in innovation process in industrial level. For Multinationals (MNEs) there are two more risk factors in managerial process as well as including the MNEs in global sites of research and development (R&D) strategy. They are in financing area with foreign exchange rate risks and capital market with interest rate and liquid and credit condition.

To find and summarize enterprise risks of small to medium sized-enterprise (SMEs) in innovation process, first of all, top managers consider the general risk scope in all types of enterprise. The general risks scope of enterprises consists of three layers or ranges. They are general environmental risks, industrial related risks and company related risks. The general environmental risks comprise overall socio- economic system including society and economic factors, but socio- perspective also relating to sociological factors.¹⁰⁷ Industrial risks consist of product and service sectors, such as market trend change, customer taste change, procurement and supply chain change and research and development (R&D) misleading in tendency. R&D is a significant step in execution of technology and innovation management. These components of industrial risk influence the competitive advantage of a company in industry or industrial sectors. Company risks are regard as internal risks that comprise operational and strategic risks within organizational conditions and managerial level, decision made, motivation management, data stolen in information management and technique breakdown in

¹⁰⁷ Anderson T. J. (2006): Global Derivatives: A Strategic Risk Management Perspective. Pearson Education, Harlow, England

network management. The Graph 3.9 classification of risk display relation of common risks in industrial level. These types of risk are nowadays increasingly mutual influence by countries' economic conditions of development.

Graph 3.9 Systematic classification of risk¹⁰⁸



(Source: Simons, R. 2000)

From the calculation of general risks condition in industrial level, and then based on above content of classification risks analyzing risks in SMEs and MNEs in innovation process. In the international trade and cooperation of research and development (R&D) faced mainly Multinationals (MNEs) three sorts of risks more than SMEs, as seek to:

- Technical risk: technique failure and drain of knowledge,
- Financial risk: property risk, interests rate risk and foreign exchange rate risk, and liquids risk;
- Economy risk: countries risk and macro economy situations

For example, from the case of BASF SE can be seen as the central research process are in chemical engineering, advanced materials and systems, biology science and organic food science field, the BASF SE invested in 2015 three significant regions in global

¹⁰⁸Simons, R. (2000): Performance Measurement & Control Systems for Implementing Strategy, Prentice Hall, New Jersey

research and development (R&D) sites within European, Asia- Pacific, and North America as innovative platforms. In order to optimize the efficiency and effective of innovation activities in variant of regions, the BASF SE strength contacts and connection with talents and experts in local positons. This management process reduces risks from culture misunderstandings and communication freezing. As a successful chance and condition of research project monitor and examine the BASF SE in each process of research and development (R&D) fromidea design, mind- map selection to the end- product or service introducing into market. In additional, the BASF SE constrains market risk and revenue risk from business to invest commodity and raw materials in different original countries, also managing the currency, exchange rates risks in local innovation sites. Hence, the BASF SE is generally and widely managing and controlling chance and risk in innovation process from technological risk, managerial cost risk to financial risk.

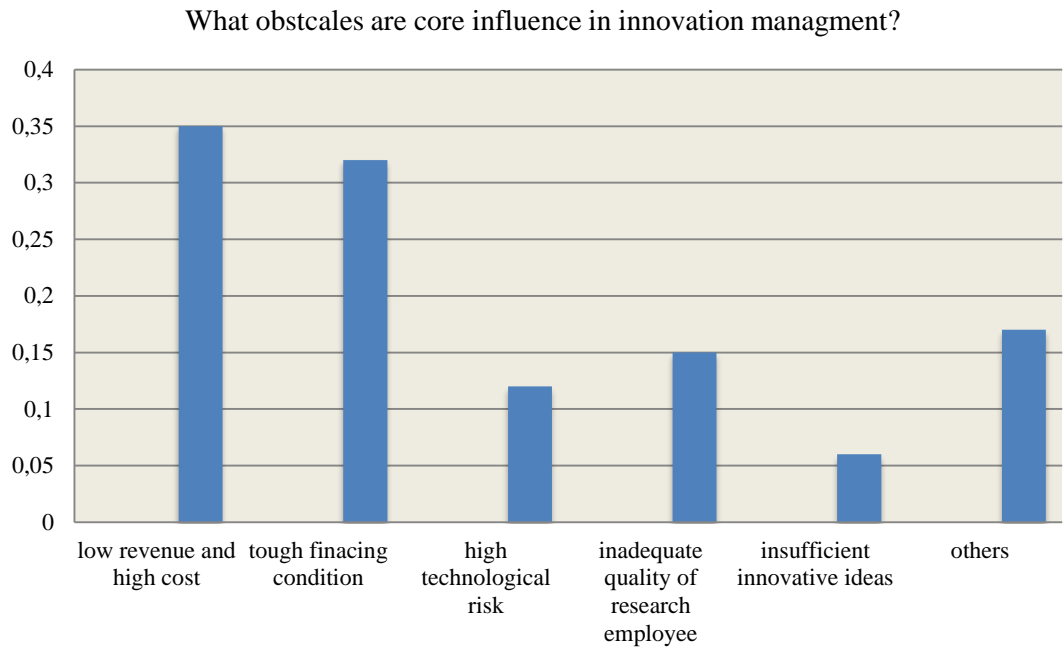
Another hand, SMEs faced risks from day- to- day business in different situations. Due to limitations of size and scale of turnover, many SMEs lacks for specialize in knowledge in market and business operations with an enterprise's commitment to the certain financing decisions when SMEs execute innovation activities. Market risk (financial market and consuming market) and operational risk (Research and development (R&D), procurement and logistic) have been became main obstacles for SMEs. For instance, according to a report released by ECB in 2014, SMEs access to Finance resource in euro area, generally SMEs more dependent on the Bank lending than larger multinational enterprises (MNEs), in terms of financing structures and possibility of business risk resistance, SMEs had high probability of default rate than MNEs. In Particularly, SMEs are more hard- pressed and difficult to find more alternative financing sources, such as debt insurance, to support business expanding and research and development (R&D) activities.¹⁰⁹ Consequently, Many SMEs dependent on bank's financing resource and thus increased financial risks that

¹⁰⁹European Central Bank(2014): SMEs Access to Finance in the Euro Area: Barriers, and Potential Policy Remedies, Monthly Bulletin, July 2014

associated with banks in financial market. This situation and tough financial condition have been investigated by European Central Bank (ECB) and some commercial banks in financial crisis period. Given the importance of SMEs in euro area considered ECB and some big well-asset commercial banks reduce high proportion of Bank-dependent SMEs in financial market and intend to restraint risks and reduce financing costs for SMEs in day-to-day operation and management, especially in innovation area. According to the economic research from Swiss commercial Bank, Credit Suisse, reported innovation is a chance but as well as risk for SMEs growth in the vision of future, many micro or small firms have excellent ideas, but due to some obstacles, like low market revenue, high research costs and less financing support, or less stable and quality of research team, innovation is to become hurdle in SMEs. There is the research of Credit Suisse in 2011 that content questioned about what the main obstacles in innovation management for enterprises are, and what are extreme obstacles that prevent and delay innovation management in day-to-day operation. Many SMEs thought about market revenue and high cost of research with 35 percent and tough financing conditions with more than 30 percent. Beside financing and cost reason, quality of research employee is the third obstacle in innovation management with 15 percent. There are two questions of investigation from the interview of the Swiss commercial bank Credit Suisse.¹¹⁰ The second question of investigation is about some serious and highest degree of hurdles in innovation management. The answers were from interviewed SMEs and provided such as market conditions with over 30 percent as the biggest innovation utmost obstacle. The resources problem includes Human resource and finance resource occupied the second and fourth position of the investigation with 25 percent and 14 percent respectively. The third extreme obstacle of innovation management is national regulation and legislation perspective with 25 percent for such SMEs. The two bar statistics show as bellow exhibitions to display what are main obstacles for small to medium-sized enterprises on innovation perspective.

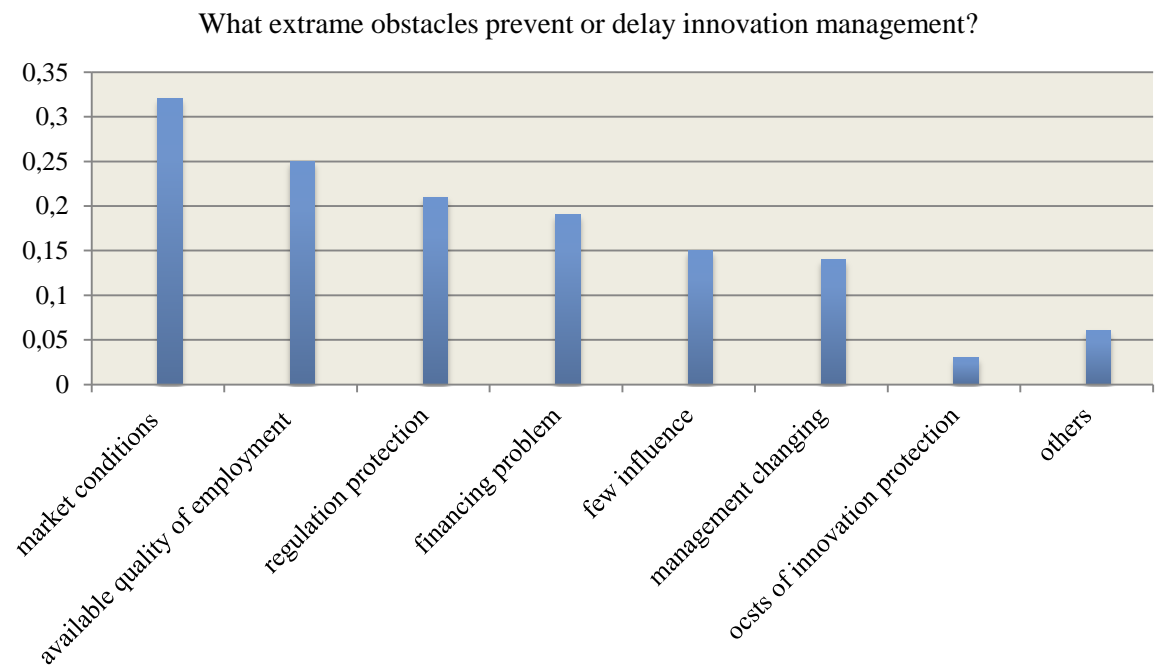
¹¹⁰Megatrends- Chance und Risiken für KMU 2011: Innovation, www.credit-swiss.com/businessesasypaket.

Graph 3.10 Core obstacles of innovation management for SMEs



(Source: Credit Suisse Economic Research KMU- Umfrage 2011)

Graph 3.11 the extreme obstacles prevent or delay innovation management for SMEs



(Source: Credit Suisse Economic Research KMU- Umfrage 2011)

Based on above the economic research and statistic from the Swiss Bank Credit Suisse

illustrated that there are three special aspect limited small to medium- sized enterprises (SMEs) in innovation management field. Such obstacles is to become risks in the three aspects affect research and development (R&D) activities for SMEs.

To sum up, the three aspects of obstacles in innovation management are:

- Operational and enterprise risk (inadequate of innovation idea, specialist of research team, quality and stability of new product, tough financing condition)
- Market risk (market share of product and service, ambiguous market trends, time of new product launch into market)
- Environmental risk (regulation and legislation obstacles, competitive with large enterprise)

For example, the medium- sized German company Faber- Castell is a traditional pencil and manufacturer, but now the company is also manufacturing cosmetics pencils and make- up applicators.¹¹¹ As a nearly four centuries pencil manufacturer in the world, the German company ran business since 1761. The company provides high quality product for pencil- lovers, but with the market leader, Faber-Castell insists on product innovation. The management board of the company believes that changes in a consumer market is necessary for company, consumer demand irresistibly propose us constantly innovation and new design for product. Thus the company considers not only the new demand in products or increasing capacity of production, but also desire to innovate product and service. However, Faber- Castell interplays in the international market with many challenges and risks in market. Material- waste is a big challenge for the enterprise and the company always seeks to recycling, sustainable and less harmful resource for products. The second risk is the classic brand in the sector has touched proof of market and consumers ask for more innovation and personalization. In the fashion branch, Faber- Castell must find new suppliers and market channel in global market. The new knowledge and experience, and adequate employee cost the company many resource. Another case is from the LEGO Group. As a family company, the

¹¹¹The Future of the Pencil: Faber- Castell Cosmetics: Innovation and Personalization, Business and Finance, www.economist.com, Dec. 2013

smooth transaction is a clear indication that interacts with management and engages in family ownership continually. Therefore the structure of the Group is something special.¹¹²The LEGO group is interested in the product and quality, business strategy, corporate value and employees- which made up the corporate core value system in corporate history. The owning family looks after the company carefully, but sometimes there is some management conflict between management board and family owners. It means the family foster genuine of the LEGO, care for the company's customers, employees and business partners, although making money and enlarge the scale of business are also important. In doing so, it is unavoidable that agency problem in family company exist. The family's value is more important. The LEGO brand ensures the core value of enterprise and the direction of decision making.

In addition, the market risk arose in 2015, according to the annual report 2015 of the LEGO Group. North America and most European toy markets kept a steady and mid-single digit growth in the year 2015, and most of the Asian toy markets displayed also solid growth but the increased rate have slowed to compared to most recent period. And also Russian toy market grew slowly due to the difficult currency situations. During the forecasting, the LEGO Group expected to grow low single digit in 2016, and the Group continues to focus on innovation and global expansion. As a consequent, the Group will increase the risk related trade receivable and prepare an increase of provisions for bad debt.

¹¹²The LEGO Group: A Short Presentation 2016

4. Managing risk of technology and innovation

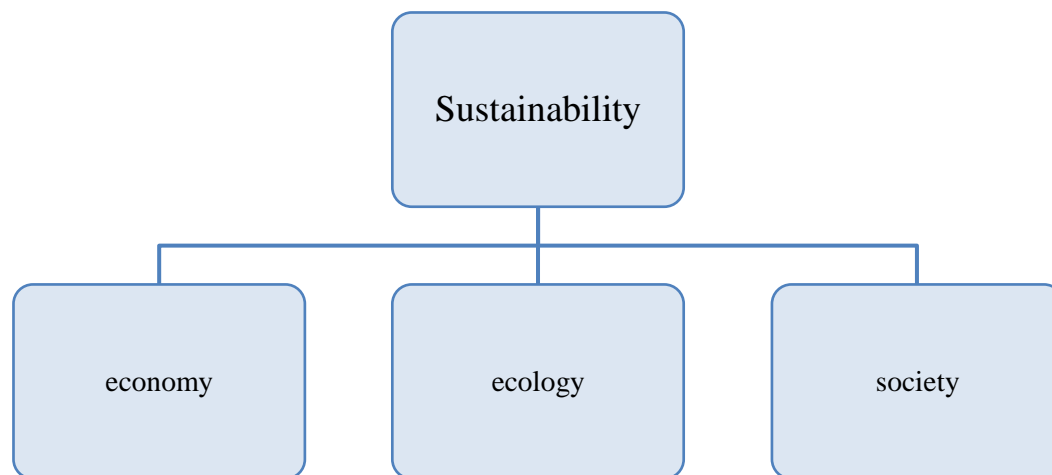
Classified risk in different sized companies, to consider what risk is main challenge for Multinational Corporation and what risk ought to face by small to medium- sized enterprise. Risk- and cost- orientation in technology and innovation management seek to whole direct and potential influence in economy, and socio- system, it is not only just in business area, despite enterprise risk management emphasis economic value added. In doing so, management of technology and innovation implement in industrial level and the global research network spread in the world, international trade and investment play a significant role and as a push- force for industry and sectors of industry. Many enterprises are growth through innovation and R&D activities under appropriate risk controlling.

Here top managers can from perspectives of international or locational resource- efficient management, sustainable supply and access to environmental technology within product and service sectors. Considering that how manage risks and value- based innovation, supply chain management plays an important role in business operational area. Forecast and risk analyses with the Total- Cost- of- Ownership (TCO) concept are basic path of product and service in framework of cost management. New technology and innovation nowadays have been switched through information system and communication techniques reduce costs and risks.

4.1 Purpose and intention to control risk

Sustainability of corporate is a significant factor for all kinds of company at present, it is not only a concept for companies that make decisions or manage tactical or strategic process in economic and business behaviour, but also those enterprises are through improvement of innovation and technology to initiative competitive strength into society, meanwhile to protect environment for public with product and service applying in production and manufactureprocures. As a result, now there is new term that is called “Sustainability + Innovation =Sustainovation”.¹¹³ Hence, the new item displays a significant purpose that companies create an eco- business to expand economic value. The exhibition of 4.1 shows the three perspectives of sustainable purpose for innovation management of global research and development (R&D).

Graph 4.1 Three pillars of Sustainability¹¹⁴



(Source: S Schaltegger, T Dyllick, 2002)

According to the chairmanship of former Norwegian Prime Minister of the World

¹¹³Green Economy, www.trendreport.de, June 2016, pp3-4

¹¹⁴Schaltegger, S., Dyllick, T.(2002): Einführung: Nachhaltig Management der BalancedScorecard: Konzept und Fallstudien, Gabler Wiesbaden, pp19- 39

Commission on Environment and Development (WCED) (it is known also as Brundtland Commission) Gro Harlem in 1987 presented, “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”¹¹⁵The ideas of sustainable development is the goals of economic and social development must be defined in terms of a lasting sustainability if the state of technology and social organisation on the environment’s ability to meet present and future needs of human and ecological system. With a supplement of requirements for the sustainable development, the Commission emphasized the requirements: “The strategy for sustainable development aims to promote harmony among humans and between humanity and nature. An economy system that is able to generate surpluses and technical knowledge on a self- reliant and sustained base; a social system that provides for solutions for the tensions arising from disharmonious development; a production system that respects the obligation to preserve the ecological base for development; a technological system that can think and search continuously for new solutions of problem and development; and an international system that discovered route of cooperation present and fostered patterns of trade and finance.”¹¹⁶In June 2012, the United Nations (UN) of conference on Sustainable Development was held in Rio de Janeiro, Brazil (The conference known as Rio+20). The one of the fairly significant work from the Rio+ 20 conference was the endorsement of the “Green Economy” as flexible management mechanism for advancing sustainability for all nations. Green Economy is an important tool and plays premier role in sustainable development, and it should contribute to eradicating poverty as well as sustaining economic growth, enhancing social security, improving opportunity of human welfare and creating a fair working condition and environment for employment and decent work for all, while maintaining the health functioning of

¹¹⁵UN General Assembly, Resolution 42/ 186, Environmental Perspective to the Year 2000 and Beyond, www.un.org/documents, 11 December, 1987, (Accessed on April, 2015)

¹¹⁶World Commission on Environment and Development (WCED)(1987): Our Common Future, Oxford: Oxford University Press

the Earth's ecosystems.¹¹⁷ The Green Economy provides options for policymakers and also decision-makers who considered strategies that require a transition from a clean and green economy growth through technological updating and promoting innovation in industries of countries. However, there is a critical thinking of Green Economy. In developed regions or industrial countries have the available finance and technology support and innovative capacity in developed countries create new working positions and opportunities for domestic market to supply green transition. On the contrary, many developing countries and emerging economies lacked investment and finance available in domestic market, if these countries select green economy transition- many country risk, market risk and finance risk will impact home companies in industries. Obviously is the possible exception of emerging countries update technologies like clear coal in China and Bio fuel in Brazil,¹¹⁸ but the technological and financial gaps exist in advanced countries and emerging and developing countries, this is an obvious disadvantage of Green Economy in the future development.

Meanwhile, there is also an important intention of technology and innovation management for enterprises. Transparency- principles of technology and innovation management require all enterprises whatever MNEs or SMEs understand and follow the rules in business operations and also protect interests of the enterprises' work of innovation. Transparency is at its strongest in the domains of finance, corporations and securities. Within Financial exercise, transparency of corporate governance has a significant principle that is consolidation. Consolidation requires the total supervisory coverage of a firm's financial affairs, which transparency of financial affairs enable.¹¹⁹ Transparency is also a principle which enforced the regulation in some regulatory demands by means of law. For example, the agreement on Trade- Related aspects of Intellectual Property rights (TRIPS). It focuses on the interface between the protection

¹¹⁷United Nations (UN)(2012): The working Paper of The Future We Want, New York: United Nations, United Nations Commission on Sustainable Development (UNCSD)& United Nations Conference on Trade and Development (UNCTAD)((2011): Trade and Green Economy: In Rio+ 20 issues briefs, New York: UNCSD Secretariat and UNCTAD

¹¹⁸United Nations (UN)(2011): Objectives and themes of the United Nations Conference on Sustainable Development, Report of Secretary- General, December 2010, New York: United Nations

¹¹⁹John Braithwaite, Peter Drahos(2000): Global Business Regulation, Cambridge University Press, pp507- 515

of intellectual property rights and international trade. International disciplines in the field of intellectual property rights could find their way in the WTO code, and also it has existed in the World Intellectual Property organization (WIPO).¹²⁰ Transparency is a global requirement in international business activities. Therefore, harmonization of all business communities is a form of coordination and coordination is an information-intensive activity.

The World Trade Organization (WTO) and the World Intellectual Property Organization (WIPO) offered a more effective implementation process, between the key trade negotiations and the culture status of business communities.¹²¹ Transparency of negotiation process improves the understanding of each counterpart, in order to reduce disputes in international trade and protect enterprises' interest in research and development activities. In doing so, the objectives of the TRIPS Agreement are main three-fold. First, to reduce specific distortions and impediments to international trade caused by the nature of national intellectual property protection afforded within member states. In this context the Agreement established a certain minimum of protection of intellectual property rights in member states. Secondly, conversely it is intended to ensure that the intellectual property protection afforded does not itself distort or impede international trade. (The Agreement on Trade – Related Aspect of Intellectual Property Rights (TRIPS) includes Trade in Counterfeit Goods).¹²² Thirdly, the protection of intellectual property rights should contribute to the promotion of technological innovation, and assist in the transfer and dissemination of the technology.¹²³ The categories of intellectual property rights covered as follow: copy right and related rights;¹²⁴ trademarks;¹²⁵ geographical indications;¹²⁶ industrial

¹²⁰Asif H. Qureshi, Andreas Ziegler(2001): International Economic Law (2nd Edition), Sweet& Maxwell, pp338-347

¹²¹F. M. Abbott(2000): Distributed governance at the WTO- WIPO: an evolving Model for open architecture integrated governance, Journal of International Economic Law, (3)2001, pp63- 81

¹²²C. Correa (2007): Trade- Related Aspect of Intellectual Property Rights- A Commentary on the TRIPS Agreement, Oxford: Oxford University Press

¹²³TRIPS Art 7.

¹²⁴TRIPS Arts 9- 14.

¹²⁵TRIPS Arts 15- 21.

¹²⁶TRIPS Arts 22- 24.

designs;¹²⁷ patents;¹²⁸ and the protection of undisclosed information.¹²⁹ In addition, the Agreement regulates certain anti-competitive practices in contractual licences.¹³⁰ It's obvious that the protection of patents is the main field. The Agreement incorporates and reinforces the provisions of certain international conventions in the field of intellectual property.¹³¹ Technological changes confront the international trade system and accelerate the wide spread of foreign direct investment (FDI), particularly this phenomenon is led by MNEs. However, the dispute of intellectual property now becomes a barrier in enterprise innovation management, and also it is to be a risk factor for trading and investment. Therefore, the TRIPS Agreement will be revised and supplemented continually with increasingly international trade activities among cross-border. Also there is no doubt the WTO code will enforce regulation and principles in intellectual property rights and focus on traditional system and make adjustments in the specific business areas, especially in service market, such as e-commerce, financial innovation and newly the Industrial 4.0. A sustainable protection for technological development and innovative enterprises in industrial level is necessary.

¹²⁷TRIPS Arts 25-26.

¹²⁸TRIPS Arts 27-38.

¹²⁹TRIPS Art 39.

¹³⁰TRIPS Art 40.

¹³¹Asif H. Qureshi, Andreas Ziegler(2001): International Economic Law(2nd Edition), Sweet& Maxwell, pp339-341

4.2 Resourcing management of technology and innovation

Resource risks in research and development program exit. Companies can utilize SWOT- analysis and through due diligence examine the integration process of resource. With SWOT- analysis can enterprises and top managers observe and estimate what general economic is in the world and what situation of company now undergo. As a benchmark of comparison and examination tool inspects enterprises in the management of technology and innovation, can identify own advantages of product and service in market and analyze competitions of rivals in business area. The SWOT- analysis consists of four elements: strength, weakness, opportunity and threatens. Strength and weakness are internal factors that controlled by enterprises while the company own superior quality and inherent advantage in a long time. Opportunity and threaten exist in external environment. Enterprises can utilize the two basic elements to assess outside business conditions and also to estimate and calculate further development in main business operation and entering new business area and field. Different business purposes have different due diligence requirement. For instance, a company and the due diligence team need to search intensive information and documents for a particular business activities, such as the Daimler AG executes the group's sustainable strategy with legal due diligence to identify risks and enforce responsibility of product, production, employee, ethics, society and business partners.¹³² Another case of the BASF SE wants to make acquisition decision in chemical industry, therefore the corporation complete commercial due diligence to analyse continue increase in chemical business area, the competition and reputation of target company, and innovation capacity of operational management.¹³³ The high quality of due diligence can identify risks and chance in potential opportunities of market, and also create value for both companies and business partners. This is because company gleaned information and completed due diligence investigation can be appropriately ensured risks and issues of the deal, and then the company will take

¹³²Daimler AG Management Report (2015): Sustainable Report 2015

¹³³BASF SE Annual Report 2015

action to close the deal. In the whole trading of business includes before and after closing the deal, the company relied on comprehensive resource in industrial standards. The company evaluates and estimates from technology to production. The company is a resource- based view of firm which means the company relies on resource to establish comparative advantages under its competitive conditions. The company is able to collective resources that include assets, capabilities, knowledge, organizational process, information, etc. In additional, the company is also has the ability to generate benefit with outside stakeholders in a sustainable environment. Hence, it requires company to know exactly that what resources can access to and what resources can use in an efficient way. The resource- based view of the firm states the principle means for a firm to gain a competitive advantage is through the skills and knowledge of its employees. Generally, company owns and utilizes resources that are classified physical natural resources, human resource and organizational capital resources.¹³⁴ The different scales of firm access to resources are different. The multinationals have global network to purchase and obtain resources.

¹³⁴Barney(1991): Firm Resources and Sustained Competitive Advantage, Journal of Management, 17(1) pp99- 120

4.2.1 External factors management

In external scope management can identify three aspects that are global sourcing, regional sourcing and local sourcing. The global sourcing management can use the Total- Cost- of- Ownership (TCO) concept to decrease and constrain risks and costs of business. TCO is a process- orientation management method that it is not only a number of available suppliers' cost management in purchasing and delivering period, but as well as are the total costs in manufacturing and entire product life cycle calculation and the side of buying risks management in possessions of scant sourcing and limitation. Innovation and technology management intend to control risks and costs in researcher and development (R&D) area, also to improve efficiency in enterprises' investment in new product and service or performance of business process. The concept of Total- Cost- of- Ownership described by Ellram (1993): "Total- Cost- Of- Ownership represents a philosophy which aims at understanding the total cost of global purchasing from particularly suppliers. TCO is a complex approach and useful instrument for buyers which required the purchasers making decisions, which costs it considers most important or significant in the world resourcing of acquisition, possession, use and subsequent disposition of a good or service."¹³⁵ The risks and costs of global sourcing are within framework of supply chain management and process controlling mechanism. Nowadays, for many industries and sectors consider also sustainable development with material and product cycle.

The regional and local sourcing strategies concentrate on constant research and innovation (R&D) costs in technology and innovation management period. Regional sourcing focus on a larger space than the room of local sourcing and integrated industrial and wide sectors, such as industrial region, business and commercial district, muster of researching park. The advantage of regional sourcing is that establish a hub of R&D in a nation or administrative district can reduce the managerial costs and transaction cost in cross- border network, such as exchange rate and tariff. The local

¹³⁵Daniel Jeffery Koch, Marion A. Weissenberger- Eibl (2011): Gesamtkostenrechnung TCO, Fraunhofer- Institut für System- und Innovationsforschung, p29

sourcing strategy wants to decline the costs of transportation and improve the quality of delivery and loading and transmission with suppliers. Local sourcing strategy facilitates the research and development (R&D) activities with resources sharing. Of the advantage is that enterprise reacts instantly with external partners in local site through intensive cooperation and lower the reliable degree of headquarters. And local sourcing can minimize the administrative cost in innovation management during culture and language integration. It will increase profits and operational revenue with innovation partners. In addition, the Total- Cost- of- Ownership (TCO) represents a philosophy of cost management which aims to understand the total cost of a purchase from a particular supplier.¹³⁶

The background and basic conditions analyze the Total- Cost- of- Ownership (TCO) concept can form into macro- and micro- level. The Graph 4.2 Total- Costs- of – Ownership Concepts formed macro- and micro- level into decision- making area.

Table 4.1 Concept of Total- Cost- of- Ownership

Quantities Analysis	Qualities Analysis
Total Costs Analyze	Countries' Risks Analyze
Supply Chain Evaluation	Market Conditions

(Source: Horst Hartmann, 2009)

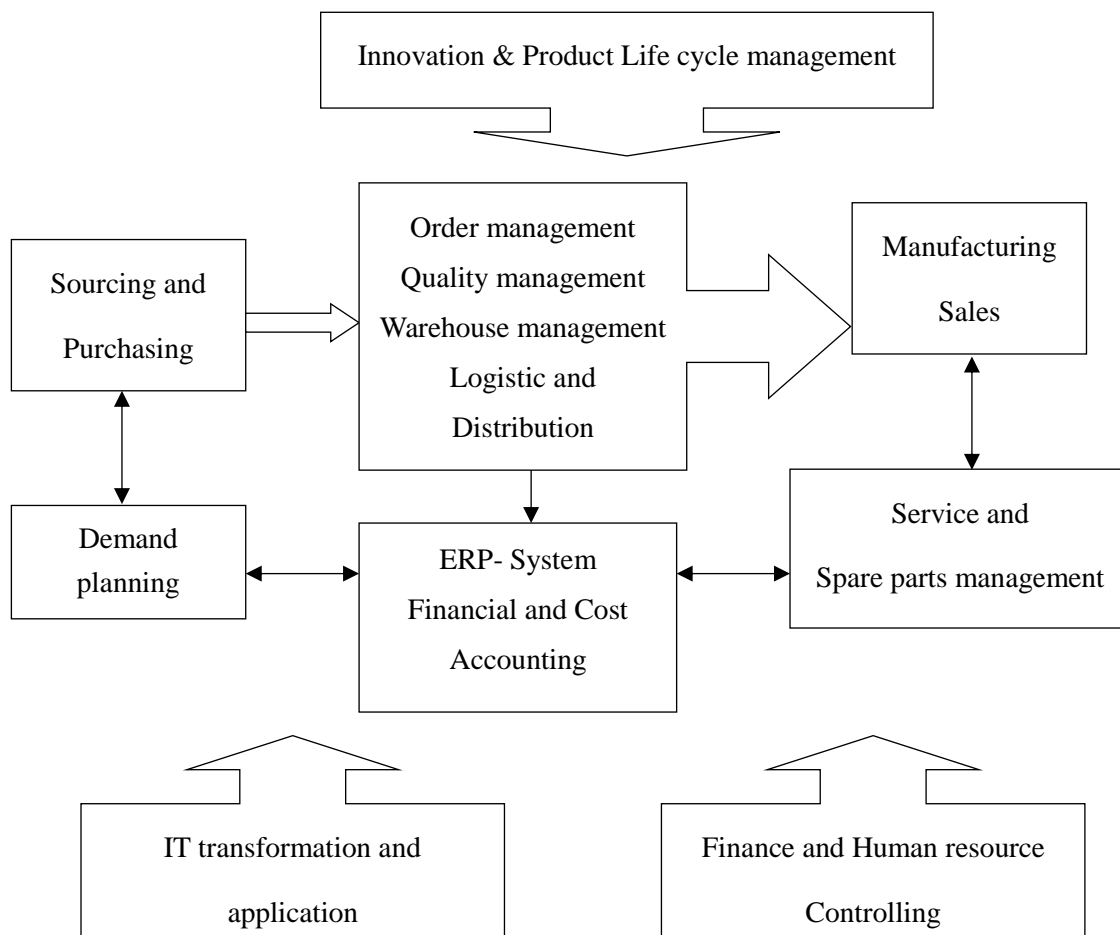
In case of research and development (R&D) phase, for instance enterprises input pieces of cost as material, labour, and capital from company in a certain time duration (assume a year project), form capital, human resources (Know- how) and suppliers, and technique equipment can recycle and construct a sustainable program in innovation site. The entire technology and innovation management process must generate value of research that is a basic and initial point in thinking of financial risk management.

¹³⁶Daniel Jeffery Koch, Marion A. Weissenberger- Eibl (2011): Gesamtkostenrechnung TCO, Fraunhofer- Institut für System- und Innovationsforschung, p30

4.2.2 Internal factors management

Enterprise's internal sourcing strategy includes multiple and single sourcing. Internal factors management concentrated early inputs from suppliers and the procurement of entire information network and the final efficiency of manufacturing. Each component of internal strategic management is under certain conditions of commodity and capital market. It combines the relationship between market and innovation activities in a long- term reward from internal resourcing management. From internal sourcing management, enterprises can also estimate the degree of waste in technology and innovation management.

Graph 4.2 Internal integrated supply chain¹³⁷



(Source: based on Otto- Ernst Heiserich, Klaus Helbig, Werner Ullmann, 2011)

¹³⁷Otto- Ernst Heiserich, Klaus Helbig, Werner Ullmann(2011): Logistik: Eine Praxisorientierte Einführung, Gabler Verlag, p123

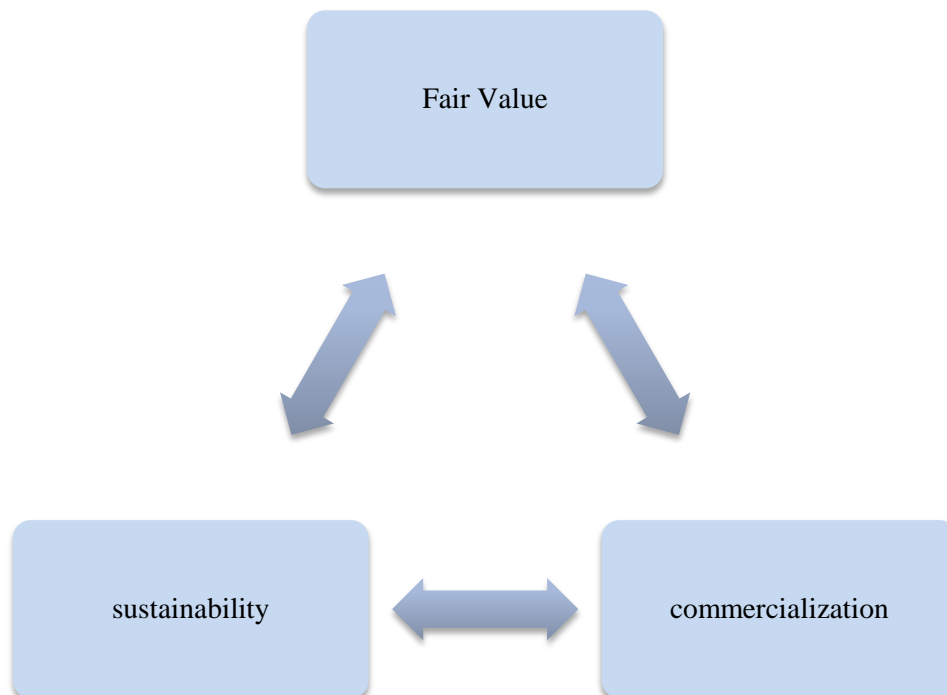
The internal resource management demands high quality and intensive information as base of framework in management process. In the internal network and supply chain management concrete procurement, product and distribution management which is associated with suppliers and demanders under total administrative costs in the entire delivery chain. The integrated supply chain planning matrix formulated demand planning, the ERP (enterprise resource planning) system and accounting (or e-accounting) management and internal controlling perspectives.¹³⁸ The systematical resourcing and supply chain management is in order to reduce uncertainty of production in industrial business and ensure the target of enterprise's decision-making in the right direction of day-to-day management as well as management controls responsibility of the information resource in innovation process within different departments and coordinate each procedure from sourcing providing. With a long-run strategic planning will enterprise conquer occasional issues in operation and replace coincidence of managerial problem in the future. Hence the internal sourcing management plays a crucial role that not only consolidates and integrates source networks, but also instructs enterprise calculation and estimation in technology and innovation management as forecasting function.

¹³⁸Otto- Ernst Heiserich, Klaus Helbig, Werner Ullmann(2011): Logistik: Eine Praxisorientierte Einführung, Gabler Verlag, pp128-129

4.3 The value of risk management on technology and innovation

In an innovative enterprise, the creation of value is the accumulation of effect that produces new ideas and applicable product and service to marketplace.¹³⁹ Time value management is important for business performance and value creation and company intentions to create fair value for the whole business chain while implement technology and innovation activities. The return that is sought a direct benefit to the bottom line of the innovation corporation in creative environment and enhance other non-business areas of potential value, such as social wealth and human rights with sound working conditions and ecological system.

Graph 4.3 Value of technology and innovation management



(Source: own compilation)

As above contents mentioned that innovation and technology management in MNCs and SMEs will be faced many risks and uncertainties. Nowadays many enterprises will move into another country to cooperate and research with local institution through international trade. Hence, it is necessary that control the international trade risks in

¹³⁹Margaret A. White, Garry D. Bruton(2007): The Management of Technology and Innovation, pp179- 181

innovation process to generate and maximize innovation portfolio. International trade risks divide three types: they are country risk, property risk and credit or commercial risk. Country risk (also political risk) is common in international business and cooperation, especially in global research network, county risk impact on the execution of R&D process and the quality of cooperation. Country risk associated with international trade and business can be related considerably to government actions and polices, for instance: expropriate a company's assets and profit, a large number of fine for a company through a charge, impose foreign exchange currency and rate control, impose tax law that after preferential treatment to domestic companies, impose social or work- related regulations that offer preferential treatment of domestic companies, restrict the movement and transaction of company's assets and resources, restrict cash flow free exchange and outflow. At present high political risk like terrorist activities and army coup also affect international business.¹⁴⁰

The impact of such behaviours and policies cannot undertake enterprise commercial activities, particularly in research and development (R&D) procedure of innovation management. The global R&D network exists in a stable and sustainable environment and through reinvest from such profits for future growth. Therefore the recognition, assessment and management such risks and uncertainties are an important aspect of an enterprise's ability in international trade and global innovation activities. However, the common sense of international trade and investment is that higher competitive advantage can only be attained by trading off higher levels of risk for higher overall returns.¹⁴¹ Companies tend to consider a holistic risk management strategies and policies that minimize risks in innovation process for company rather than eliminate altogether risks in cooperation of global innovation network, which it is obviously benefit from SMEs in trading and research with limited resource and enterprise- risk management (ERM) instruments. Given the conditions and situations of enterprises in R&D activities, such policies can be considered by enterprises: first of all, structuring

¹⁴⁰Tony Davies, Tony Boczko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp445- 449

¹⁴¹Tony Davies, Tony Boczko, Jean Chen(2008): Strategic Corporate Finance, McGraw- Hill Education, pp447- 449

the companies' financial and operating policies to ensure acceptable to, and considerable regulatory requirements of research and development (R&D) in different countries. Secondly, developing close social relationships with overseas institutions and constructing a sustainable partnership with local community. Thirdly is integrating international production of products to include the global research network from overseas company and home company are dependent on home company.

4.4 The case application of the Daimler AG

Daimler AG is one of the most successful automobile companies in the world, with divisions Mercedes- Benz Cars, Mercedes- Benz Vans, Daimler Trucks, Daimler Buses, and Daimler Financial Services become the Daimler Group one of the global biggest producers of premium cars and one of the biggest manufacturers of commercial vehicles with top- class in the world wide. Not only are the Group's advanced and comprehensive products, but as well as Daimler Financial Services contribute to sound performance with self- driving and individuals financing, leasing, fleet management, insurances, Carsharing, and innovative mobility services like the moovel App and the mytaxi App.¹⁴² The traditional strengths, such as technology- drivers and high quality standards, will combine with trend of digitalization in the automotive industry and automobile branch, which enable to the Daimler AG establish new advantages in commercial vehicle segments and financial services. The Enterprise- risk management and analysis are compiled by Daimler AG and published through printing Media, social Media and Internet.

The four strategic focus on innovation area from Daimler AG ¹⁴³

- Strengthening the core business,
- Growing globally,
- Leading in technology,
- Pushing digitization.

The group, firstly, focuses on the main business and central profit growth in industry. As one of the inventor of automobile and one of the most innovative vehicle manufacturers, the Group looked at the way of development and shaped the brilliant future of all divisions. In Mercedes- Benz Cars division, the Group is continue to launch attractive and highest- volume model serious in segments. For example, from 2012 to 2020 Daimler AG launched more than 30 new car models. It includes E- class and C- class wagon. In 2014, C- class was the most competitive product in segments

¹⁴²Daimler AG Management Report: Daimler At a Glance, February 2016

¹⁴³Daimler AG Annual Report 2015

and it was also the most global vehicle from Mercedes- Benz.¹⁴⁴ In 2015, the Group expanded the product range with the Mercedes- Maybach model, the Mercedes- AMG GT, the CLA Shooting Break, and the GLE coupe series. In year 2016 and successive year 2017 will be highlight of E- class series, S- class and GLA model.¹⁴⁵ Today the M-class SUV remains the world market leader position and thus the number one premium SUV. Mercedes- Benz Vans intend to strength the leadership and advantages in home market and good position in western European. The Vans division is systematically developing its proven commercial vehicle models, such as Sprinter series, Vito and Citan, which it primarily addresses commercial function for customers. There is a very successful year for Mercedes- Benz Vans in 2015 with sales and earnings. The products focus on the economy and safety for drivers and passengers. The important goal clearly presents: Mercedes design and manufacturing with technological safety- control- system are key success in the Vans division and the Group will introduce V- class multiple- purpose vehicle, the Marco Polo model and the Vito Tourer model in 2016 and 2017, which expands new items in the new regional market, like North and South America and China. The second strategic plan is going and opening new market scale. Of course dominates the Daimler Group in automotive industry and leads an advantage position in market. As above contents mentioned that not only the product series of Mercedes- Benz Cars or Vans are delighted customers, but also the Daimler business services extends the value chain in business activities of the service division with offensive innovation plan. For instance, the Daimler Financial Services division offered leasing and commercial vehicles and cars financed in regions. It reached a new record of more than 3.7 million at end of 2015.¹⁴⁶ The Daimler Financial Services provide a comprehensive range of automotive- related financial services. The Group invests huge resources in this business field. Its products range from commercial fleet management, financing offers

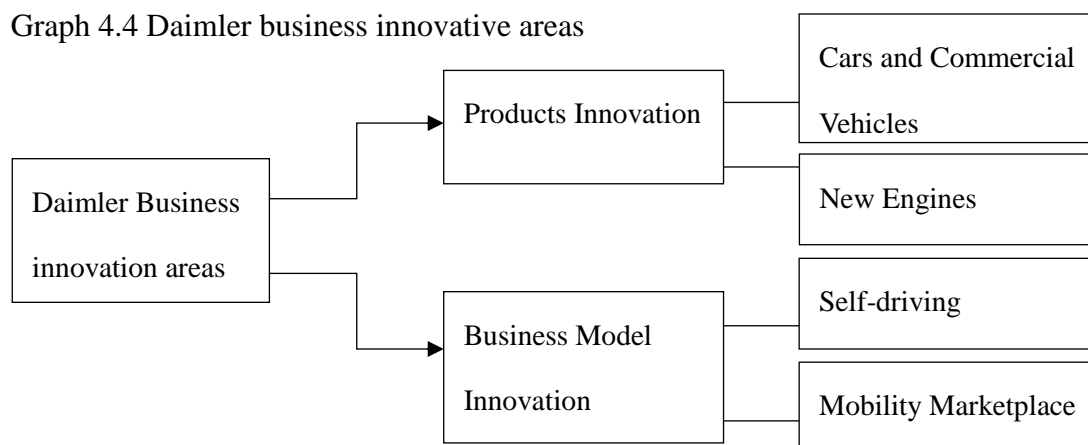
¹⁴⁴Daimler Corporate Presentation 2014, April 2014

¹⁴⁵Daimler AG Annual Report 2015

¹⁴⁶Daimler AG Management Report: Daimler At a Glance, February 2016

for trading and dealing partners, such contract volume rose sharply, insurance solutions and innovative mobility services, for example, the Car2go brand, the mytaxi and the moovel App and Mercedes Me App.¹⁴⁷ For example, the Mercedes Me provides digital service for customers. It allows all customers completely access to the exclusive Mercedes- Benz brand world. Mercedes Me as a digital platform offers mobility for each user to drive Mercedes- Benz cars and to connect with Daimler financial service as well Car2go, moovel services, or even own a non- Group brand vehicle in a real life, the Daimler AG focus on inspiration of lifestyle, quality of life and content of entertainment- regardless of business travel and vacationing.¹⁴⁸ Mercedes Me also allows Daimler to address people on the Internet and real world, the Group wants to provide more flexible services to individuals. The graph 4.4 summarized the Daimler AG innovative business areas.

Graph 4.4 Daimler business innovative areas



(Source: own compilation)

The third strategic point is concerned with capability of technology and new products by Daimler AG. The Group strength competition and expand leadership in the areas of drive system technology, safety, autonomous driving system, right- and left- hand drive system solutions, recycling materials and renewable materials, and intelligent Hybrid Technology.¹⁴⁹ Maintaining leadership of technology and innovation in automotive

¹⁴⁷Daimler AG Management Report: Daimler At a Glance, February 2016

¹⁴⁸Daimler AG Annual Report 2015

¹⁴⁹Daimler AG Management Report: Corporate Presentation Fiscal Year 2015

industry, the Daimler AG was one of the highest spenders on research and development (R&D) worldwide. Between 1997 and 2007, the Daimler- Benz went through several major mergers and demergers. In 1997, before the merger with the Chrysler, the Daimler- Benz turned over more than US dollar \$69 billion and employed workforce of more than 300, 000 world- wide. Eight years late, in 2005, the DaimlerChrysler AG turned over US dollar \$176. 7 billion and employed workforce of more than 380, 000 world- wide.¹⁵⁰DaimlerChrysler had four divisions of business area: Mercedes- Benz cars Group, Chrysler Group, Daimler commercial vehicles and Daimler Financial Services. To review the merger from 1997 to 2005, the Daimler AG and Chrysler transact technology and know- how and share the innovative network in global sites. Although two auto- companies had some issues and mismanagement in operation. In 2007, Chrysler was sold to Cerberus, in a move that raised share prices for the new Chrysler and Daimler.¹⁵¹According to the Daimler AG annual report claimed that in connection with the Chrysler transactions entered into 2007 and 2009, the Daimler group provided financial guarantees for the Chrysler obligations: and at last year 2015, those financial guarantees were maturity and the Chrysler valued amount of interest €0.3 billion, whereby the Chrysler paid €0.2 billion to Daimler's escrow account as for collateral financial guaranteed obligations. The rest of financial guaranteed obligation was related to bank loans of Toll collect GmbH, which is the operator company of the toll- collection system for trucks in Germany.¹⁵²Invested in field of technology and merged other companies also have risks. For instance, if the guarantees of obligation are not fulfilled by the company or final operating permit not granted. Furthermore, arbitration proceedings have been initiated and been obscured Daimler Financial Services.¹⁵³Therefore such risks need to be managed by Daimler AG, although such hidden financial risk cannot be reliably estimated.

¹⁵⁰Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, pp573- 601, This case study authored by Dr. Maximilian von Zedtwitz

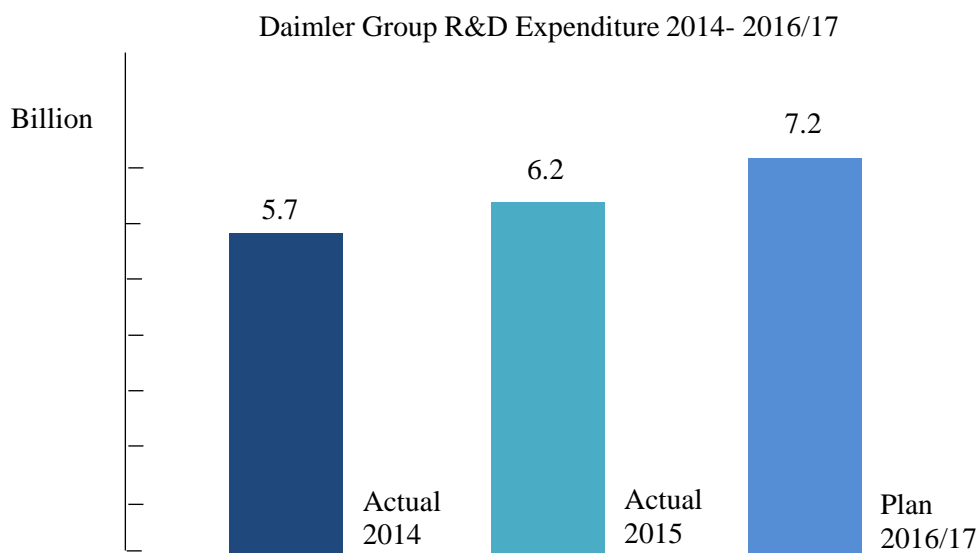
¹⁵¹Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the Secrets of Future Competitiveness, pp578- 579

¹⁵²Daimler AG Annual Report 2015

¹⁵³Daimler AG Annual Report 2015

Now the Daimler Group wants to continue keeping priority of innovation capacity in automotive industry and adding value through digitalization and automatization in industry 4.0. Hence, the Group keeps investment in research and development level, and still increased resource in innovation network, such as employment and capital. In 2015 invested Daimler AG €6.2 billion in field of research and development, it was higher than 2014 with €5.7 billion and it rose by 16 percent. The Exhibition 4.5 illustrated Daimler Group investment of R&D area from 2014 to 2016/2017. Planning in this fiscal year to following year, the Daimler AG decides to execute an aggressive investment decision and planning in research and development with €7.2 billion.

Graph 4.5 Daimler AG research and development expenditure¹⁵⁴



(Source: Daimler AG Annual Report 2015)

With divisions of the Daimler AG can be seen as follow Exhibition 4.2 Expenditure of Research and development from 2014 to 2016/ 2017. Mercedes- Benz cars division cost high investment in all divisions. Surely the Cars division is majority revenue from business areas. In 2014 was €4.0 billion invested by the Group and there was around 17 percent increase in 2015 to €4.7 billion. In 2016 and the following year

¹⁵⁴Daimler AG Management Report: Corporate Presentation Fiscal Year 2015& Corporate Presentation Summer 2016

2017 Daimler AG will invest €7.2 billion in Mercedes Benz cars division. Daimler Trucks occupied second position of investment area with €1.3 billion in 2015 and in 2016/ 2017 fiscal year will the Group maintain the level of investment. The number increased slightly by 9 percent than 2014 with about €1.2 billion. Mercedes- Benz vans and Daimler Bus divisions will pure capital €0.4 billion and €0.2 billion in 2016/ 2017 year respectively. Obviously is that the Daimler Bus division keeps the level from 2014 so far. And Daimler Financial Services does not release exact number of investment.

Table 4.2 Research and Development (R&D) expenditure by division¹⁵⁵

(in billions €)	2014 Actual	2015 Actual	2016/17 Plan
Daimler Group	5.7	6.6	7.2
Mercedes- Benz Cars	4.0	4.7	5.4
Daimler Trucks	1.2	1.3	1.3
Mercedes- Benz Vans	0.3	0.4	0.4
Daimler Buses	0.2	0.2	0.2
Daimler Financial Services	-	-	-

(Source: Daimler AG Annual Report 2015)

The research and development (R&D) department centralized for a range of potential products and product series and covered business units and brands, such as passenger cars, and commercial vehicles, etc. The innovation actives are contracted directly from business units and aimed at transferring new as well as mature technology for each business unit.¹⁵⁶ For instance, in 2015 the Daimler Trucks division optimized vehicles and enhanced Powertrains in order to improve the technical standards of fuel

¹⁵⁵Daimler AG Annual Report 2015 & Daimler AG Management Report: Corporate Presentation Summer 2016

¹⁵⁶Daimler AG Annual Report 2015

efficiency in commercial vehicles. It is possible that the Predictive Powertrain Control System can reduce diesel fuel consumption by appropriately 5 percent. In Europe, the Daimler Truck division wants to reduce the fuel consumption by an average as much as 20 percent per unit over the period from 2005 to 2020.¹⁵⁷ On October 2015, the first autonomous driving series of product truck- Daimler- Benz Actros has been undergoing fleet tests in Portugal and Germany. In 2016, the new Daimler- Benz Actros series is mainly sold in Brazilian market and North America market. The autonomous driving product offers many new innovations for transportation by road. Activity safety and assistant system increase probability of security in diversity of traffic conditions, multi-touch cockpit increase digital connectivity features for drivers.¹⁵⁸ The product offers not only safety, efficient fuel consumption, as well as optimal gear shifting, breaking and stability.

Table 4.3 Capitalization rate of research and development (R&D)¹⁵⁹

(in billions €)	2014	2015
Amount of capitalized R&D as cost	1.1	1.8
Rate of capitalization of R&D	20%	27%
Amortization of capitalized R&D expenditure	1.2	1.2
Rate of amortization of R&D expenditure	4.4%	4.4%

(Source: Daimler AG Annual Report 2015)

New products are original from strong ability of innovation and technological development, and capitalization of technology and innovation management is an important way to ensure investment of innovation. In 2015, the number of research

¹⁵⁷Daimler AG Annual Report 2015

¹⁵⁸Daimler AG Management Report (2016): Head of Mercedes- Benz Trucks, June 2016

¹⁵⁹Daimler AG Annual Report 2015

and development was capitalized as development costs with € 1.8 billion; it was more than €0.7 billion in 2014, which the amount of capitalization rate was 27 percent in 2015. The Exhibition 4.3 shows the capitalization rate of R&D and amortization of invested in development expenditure. The amortization of capitalized research and development (R&D) expenditure totaled amount of €1.2 billion in 2015, the number was equal to amount of expenditure during the year 2014 and with 4.4 percent of amortization rate in capitalized R&D investment. It remained at a high level in investment return of capital. This is a crucial work for research and development (R&D) procedure.

Developing such sophisticated technologies relies on not only the Group's innovative capability itself, but also financial strength and sound long-term partnerships with another company. Some important Joint Venture partners consist of Aston Martin and Rolls-Royce in 2013. At the end of 2013, Daimler AG established yet new partnership with Aston Martin, which the Daimler Group supplied with V8 engines from AMG and high electronic components as a first deal of corporation. In return, the Daimler Group received up to five percent equity form from Aston Martin. The Group also invested €2.3 billion in area of product and technology for corporation, the Daimler Group took the same approach that is the similar proceeds from the sale of shares from corporation in Rolls-Royce Power System Holding (RRPS) and then transferred the shares to joint venture partner Rolls-Royce.¹⁶⁰ Those deals benefited both corporations. The portfolio of research and development anticipated trends in present and future market, customers and also researchers and employees. Therefore the Daimler AG always targets investment in innovation and strengthens R&D activities in core business area with partnerships to construct business network. There are some new important business partnerships establishing in 2015. The table 4.4 shows the new partnerships in global R&D network. By now, the Daimler AG connects strategic partnerships of global research and development networks and comprises in eleven

¹⁶⁰Daimler Corporate Presentation 2014, April 2014

countries with 23 locations. In home- base site, the Daimler AG reorganized the sales system and opened an ultramodern testing and research Centre in Sindelfingen and Stuttgart in Germany. Outside Germany, the Daimler AG establishes R&D network in European countries, North America, Latin America, Asian countries and Africa.

Table 4.4 Important strategic R&D partnerships

Location	Countries/ Districts	Partnerships	Products/ Services
European	Germany and Finland,	Daimler- Benz, BMW, Audi and Nokia; BASF SE	Digital maps and Local- based service; Chemical materials
Asia	Kawasaki, Japan; Beijing and Fujian, China; Bangalore, India	Mitsubishi Corporation ; BAIC Motor and BYD Corporation; DICV and MBRDI	Global Hybrid Centre and FUSO trucks and Buses; E-vehicles, Mercedes- Benz cars and Mercedes- Benz vans, The largest R&D Centre in India and Asia, trucks of the BharatBenz Brand
North America	the U.S.; Canada	Zonar System Inc.;; DTNA and Thomas Built Buses (TBB)	Research locations, logistic system and customer- relationship Centre; Spare parts, Initial Buyer Tracking Survey System and customer feedback system
Latin America	Mexico; Sao Bernard,	Daimler- Benz and Renault- Nissan	Joint Venture production plant for premium compact passenger cars;

	Brazil	Alliance; FleetBoard	Daimler trucks and Digital solutions- E modules
Africa	South Africa	Sale of Atlantic Foundries (Pty) Ltd.	Daimler trucks, Mercedes- Benz vans and distribution network

(Source: Daimler AG Annual Report 2015 and Daimler AG Management Report June 2016)

In European area, in August 2015, the Daimler Group, BMW, Audi and Nokia Corporation reached an agreement on the acquisition of HERE subsidiary, which developed and provided the digital maps and location- based services. In the future, the digital maps from Nokia and HERE will ensure available of products and services as a permanent open platform that provides independent and value- added data and information for cloud- based map and mobility services.¹⁶¹ The basis of digital map and local- based services is an assistance system that can apply and match in all eventually automotive cars and commercial vehicles, and such system links to highly precise traffic data for digital map with real- time driving data in a manner that enhances road safety and enables the new generation of innovative products and services. In Maastricht, the Daimler AG set up a contact Centre for customers in terms of concern and complain regarding as sales, after- sales service and technological issues in western European. The Customer Assistant Centre (CAC) in Maastricht coordinates Daimler- Benz cars service 24h, which also includes the organization of breakdown assistance.¹⁶² The services in CAC extend beyond service of products as well as include financial service activities, such as contracts, warranty extensions and motor insurance. Not only in western European countries, but also in home- based market, the Daimler AG upgraded customer service network in 2015. Mercedes- Benz structured its sales network and reorganized requirements and standards for services team. The objective of restructuring sales system is to optimize customer care, operate profit on a sustainable increase and protect work opportunity in home market. With the BASF SE cooperated the Daimler AG in sustainable and renewable chemical materials for next

¹⁶¹Daimler AG Annual Report 2015

¹⁶²Daimler AG Management Report: Sustainable Management 2015

generation Mercedes Buses and reducing the resource consumption and fulfills the industrial standards and requirements of the chemical regulations in Europe.¹⁶³

In Asia, there are two important research locations; one is the Global Hybrid Centre in Kawasaki, Japan and the other one is Mercedes- Benz Research and Development India (MBRDI) with headquarters in Bangalore, which is the largest R&D Centre in overseas. The research and development Centre employed appropriately 2, 900 staffs in Bangalore, which translated the knowledge from Indian scientific community, the national universities, software industry and research institutions to the Daimler AG. In November 2014, the Daimler Group opened research and development Centre in Beijing, which the facility expanded the existing R&D network in China mainland. In 2015, the Daimler Group and the Chinese automobile manufacturer planned to intensive cooperation in passenger cars and financial services areas. The Daimler AG signed agreement in March 2015 with Beijing BAIC Motor in line with the passenger car division, such as SUV market with GLA, GLC and GLK series.¹⁶⁴ Within the agreement the Daimler AG also expanded the financial business and it is an important growth factor that serves as service area in China. At the end of 2015, there are around 500 highly qualified engineers and designers at the Daimler- Benz research and development Centre in Beijing.¹⁶⁵ In California, the Daimler Group established two R&D locations in order to improve production capacities and business services in North America. This is because in NAFTA region, the Daimler AG has traditional advantage market position, especially in Daimler Trucks division. With a strategic vision of Daimler Truck division will continue investment in technology and sophisticated service system in North America market. For example, in 2015 the Daimler Group in North America subsidiary- Daimler Trucks North America has strategically invested within five years in Zonar Systems Inc., which is one of the leading suppliers of logistics, telematics and connected visual technological company.

¹⁶³Daimler AG Management Report: Sustainable Management 2015

¹⁶⁴Daimler AG Management Report: Corporate Presentation Fiscal Year 2015

¹⁶⁵Daimler AG Annual Report 2015

The two companies DTNA and Zonar will work together to launch application of tailored information technology for customers in the NAFTA region.¹⁶⁶The Daimler Trucks North America (DTNA) also provides comprehensive services in distribution and stock service in the U.S and Canada, with the business partner Thomas Built Buses (TBB) subsidiary constructed customer service network to further improve customers' degree of satisfaction. The DTNA also introduced a new Initial Buyer Tracking Survey System that generated feedback from customer for specific commercial vehicles.¹⁶⁷It is important that an advanced and systematic customer service network establishes in North America with such partnerships to improve technology capacities. Another significant cooperation in 2015 was the Daimler Group and the Renault- Nissan strategic Alliance with five- year contract, which two automakers production joint venture launched new cars in Aguascalientes, Mexico.¹⁶⁸The two companies laid the cornerstone for a new production plant for passenger car division and the new facility will produce Infiniti in 2017 and will start producing Mercedes- Benz cars in 2018. In the future, Latin America market is a great potential market for each company and the Strategic Alliance between the Daimler AG and the Renault- Nissan wants to remove into the market early and dominate market position. Daimler- Benz cars division and the Renault- Nissan will also develop new generation of premium compact cars for the brands. Hence, a strong strategic partnership as a milestone facilitates two companies' innovation and R&D cooperation under the alliance.

At the end of year 2015, the Daimler AG employed 23, 300 researchers in R&D department (2014 was 21, 700 researchers). At Mercedes- Benz Cars division worked 15, 500 researchers in 2015, a total of 5, 500 employed by Daimler Trucks, around 1, 100 of R&D researchers worked at Daimler- Benz Vans and approximately 1, 200 were in Daimler Buses division. In the end of reporting year 2015, there were around 5, 100 engineers in overseas research and development network for the

¹⁶⁶Daimler AG Annual Report 2015

¹⁶⁷Daimler AG Management Report: Sustainable Management 2015

¹⁶⁸Daimler AG Annual Report 2015

Daimler AG.¹⁶⁹

At last, the fourth strategy of the Group focuses on digitalization. Digitalization is paving stone for new creative products and services in industrial level, which provides new solutions for automotive industry for Daimler and alters some traditional and conventional method or production process. Digitalization communicates not only company and customers in entire business activities, as well as company combines with factories and workforce, machines, electronic equipment and some new renewable energy. Under the Industry 4.0 concept is that digitalization and automatization are a new era for the Daimler Group to upgrade production conditions and establish smart factory is that enhance the connectivity for the Group's product, develop customer- focused digital services and increase digital communication with individuals. The manner start initial connection and extending relationship between the Daimler AG and customers will create value at the Group. The Daimler AG initiated four goals of digitalization in business area: direct, fast, open and creative.¹⁷⁰ The approach offers many benefits for customers, employees and suppliers. For instance, the Daimler AG connects sales and production process through digitalization platform, which enables to respond to demand of customers or individuals' preferences flexibly, quickly, personally. The goals are also making internal production process efficient and to overall improve efficiency, while the eliminating the need for employees to perform certain types of heavy physical laboratory. Digitalization extends range of services in each division in Daimler AG, and it will be an important infrastructure and crucial factor to optimize logistic system and close relationship with suppliers in the future. The goals are to be the leading automotive manufacturers in terms of cooperation with international partners in an overall supply chain system. For example, in 2016 the Daimler Bus division and Mercedes- Benz Vans division are now developing integrated transport solutions and

¹⁶⁹Daimler AG Annual Report 2015

¹⁷⁰Daimler AG Annual Report 2015

improving the fleet management system.¹⁷¹

Daimler AG benefits from the global research and innovation (R&D) networks and facilitates technology and innovation management in cooperation with different partnerships, but there are some issues that impact Daimler AG in innovation activities and cooperation in overseas research locations. The Exhibition 4.5 summarizes such issues that affect Daimler AG management of global R&D locations.

Globalization of research and development (R&D) requires multi- thinking and diversity management in enterprise- level. Although the Daimler AG selects many methods and ways to build a sound diversity management system, there are awareness- building and training measures, the Group creates a sound environment of culture diversity, fair working conditions that is free of prejudice, some issues are still unavoidable. A famous case is the Daimler and Chrysler that merged in 1997. After the deal of merger, the Daimler Group established a post- integration team in DaimlerChrysler and spent several million dollars to remove negative influence on working and R&D conditions, and enforce understanding through intensive cultural workshops. But after two years, in 1999 a top manager of Daimler- Benz described the deal that was marring up and marring down, while they had quite different brand, management style and also remuneration.¹⁷² Such poorer conditions were distinct from two corporations, which had different corporate value, brand image, and payment structure. Therefore, such conflicts of management style also affected research and development (R&D) activity. The Chrysler considers products all within the cost- controlled innovation strategic plan, in contrast, the Daimler AG is a high- tech intensive automaker with uncompromising quality, the Group insists on a disciplined approach and working style in technology and innovation management. In a culture crash and brand bias atmosphere, the two companies at last run separately. “Quality at any cost” is a philosophy of the Daimler- Benz, while Chrysler aims at price- target product in market, different standards against tactical and strategic actions of R&D

¹⁷¹Daimler AG Management Report: Corporate Presentation, Spring 2016

¹⁷²Sydney Finkelstein (2002): The DaimlerChrysler Merger, Tuck School of Business at Dartmouth, (1) 71

management.¹⁷³

Table 4.5 Main issues for global R&D Management at the Daimler AG

1. Soft and informal coordination means are important in transactional R&D projects;
2. Overcoming inherent difficulties in international R&D operations in soft environment such as high costs, different language and culture, and project execution times;
3. Inter- functional differences are as important obstacles to spread global R&D as geographical distances and space distances.
4. Mismanagement in global R&D network and partnerships

(Source: Maximilian von Zedtwitz, 2008)

International research networks cost many resources and require high- level management to integrate global innovative sites for the Daimler Group. But now the Group enriches experience through international cooperation with different institutions and companies. Via new R&D strategies with transaction projects, cross- function partnerships or jointed multi- culture innovative networks can be created value beyond the traditional method.

Research centers were established where there was a growing need to combine the Daimler AG internal expertise and Know- how with that of top performance research facilities world- wide. The international way of research and development reduce logistics and manufacturing costs in real business operation. The international R& D operations are centrally controlled by the home- based laboratory and innovation site and the headquarters with budget and quality. Daimler-Benz has been a company with a strong home base, with the main foreign markets being nearby European countries, integration R&D sites are the corporate strategic thinking that is ensured by the frequent and intensive research and development activities between Germany and overseas innovation network, as well as the R&D personal and technological work exchange.¹⁷⁴ The laboratories' technology strategy requires the laboratory direction and

¹⁷³Sydney Finkelstein (2002): The DaimlerChrysler Merger, Tuck School of Business at Dartmouth, (1) 71

¹⁷⁴Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering

his team coordination. Hence coordination between each lab has become more competitive and requires more frequent communications and meetings. Time is required for the different parts of research teams and groups connection in order to enhance communication and close relationship with mutual understanding and trust. Information technology has narrowed gap between distance and space of the world and it has also changed development requirements of industry. This can be eliminated cost of administration in research and development (R&D) department and management board during the time aside from the face- to- face meetings. However, such risks are concluded by the Daimler Group and assessed by the management in operations. Exhibition 4.6 shows the Daimler AG measured such specific- enterprise risks in 2015. Such special enterprise risks reflected on influence in industrial business and investment area of the Daimler AG.

Table 4.6 Evaluation of the Company- specific risks

Risk Category	Probability of occurrence	impact
Production and Technology Risks	Low	High
Information technology risks	Low	Medium
Personal risks	Medium	High
Risks related to equity interests and Joint ventures	Medium	Medium

(Source: Daimler AG Annual Report 2015)

As an innovative- intensive corporation require also capital- and technology incentive- investment and some key success factors achieved the enterprise level of prices for the premium products of the Daimler AG. Hence, the successful products and services, the brand image, require well behaved system and mechanism to manage some enterprise- risks. The following risks above Table 4.6 deals with the special enterprise risks with production and technology, IT risks personal risks and

relevant risks. In industrial level, the Daimler AG as the premium passenger car and commercial vehicle manufacturer and service provider that is regarded as leadership of brand image, quality of product and comprehensive design by customers. Technology features based on innovative research and development are full of uncertain factors, all divisions of the Daimler Group are subject to probability of risk emerging in production, and set frontier to control risks impact on business area. As above mentioned that the information technology nowadays as an important infrastructure connect and serve as industry and sectors, which are convenience production and service suppliers in all parts of the world. The internet, IT software and cars connection are an obvious trend in automotive industry. However, the IT risk is increasingly a defective issue and a determinable factor for companies. For the Daimler AG, such special IT risks exist in the business field due to available new technologies applied in digitalization, which can affect the products, manufacturing process, industrial communication, data and information transaction among corporation and each subsidiary in real business time and operational management. Risks that could result in the interruption and of business process due to the failure of IT system if data is stolen by crime groups or IT infrastructure is breakdown, which could cause such the crucial and core commercial information loss, new innovation or technology copy, or corruption of data therefore identified and evaluated over the entire product and technology life cycles of applications and IT systems, which will be reduced business or corporate crime including bribery, forgeries, and other illegal manners. The Daimler Group has defined suitable measurement for the risk avoidance and limitation of damage. The Group not only protects the production of vehicle electronic system security from possible hacker attacks, but also ensures consumers' confidence and personal data and private right and interests in secure circumstance. Therefore, it is necessary that an IT operations Centre coordinates potential danger from cyber and hacker attacks. The Daimler Group utilizes various preventive method and tools to meet the growing demands placed on the

considerable, integrity and availability of data.¹⁷⁵The IT risks are assessed by the Group, which taken precaution low of occurrence, but the impact of IT attacks accompany greatly and deeply. High quality and creative- rich employees from the worldwide contribute to the success innovative work for the Daimler Group. As one of the most popular and attractive employers, the Group also provides pleasure and delight working conditions and environment, particularly in research and development department, the management process need to be flexible and adaptable. To support the process for technology and innovation management in R&D networks, the Group introduced an ideas management system that motived employees to promote suitable new ideas to products and services. This HR management system can submit quantitative and qualitative ideas and suggestions for improving business performance. Combining global innovation networks and over thousand outstanding researchers and engineers, the Daimler AG intends to encourage them carrying out creative ideas and in charges of the ideas management system. The established human resources management instrument moderates the enterprise- risks in personal management of research and development activities, such risks are in a worldwide toward the age, gender, occupation, recruitment, and retention of staff with high direct or indirect influences in corporate management. In doing so, it is important that technology and innovation management requires a high transparency mechanism to ensure the innovative ideas and creative resource to the Group. Risks related to associated companies, joint ventures and joint ventures are special enterprise risks, which occurred in business cooperation with other commercial partners in associated companies, and joint operations in other types of organization as kay partnerships with the Daimler AG. The potential and possible risks include financial developments and equity allocation in a negative period, which delayed the development and execution of production structure and joint venture or joint operation form. This category of special enterprise risks can generate large negatively impact on innovation and research and development (R&D)

¹⁷⁵Daimler AG Annual Report 2015

activities.¹⁷⁶The related risks have high possibility of occurrence in segments and reached medium degree of these risks in a long stretch time affected the each division. The Daimler AG measured general economic situation in the world in 2015 and the Group evaluated business development and financial circumstance, set up the probability of risks associated company, joined venture and joint operations increase to compare previous year 2014.

¹⁷⁶Daimler AG Annual Report 2015

5. Solutions and limitations

Integrated reporting is nowadays a new solution for enterprise internal controlling, particularly in financial and sustainability area. The increasing demand of information requires enterprise provide integrated thinking for outsider users with understanding and precise content. Integrated Reporting is regard as an optimal and qualitative information- outputs object by International Integrated Reporting Council (IIRC) which founded in 2010. The organisation IIRC is an international coalition of regulators, companies, investors and accounting professions and so on, for example, it is associated with International Accounting Standard Board (IASB) and Financial Accounting Standard Board (FASB).¹⁷⁷ As an internal corporate framework, the integrated report is reaction with other important reports, such as financial statement and sustainable report. IIRC provide a new guidance and managerial experience for companies with application of internal Business Intelligence (BI) system. The Business Intelligence system is an integrated IT and data management system in business area. It serves as a systematic data- analysis in an electronic form for companies. The BI system can provides an insight of operational strategy and decision- making for companies, therefore IT and Intelligence system applied in Business area is an appropriate action that combines an organisation's IT strategy and IT infrastructure with the organisation's strategic business objective and infrastructure.¹⁷⁸

Enterprises can utilize the system to measure the performance of company in day- to- day management and the content of Integrated Report like risks and opportunities an analyzing or overview of business performance and financial position are needed intelligent and advanced information producing system. The result of systematic analysis enhances quality of information for public users.

¹⁷⁷ Consultation Draft of the International (IR) Framework, www.theiirc.org, April 2013

¹⁷⁸ David Nickles (2004): IT- Business Alignment: What We Know that We Still do not Know, Proceedings of the 7th Annual Conference of the South Association For Information systems, 2004

5.1 To find solutions for risk management of innovation

Business Intelligence is one of the solutions that optimize business process and model. ERP system (enterprise resource planning) is enterprise resource integrated system that according to enterprises in industrial level or sectors of industry consolidated all the information and resources with smart or intelligent business software to optimize process of operations. Intelligent data networking is at present creating considerable new possibilities in business area, and IT comprehensive development and digitalization are a great tendency towards application in industrial level and Daimler AG as an industrial giant with over 125 year experience in automotive industry, surely have known the trends in the society and industry and seized opportunity of digitalization. With a digital process chain expand Daimler products and service in advanced business field and possess of competitive advantages in globalization as well as personality in individuals. With digital technique connect the Group not only from research and development (R&D) network, but also extend the mobility of employment and infrastructure in production and sales, therefore the digital era is under the way in Daimler AG. Daimler AG is now using IT and digital technique create and develop innovative vehicles and services and also improve the quality and work in environment and society. In doing so, there are four IT- strategies in the Group:¹⁷⁹ to improve efficiency of business process during IT application as the same time reduce and minimize threatening of internet system; introduce the entire world- class IT- Process- Model in the Group and connect with the effective- orientation IT- organisation or community, which integrate same standards of process, method and instruments; develop and enhance the role of IT service in the Group's business field, especially offering advanced service for individuals lifestyle and life philosophy; and last one that enlarge and extend the IT- structure and the IT- service in relationship between customer and all vehicle products through the new IT application as an option of business as possible.¹⁸⁰

¹⁷⁹Daimler AG Annual Report 2015

¹⁸⁰IDG Business Media (2011): Die IT- Fakten der 120 Größen Unternehmens in Deutschland, IDG Business Media

Integrated reporting is also one of the most important instruments utilized by large or small companies, for example BASF Group generates integrated report that based on the concepts, business model, elements of commercial experience in group to explain the corporation' orientation of the Group, the environment and the society. According to the International Integrates Reporting Council (IIRC) defines that integrated report is a process that results in communicating- through an annual integrated report-how organisation create value over time as well as their impact from an economic, social and environmental context within which it operates.¹⁸¹The integrated report process is explained by Consultation Draft Framework which released by IIRC, an integrated report is a concise communication about how an organisation's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over short, medium and long term.Furthermore, an integrated report is prepared primarily for providers of financial capital in order to support the financial capital allocation assessments.¹⁸²Its profitability and continued existence relies on a far broader set of resources and stewardship with capitals (such as financial, manufactured, intellectual, human and workforce, social and natural capitals).

GmbH, p129

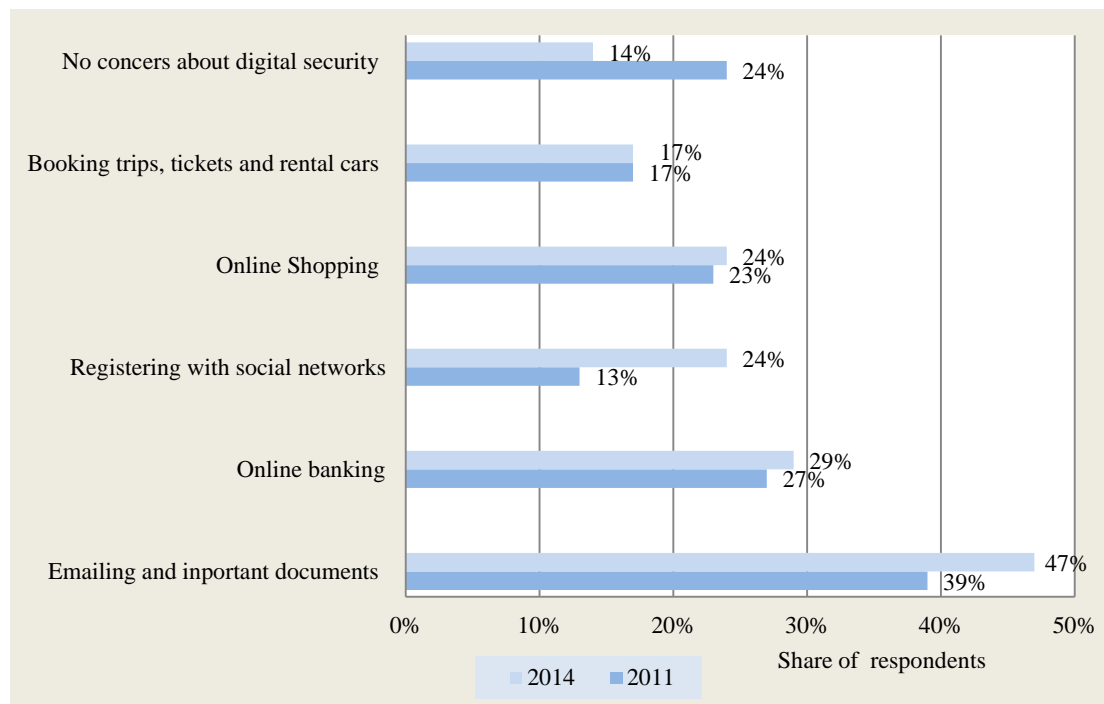
¹⁸¹Consultation Draft of the International (IR) Framework, www.theiirc.org, April 2013

¹⁸²IFRS in Focus, www.irsplus.com, www.deloitte.com,

5.2 The challenges and restrictions in risk management of innovation

Business Intelligence (BI) system is based on the information exchange and big data management, nowadays IT and the internet network security are a hot theme for each company. Also consumers concern about some issues of data safeguard and digital consuming security. The exhibition 5.1 shows such unsecured reasons influence German digital activities in year 2011 and 2014. Some uncertain factors constrained consuming behaviour and limited business and market increase. Majority of digital users in Germany concern about Emailing and important documents will be attacked, which the number is with 47 percent in 2014 that compared with 2011 that the number increased sharply, according to investigation in 2011 with 39 percent. The second factor that is worrying about online banking with 29 percent, which was a slight increase than 2011 with 27 percent.

Graph 5.1 Digital Activities due to uncertain and security certain in Germany of year 2011 and 2014

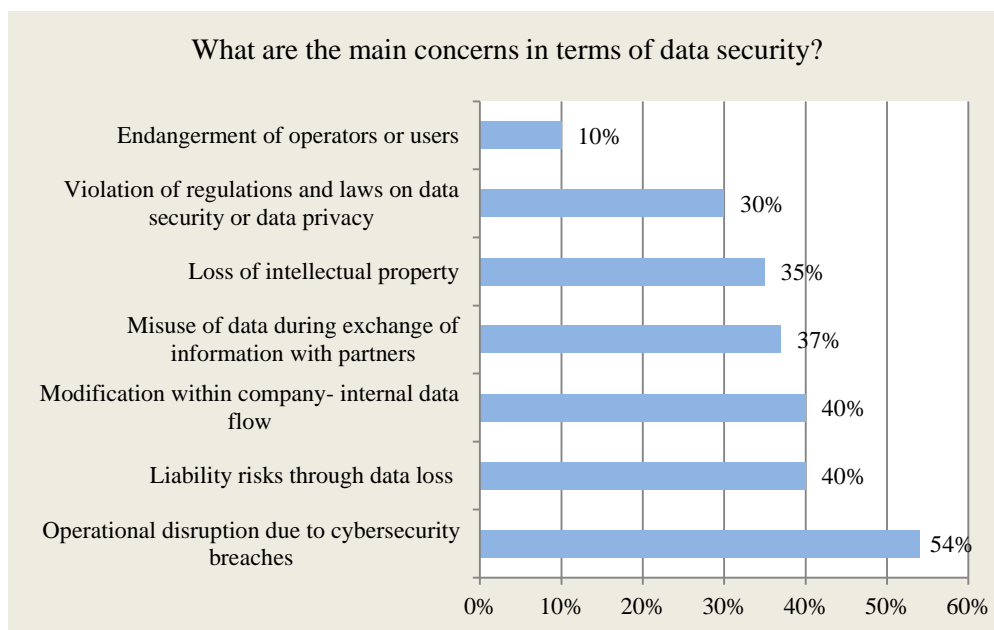


(Source: eMarketer© Statista 2016, Bitcom Germany)

Social Median and Online Shopping were with 24 percent regarded as unreliable

digital elements that limited consumers and users activities in digital platform, like smartphones, laptops, and PC- Tablet, etc. Online booking, which includes ticket purchasing, travel or hotel reserving, cars renting, is also an uncertain and unsecured perspective in new e- business. The figure is remaining a steady level with 17 percent. The data provided evidence for the Daimler AG, online consuming and digital business had many challenges for companies, not only for consuming and trading, as well as for manufacturing and production.

Graph 5.2 Main concerns of enterprises in terms of data security in worldwide

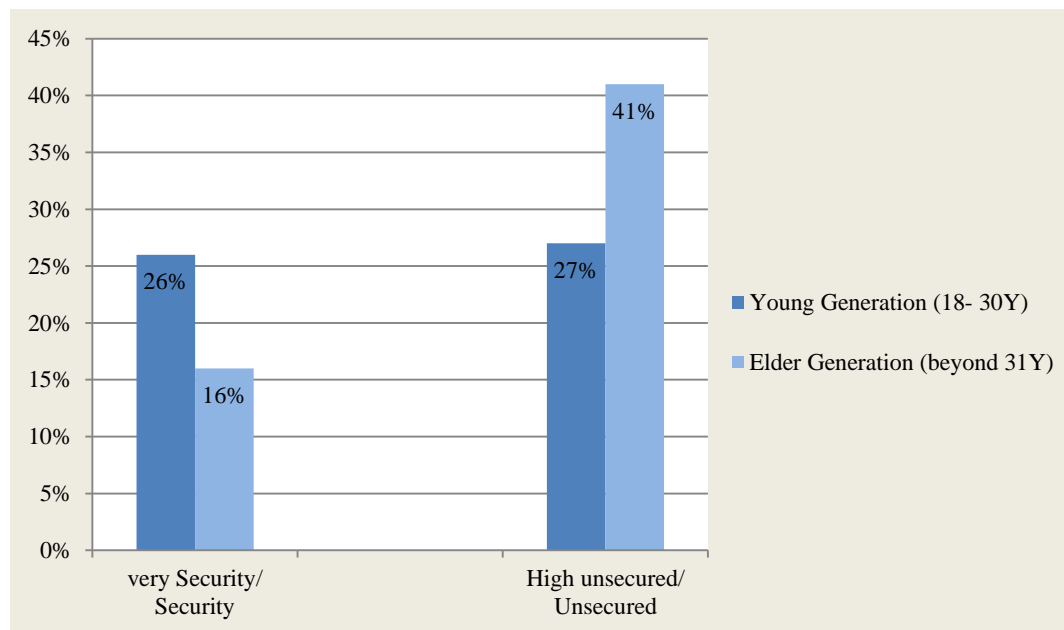


(Source: PwC© Statista 2016, November 2015 to January 2016, 2000 enterprises)

The Exhibition 5.2 illustrates in the worldwide the enterprises concern about such disquiet of data and information security in production and manufacturing. Data loss and stolen are huge destruction to enterprises in commercial competition and business trading. According to the Daimler AG expressed that the quality of data is core and competent requirement to satisfy production and meet standards in digital environment. Innovation and process of innovation spent time and tremendous resources, particularly now in international research and development (R&D) activities, the data and information protection are more important for companies in recent years. In addition, now enterprises depend on global suppliers, supply chain

and procurement management relied on smart software and advanced IT network, hence, innovation management is within the context of the data and information protection and controlling can help enterprise extending and managing entire value chain, especially in SMEs or startups. Based on the graph displays cyber security and hacker attraction are the most serious issues that breach production and day- to- day management in industrial level. Exceed 50 percent of enterprises concerned about the operational disruption in management recently. Data loss and Modification are both with 40 percent affect real business for enterprises. The internal data flow belongs to the enterprise as business security to protect and the information loss result in inevitable commercial crime. Following risks are date abused in exchange with partners and loss of intellectual property with respect 37 percent and 35 percent. They are also an aggressive infringement in business area.

Graph 5.3 Interview of private data in Connected- Car- Services



(Source: Deloitte© Statista 2016, Germany)

The young generation considered less risks or unsecured influence in car services and it reflects the young people eager to experience such fresh ideas and new products and services, obviously over 40 percent elder generation who beyond 30 years had significant awareness of data security in the Connected- Car- Services in Germany. It

is important and also a challenge for the Daimler AG, this is because the group of consumer afford to the Daimler premium passenger cars.

Private data security is a serious topic for customers in Connected- Car- Services, and the Daimler Group is aware of the issue of private information right and ensuring customers' right protection. The Group has discovered one solution for customers. For example, in 2015 the Daimler AG involved in drawing up draft of personal- related data in connected vehicles and services, which was handle by the European Automobile Manufacturers' Association (ACEA).¹⁸³

Sustainable management is a green concept of economic development, it is regard not as a new or created idea, as well as it is considered to a long- term strategic development target for countries and companies. However, there is a doubt that if enterprise over emphasize green economy and new material research and development and applied in products, it increases stress of operational costs for company and also affects operation in production management. Furthermore, some sustainable concepts are difficult to describe the relationship between environment pollution, phenomenon of climate changing, environmental protection and some alternative product or service. For instance, now many auto products are described that the vehicle is low carbon and low emission product, however, a company to meet all the goals and standards of economy, ecology and society in short time, that is a long way to realize them. The role of technique will generate influence as well as the product life cycle in maturity period.

¹⁸³Daimler AG Management Report: Sustainable Management 2015

6. Conclusions and outlook

Innovation is a motor that drives enterprise movement ahead. In global market, the product and service represent a symbol of a company's image and reputation. All the time, "Made in Germany", "Made by Japan", "Design by Britain" or "Design by Swiss" represent high quality of product, sophisticated technology and top design style. The product or service generates value not only for companies, for customers as well as change the life style of people and influence and alter the society and the environment. Comparing MNCs and SMEs, the Multinational corporations are a main stream to trail innovation in global research and development activities, and the MNCs are also supreme force of FDI activity. SMEs are vivid market participants in all business areas, for example, in Germany they are called "Hidden Champions". Many SMEs paly a pioneering role and explore the industrial of industry new ideas and even unexpected development in German and the world market. Introducing new products and services help companies protect their margins, obtain competitive advantages, while investing in process of technology and innovation management assistant companies reducing the costs. Advanced information technology plays a significant role in industry development and upgrading and also facilitated to product innovation. For example, the computer- aided design and the computer- aided manufacturing software have made production easier and faster for manufacturer design and produce new products; the Enterprise Resource Planning (ERP) software increases efficiency of resource collection and utilizing. The concept of enterprise source planning also can apply in process of producing and manufacturing, like product planning and product examination. Particular with concept of sustainable management for MNEs and SMEs can benefit from the information technology (IT) and business intelligent (BI) system.

Considering again with the financial management of technology and innovation in enterprises level, many companies and top managers consider form of discounted cash flow to analyze and evaluate projects. Discounted cash flow method is quantitative

method for measuring whether the expected return and anticipated future benefits are enough to fill up financial expenditure, given risks and time. Discounted cash flow method tacks account of the payback period, risk, and time value of money.¹⁸⁴Two commonly forms of discounted cash flow are net present value and internal rate of return for evaluating investment decisions and assessing return of project.

In many industries, technology and innovation management are the most important driver of competitive success. Many companies and firms receive more than one- third of their sales and profits from products developed within the past five years.¹⁸⁵The increasing importance of innovation is taking part in to the globalization and sourcing integration of markets, like FDI and M&A. Foreign competitions has accelerated pace of technological improvement and innovative activities on management. Many companies include the SMEs and MNCs put pressure on continuously innovation in order to produce diverse and differentiated products and services. To acquire more intelligence resources, enterprises move to overseas to establish research and development (R&D) Centre or location, in order to reduce costs of research and human resource management. Therefore comprehensive and intensive work in technology and innovation management requires top managers with a holistic and systematic thinking and method to execute and complete management.

To sum up, enterprise risk management is a framework that calculates and measures a wide category of risks. And technology risks as a specific risk affects enterprise in research and innovation area and business operation in long- term development. To review development of technology, many successful innovations in the business world changed business model, production and manufacturing process. Many famous cases ware edited by business school and introduced into classical business case study.

However there are also many failure and awful cases of technology and innovation in business area in case of human re- thinking and introspection. Nowadays, the concepts

¹⁸⁴Mellissa A. Schilling(2013): Strategic Management of Technological Innovation, 4th Edition, McGraw- Hill Education, pp133- 138

¹⁸⁵G. Barczak, A. Griffin, K. Kahn(2009): Tends and Drivers of Success in Industry Practice: Results of the 2003 PDMA Best Practice Study, Journal of Product Innovation Management, (26)2009, pp3- 23

of digitalization and visualization bring many new ideas and evolvments in the life and business world and generate influence in the society. For example, smart factory is one of the concepts in manufacturing and production process in industrial sectors, many enterprises introduced smart and intelligent producing, insistent communication and management systems into manufacturing procedure within industrial level that extend value chains and improve efficient resource utilizing and recycling, also the robots or assistant robots heavily input and place in production line to instead of human as an important supplement for workforce. In a short- range forecasting that several changes in industry impact both workforce and workplace among robots or such machines applied in manufacturing and management process, in long- range forecast that some innovative method and running mechanism will reduce costs in production and either human or machines manipulate such system in working environment and working conditions are more flexible, safety and convenience.

The thesis selects the case from automotive industry and the German successful and innovative manufacturer- Daimler AG as a case study, which discuss risk management in technology and innovation process. Because of car industry is a main engine and strong advanced industry in Germany and the Daimler AG enjoys a famous reputation in the world. Such new innovation in varies of generation products formed the great brand. Now some new products are worth expecting and focus. The electronic- car (also called E- auto) is one of the hot point in the car industry. Due to the issues of climate change and emissions result in cars product evolution. The E-auto is regarded as an alternative product for traditional products like diesel- or fuel cars, are draw much attention in many nations. There is a reasonable and increasing demand in such countries like China with the air pollution background and passenger car market becomes prosperous and booming since several years. Also in the U.S and Europa are mature car markets and exist a realistic demand in next several years. Hence, it is an important topic that is worth observing and further researching in automotive industry.

Bibliography

Albert N. Link, Donald S. Siegel (2007): Innovation, Entrepreneurship, and Technological Change, Oxford University Press

Asif H. Qureshi, Andreas Ziegler (2001): International Economics Law 2nd Edition, Sweet& Maxwell

Barczak, G., Griffin, K. Kahn (2009): Trends and Drivers of Success in Industry Practice: Results of the 2003 PDMA Best Practice Study, Journal of Product Innovation Management, (26) 2009, pp3- 23

Barney (1991): Firm Resource and Sustained Competitive Advantage, Journal of Management, 17(1), pp99- 120

Belkoui Ahmed (2001): International Accounting, Quorum Books

Black, F (1990): The Tax Consequence of long- run Pension Policy, Financial Analysis Journal, pp17- 23

Bruce Lyons (2009): Cases in European Competition Policy: The Economic Analysis, Cambridge University Press

C. Correa (2007): Trade- Related Aspect of Intellectual Property Rights- A Commentary on the TRIPS Agreement, Oxford: Oxford University Press

Charles W. L. Hill (2007): International Business: competing in the global marketplace, McGraw- Hill/ Irwin

Chesbrough, Henry (2006): Open Innovation: A New paradigm for Understanding Industrial Innovation, Oxford University Press, pp1-12

Christian Laux (2004): Integrating Corporate Risk Management, J. W. Goethe-University Frankfurt am Main

Christopher L. Culp (2001): The Risk Management Process: Business Strategy and Tactics, New York: Wiley

Christopher L. Culp (2002): The Art of Risk Management: Alternative Risk Transfer, Capital Structure, and the Convergence of Insurance and Capital Markets, New York: Wiley

Christopher L. Culp (2002): The Revolution in Corporate Risk Management: A Decade of Innovation in Process and Products, Journal of Applied Corporate Finance 14(4) pp8- 26

Clifford W. Smith, Neil A. Doherty (1993): Corporate Insurance Strategy, Journal of Applied Corporate Science, pp4-15

C.W. Smith, R. M. Stulz (1985): The Determinants of Firm's Hedging Policies, Journal of Financial and Quantitative Analysis, pp391- 405

Daniel Jeffery Koch, Marion A. Weissenberger- Eibl (2011): Gesamtkostenrechnung TCO, Fraunhofer- Institut für System- und Innovationsforschung

Darrel K. Rigby (2015): Management Tools 2015: An Executive's Guide, Bain & Company

David Hillier, Stephan Ross, Randolph Westerfield (2011): Corporate Finance: The European Edition, McGraw Hill Higher Education

David Nickles (2004): IT- Business Alignment: What We Know that we still do not Know, Proceeding of the 7th Annual Conference of the South Association for Information systems, 2004

Erik Angner (2012): A course in Behavioral Economics, Palgrave Macmillan, p30

European Commission (2010): An integrated Industrial Policy for the Globalization Era Putting Competitiveness and Sustainability at Centre Stage, SEC 2010

F. M. Abbott (2000): Distributed governance at the WTO- WIPO: an evolving Model for open architecture integrated governance, Journal of International Economic Law, (3)2001, pp63- 81

Forster, R. (1986): innovation: The Attacker's Advantage, New York: Summit Book

Harald Ehrmann (2007): Kompakt- Training: Balanced Scorecard 4. Auflag, Friedrich Kiehl Verlag

Harrington S. E., Niehaus G. (2002): Enterprise Risk Management: The Case of United Grain Growers, Journal of Applied Corporate Finance

Heiserich, Otto- Ernst., Helbig, Klaus., Ullmann, Werner. (2011): Logistik: Eine Praxisorientierte Einführung, Gabler Verlag

Herwig R. Friedy, Walter Schmidt (2000): My Balanced Scorecard, Rudolf Harfe

Verlag, Freiburg i. Br.

Hubert, R (1998): Capital Market Imperfections and Investment, Journal of Economic, March, 1988 pp193- 225

IBM: Risk Appetite: A Multi- faced Approach to Risk Management, April, 2008

IDG Business Media (2011): Die IT- Fakten der 120 Größen Unternehmen in Deutschland, IDG Business Media GmbH, p129

Ivan Png, Dale Lehman (2007): Managerial Economics 3rd Edition, Blackwell Publishing Ltd, Oxford

Jean Triole (2006): The Theory of Corporate Finance, Princeton University Press

John Braithwaite, Peter Drahos (2000): Global Business Regulation, Cambridge University Press

John Marthisen (2008): Risk Takers: Use and abuses of financial derivatives 2nd Edition, Prentice Hall, Pearson Education

Jürgen weber, Utz Schäffer (2014): Einführung in das Controlling, 14 Auflage, Schäffer- Poeschel Verlag

Kaplan R., D. Norton (1996): The Balanced Scorecard, Cambridge, MA: Harvard Business School Press

Limberg T. (2008): Examining innovation Management from a fair process

perspective, Gabler Verlag

Lisa K. Meulbroek (2002): A Senior Manager's Guide to Integrated Risk Management, pp56- 70

Manfred König, Rainer Völker (2002): Innovation Management in der Industrie, Carl Hanser Verlag

Margaret A. White, Garry D. Bruton (2007): The management of Technology and Innovation

Melissa A. Schilling (2013): Strategic Management of Technological Innovation, 4th Edition, McGraw- Hill Education

Nils Kraizy (2013): Innovation in Small and Medium- Sized Family Firms: An analysis of Innovation- Related Top Management Team Behaviours and Family Firm- Specific Characteristics, Springer Gabler, Wiesbaden

Norbert Klingebiel (1999): Performance Measurement, Gabler Verlag

Oliver Gassmann, Ellen Enkel (2004): Towards a theory of Open Innovation: The core Process Archetypes, R&D Management, 36(3), pp223- 228

Oliver Gassmann, Ellen Enkel (2006): Open Innovation, Die Öffnung des Innovationsprozess erhöht das Innovationspotenzial, Zeitschrift Führung + Organisation (ZFO), 75(3), pp 132- 138

Osterwalder A, Pigneur Y. (2010): Business Model Generation: A Handbook for

Visionaries, Game Changers, and Challengers, Hoboken

Paul G. Keat, Phillip K. Y. Young, Stephan E. Erfle (2014): Managerial Economics: Economic Tools for Today's Decision Makers, 7th Edition Pearson Education

Per Henriksen, Thomas Uhlenfeldt (2006): Contemporary Enterprise – Wide Risk Management Frameworks, Copenhagen Business Press School Press

Persaud, A. (2005): Enhancing synergistic innovative capability in multinational corporations: An Empirical Investigation, Journal of Product Innovation Management, pp412- 429

Philipp Walter Sauter (2014): Managing Dispersed Innovation in SMEs, PhD Dissertation, university of St. Gallen, 2014

Reiner Clement, Dirk Schreiber (2015): Internet- Ökonomie, Springer Gabler Verlag, pp278- 287

René M. Sturz (1993): Rethinking Risk Management, Journal of Applied Corporate Finance, pp8- 25

Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2000): Managing Global Innovation- Uncovering the secrets of future Competitiveness (2nd revised Edition), Springer- Verlag, Berlin, Heidelberg, New York

Roman Boutellier, Oliver Gassmann, Maximilian von Zedtwitz (2008): Managing Global Innovation- Uncovering the secrets of future competitiveness (3rd Edition), Springer- Verlag, Berlin, Heidelberg,

Robert C. Merton (2006): Allocating Shareholder of Capital to Pension Plans, Journal of Applied Corporate Finance, pp15- 24

Schaltegger S., Dylick T. (2002): Einführung: Nachhaltig Management der Balanced Scordcard: Konzept und Fallstudien, Gabler Wiesbaden

Simons R. (2000): Performance Measurement & Control System for Implement Strategy, Prentice Hall, New Jersey

Stephan Penman (2015): Valuation: The State of the Art, Schmalenbach Bus Rev (17), pp3- 23

Stevenson H., Jarillo J. (1990): A Paradigm of Entrepreneurship: Entrepreneurial Management, Strategic Management Journal, 11(4), pp17- 27

Sydney Finkelstein (2002): The DaimlerChrysler Merger, Tuck School of Business at Dartmouth, (1) 71

Tony Davies, Tony Boczko, Jean Chen (2002): Strategic Corporate Finance, McGraw-Hill Education

Torben Juul Anderson (2006): Global Derivatives: A strategic Risk management Perspective, Pearson Education, Harlow, England

Torben Juul Anderson (2008): Global Derivatives: A strategic Risk management Perspective, 2nd Edition Prentice Hall, Pearson Education

Torben Juul Anderson, Peter Winther Schroder (2010): Strategic Risk Management:

how to deal effectively with major corporate exposures, Cambridge University Press

United Nations (2011): Objectives and themes of the United Nations Conference on Sustainable Development, Report of Secretary- General, December 2010, New York: United Nations

United Nations (UN) (2012): The Working Paper of the Future We Want, New York: United Nations

United Nations Commission on Sustainable Development (UNCSD) & United Nations Conference on Trade and Development (UNCTAD) (2011): Trade and Green Economy: In Rio+ 20 issues briefs, New York: UNCSD Secretariat and UNCTAD

World Commission on Environment and Development (WECD) (1987): Our Common Future, Oxford: Oxford University Press

E- papers:

Bernard Sinclair- Desgagné (2013): Greening Global Value Chains: Some Implementation Challenges, Policy Research Working Paper, World Bank, <http://openknowledge.worldbank.org/handel>, September 2013

European Central Bank, (2014): Survey on the Access to Finance of Enterprises in the Euro Area, www.ecb.europa.eu, November 2014

European Central bank, (2013): Statistics Paper Series: Task Force on Valuation of Foreign Direct Investment Positions final paper, www.ecb.europa.eu/pub, (4) December 2013

European Central Bank, (2014): SMEs Access to Finance in the Euro Area: Barriers, and Political Policy Remedies, monthly bulletin, <https://www.ecb.europa.eu/pub/research/working-papers>, July 2014

European Foundation for Quality Management, (2013): An Overview of the EFQM Excellent Model, www.efqm.org, EFQM Brussels

Olaf Weber (2013) Impact measurement in microfinance: Is the measurement of the social return on investment: an innovation in microfinance, Journal of Innovation Economics & Management, <http://www.cairn.info/revue-journal-of-innovation-economics-2013-1>, 01, 2013

J. Stephen McNally (2013): The 2013 COSO Framework and SOX Compliance, www.coso.org, June 2013

Larry Rittenberg, Frank martens (2012): Enterprise Risk Management- Understanding

and Communicating Risk Appetite, www.coso.org, January 2012

Patchin Curtis, Mark Carey (2012): Risk Assessment in Practice, Committee of Sponsoring Organizations of the Treadway Commission, www.coso.org, October 2012

Megatrends- Chance und Risiken für KMU 2011: Innovation, www.credit-swiss.com/businessparket,

Global Trends in Corporate Governance, www.deloitte.com, Dec 2015

The Future of the Pencil: Faber- Castell Cosmetics: Innovation and Personalization, www.economist.com, 2013

G20/ OECD Principles of Corporate Governance, www.oecd.org/drf, Sep. 2015

IFRS in Focus, www.irsplus.com, April 2013

Francesca Ricciardi (2013): Innovation Process in Business Network, Wiesbaden, www.springer-gabler.de,

Edith Olejnik (2013): International Small and Medium- sized Enterprises: Internationalization Patterns, Mode changes, Configurations and Success factors, Wiesbaden, www.springer-gabler.de, 2013

Patricia Hofmann (2013): The impact of International Trade and FDI on Economic growth and Technological Change, Physica- Verlag, a brand of Springer, Heidelberg, New York, London, www.springer.com,

Consultation Draft of the International (IR) Framework, www.theiirc.com, April 2013

Green Economy, www.trendreport.de, June 2016

UN General Assembly, Resolution 42/ 186, Environmental Perspective to the Year 2000 and beyond, www.un.org/documents, 11 December, 1987

World Investment Report 2015, Reforming International investment Governance, New York and Geneva, www.unctad.org/wir, 2015

Corporate websites and Homepage:

Adidas Corporate Investor Relationship Presentation: Open Source, www.Adidas-group.com, July 2016

Bayer Annual Report 2015, www.bayer.de,

Bayer Combined Management Report 2013, www.bayer.com,

BASF SE Financial Statements 2015 and Management's Report, www.basf.com,

Intelligent Energie- Ein Weißbuch des Creator Space™, www.basf.com,

Daimler AG Annual Report 2015, www.daimler.com,

Daimler AG Management Report; Daimler at a Glance, www.daimler.com,

Daimler AG Management Report: Corporate Presentation Fiscal Year 2015,
www.daimler.com,

Daimler AG Management Report: Daimler Corporate Presentation 2014,
www.daimler.com,

Daimler AG Management Report: Head of Mercedes- Benz Trucks, www.daimler.com,

Daimler AG Management Report: Corporate Presentation Spring 2016,
www.daimler.com,

Daimler AG Management Report: Corporate Presentation Summer 2016,
www.daimler.com,

Daimler AG Management Report: Sustainable Management 2015, www.daimler.com,

The LEGO Group: A short Presentation 2016, www.LEGO.com/aboutus,

Declaration

I hereby declare that I prepared the dissertation submitted independently and no other means and sources apart from specified were applied. Furthermore I have NOT made payments to third parties for any part of the submitted dissertation. The paper has not submitted in a different degree programme at the same time or in a similar form and has also not been published yet as a whole.

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Signature of the Author – (Name, First Name in print)