Prioritizing and selecting KP
An AHP-based model to evaluate the alignments among strategy business model and performance metrics

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Prioritizing and selecting KPIs

An AHP-based model to evaluate the alignments among strategy, business model and performance metrics

By

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Abstract

Purpose: Big data innovations and developments bring opportunities to leverage the impacts of performance metrics on business strategy making process. The purpose of this research is to study the selection of performance metrics based on preferences of strategy makers, and find out what metrics are prioritized in current business strategy makings and how to assess the alignments among strategy, business model and business processes.

Design/methodology/approach: The authors prioritized group commitments and commitment KPIs in a case study of a large technical company in Netherlands, using the AHP approach for multi-criteria decision makings. Hardcopy questionnaire and interview sessions were used in collecting data to analyze the prioritization results.

Findings: Based on the prioritization results of business strategies, we find decision makers strongly prefer strategies with financial goals and this preference causes the imbalance of financial and non-financial metrics on the dashboard. The prioritization of metrics is highly influenced by the data availability of management reporting. Prioritization of performance metrics are data driven and bring bottom-up impacts on the dynamics of strategy makings.

Research limitations/implications: With regards to the impact of multi-actor networked decision-makings, the study finds that further research needs to explore factors that impacted strategy making more thoroughly. The conflicted interests of stakeholders, internal policy, and the excessive amount of metrics make strategic decision makings difficult.

Practical implications: The application of AHP in the case study contributes to improving the speed of decision-making processes, providing scientific results on KPI prioritization and selection, and providing an approach to assess the differences between what strategy makers think and what they execute and prioritize on a practical level. The prioritization of performance metrics is a sustainable approach that can be extended to other strategic decision makings as well, for example prioritizing of business model elements or business processes.

Originality/value: This research proves that the multi-criteria decision-making approach AHP can be used to prioritize and identify strategic focus based on selections of performance metrics. The research also demonstrates the importance of combining bottom-up data-driven analytics with top-down strategy making processes in big data developments.
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1 Introduction

Information is multiplying at an exponential rate and companies increasingly want to take advantage of fast-moving and complex data to achieve improvements in business performance (Platt et al., 2014). Information technology is positioned as a critical driver for improving business performance by organizational transformations, new business process designs, and new organizational and industry structures (Martikainen & Halonen, 2011). Traditional information systems used by organizations in decision making has primarily focused on historical events rather than real-time changes (Bhimani, 2015). However, rapid developments and evolutions of big data have been not only challenging the conventional technology but also offering enormous opportunities and advantages for companies that learn how to harness it (ATKearney, 2013). More than 90 percent of Fortune 500 companies were estimated to have at least one big data initiative in 2013 (ATKearney, 2013). A recent study reveals that “… Big data now poses a challenge to enterprises in that it arises from wider configurations of information pools – past and present, structured and unstructured, formal and informal, social and economic, and which constantly evolve in their content and representation …” (Bhimani, 2015). How to unleash possibilities in the strategy making process and create strategic value via big data innovations has become a top concern for a growing number of organizations. Managers and researchers encounter extreme difficulties while assessing alignments between performance metrics and business strategy, business models, and business processes. We categorize these difficulties as misalignment of strategic objectives, poorly operationalized business models, and implementation barriers in business processes (Bouwman et al., 2013; Neely, 2008).

Misalignment in tracking strategy using performance management

Existing strategy-making process typologies are organized by three themes: rationality, vision, and involvement (Hart, 1992). Since human judgment contains heuristics and biases, the strategic process could not be a fully “comprehensive, exhaustive, and analytical” in approach. The achievable level of rationality is limited by behavioural issues, for example, bounded rationality, satisficing, and political behaviour. To solve implementation problems of strategy making, researchers suggest that “the extent and type of involvement of organizational members” plays a significant role in the process (Hart, 1992). Mintzberg (1987) defines strategy with five Ps: play, ploy, position, pattern, and perspectives. The level of rationality is reflected by the first Ps, and the perspectives indicate that strategy-making process is a multi-actor decision-making process (Hart, 1992).

Based on extensive existing empirical studies, firm performance is used to measure the extent of success in strategy making processes. Kaplan and Norton (1996) designed strategy map to help firms translate strategy into operational terms, and they developed the Balanced Scorecard to align organizations to strategies with objectives, targets, and initiatives. The Balanced Scorecard has strong influences on the developments of existing performance management frameworks. Various performance management schemes and key performance
indicators (KPI) have been developed and widely applied by organizations all over the world. However, Neely et al. (2008) argues that performance measurement plays a tactical role rather than a strategic role. Traditional financial indicators have been dominating the dashboards of Executive Committee for decades. More than 90 percent of directors and executives of large international corporations believe non-financial indicators are critical, but less than 50 percentages are capable to report non-financial indicators (Lacker, 2014). Companies reported that “undeveloped tools” are being used to analyse non-financial indicators (Lacker, 2014). Unlike the dominant roles in operational decisions, enterprise performance management has very limited impacts on strategic decisions due to the lack of integrated technology and poor quality data (Neely et al., 2008).

Nowadays, big data innovations enable organizations to measure all kinds of performances. However, limitless information is being analysed with limited imagination and limited processing power (Priestley, 2015). Despite a little bit more data support, same questions being asked in the past still receive the same answers (Priestly, 2015). To alter the dynamics of organizational decision making and authority, strategic makers are required to articulate big data-drawn insights into “convincing argumentative terms” to support managerial action (Bhimani, 2015). It is critical for firms to identify effective performance metrics to track strategy making process, and translate the results of business performances into “convincing argumentative terms”.

Business model and performance management

“Business model is frequently mentioned but rarely analyzed” (Teece, 2010). In past decades, researchers have developed various business model concepts and frameworks. Some business models have been widely used all over the world, for example, the CANVAS business model proposed by Osterwalder (2002). However, existing research and literature primarily focus on the high-level conceptualization of business model (BM) and BM innovations, the practical implementation and operationalization of BMs are rarely developed (Bouwman et al., 2013). Based on an extensive literature research and analysis, Bouwman et al. (2013) identify following knowledge gaps between existing research and practices (Table 1-1).

![Table 1-1 Limitation of existing BM research (Adapted from Bouwman et al. (2013))](image-url)

<table>
<thead>
<tr>
<th>Research perspective</th>
<th>Existing literature research</th>
<th>Further research direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High-level conceptualization</td>
<td>Practical implementation of concepts and ideas</td>
</tr>
<tr>
<td>Unit of analysis</td>
<td>Individual organization/firms</td>
<td>Networked organizations/firms</td>
</tr>
<tr>
<td>Attention to metrics</td>
<td>Specific issues, e.g. the performance of processes, supplier selection, financial and investment performances.</td>
<td>Adopt a BM perspective from a value network or business networked environment</td>
</tr>
<tr>
<td>Perspective of BM analysis</td>
<td>Qualitative or design-focused analysis</td>
<td>Quantitative analysis including customer-related, service-related, technological, organizational, financial and other operational metrics</td>
</tr>
</tbody>
</table>
To overcome knowledge gaps and help BM designers to develop more viable and feasible business models, researchers proposed to use a specific set of performance metrics to help business model designs and analysis. Proposed metrics are categorized in eight perspectives: customer, service, technological, organizational, financial, value exchange, information exchange, and process exchange (Bouwman et al., 2013). Four design cases were used to examine how performance metrics can assist BM designers in business model design and analysis. Results show that the use of proposed metrics helps BM designs by increasing focus on strategy outcomes and business performance levels (Bouwman et al., 2013). However, the four design cases strongly concentrate on individual companies with a relatively small set of metrics (less than 20 metrics). Companies with large complexities and interdependencies usually use a larger amount of metrics while measuring business performance and developing new business models. It is unclear how to select such a smaller set of metrics from a repository with thousands of metrics and how metrics can improve operationalization of business models in a large multi-sector corporation environment.

**Implementation barriers of performance management**

“The story of performance management for most organizations has not been a happy or successful one in the past” (Barrows & Neely, 2011) Since 1980s, numerous performance management frameworks are defined. Performance indicators or metrics are defined with the goal of leading “effective decisions, actions, and alignments of strategy and organizations” (Barrows and Neely, 2011). However, execution gaps and barriers impede adoptions of new performance management systems and performance metrics (Neely, 2008). The lack of understanding and poor information quality of performance metrics obstructs managers to identify and assess alignments of strategic goals and business objectives.

To summarize, existing research underline the urgency to investigate alignments among strategy, business model, and performance metrics. Even though scorecards and business models have been widely used in the past, what remains implicit and underdeveloped is what evaluation criteria determine the effectiveness of performance metrics, how to evaluate alignments in operations, and how to prioritize and select the optimal set of performance metrics to achieve strategic goals and reach high level of business performance. To explore these questions within a real-life setting, this study focuses on a particular research domain, i.e., the prioritization and selection of performance metrics in a large technology company with multi-sector and complex enterprise environments. The next section elaborates on the research unit and what problems are in this particular research domain and why it is an attractive area for studying prioritization of KPIs and alignments among strategy, business model, and performance metrics.
1.1 Research domain

This study focuses on the research domain of prioritization and selection of performance metrics of Royal Philips, a large technology company with multi-sector and complex enterprise environments.

As a corporation with 123 years of history, it always strives to improve people’s lives through meaningful innovations. Royal Philips’ strong capability in research and its competitive advantage enabled the company to achieve its visions. However, the internal **operational issues** hampered the business performance the most (Philips, 2012), despite the slower market growth and margin pressure from higher material prices. Quoting from the present CEO Frans van Houten in an interview, “… the one thing where we need to improve most is **operational excellence**. It is in fact that lack of operational excellence that slows us down. If only we can bring our innovation faster to market, without waste, without mistakes, we will impress our customers so much more”. This quote emphasizes the urgency to thoroughly examine the operational issues.

To monitor the status of operations and steer business performances on a strategic level, a common and standard structure of management reporting is required. Now, each business group autonomously manages and reports its operational performance, this results in a large number of performance indicators and difficulties in comparing business performances across business groups, markets, and functions. For example, the KPI “order fulfillment lead time” used to have two different definitions and calculations in business group Lighting and business group Healthcare. Markets in Europe and Markets in North Latin America have different customizations on SAP systems (enterprise software to manage business operations and customer relations) that lead to different results of a KPI.

The high variety of operational performance indicators and performance management system makes it difficult to devise an actionable strategic plan. Thus, the performance measurement team is leading the design and implementation of a new standard performance management system. However, this team gets resistance from business groups when harmonizing various performance metrics’ definitions into a standard one. The new standard performance management system still contains a large number of performance metrics. The executives, operation managers, and the performance measurement team recognize that a large number of performance metrics is diluting focus of business activities and reducing the effectiveness of the new performance management system. The executives are searching ways to re-assess the effectiveness and priorities of metrics. It is unclear which metrics are critical to analyze business performance, to generate business values, and to align objectives of business strategy, business models and business processes. Following sections detailed explain problems of performance metrics at Philips in three different levels: strategy, business model, and business process.
Strategy and commitment KPIs
The Executive Committee at Philips defines strategies with visions, missions and group commitments. Visions, missions, and group commitments illustrate what a company aims to achieve and lead strategic planning and annual operation plans. The execution of each group commitment is tracked by several commitment KPIs on commitment dashboard. Group commitments and commitment KPIs are updated yearly to reflect strategic changes. In 2015, the commitment dashboard contains 46 commitment KPIs that defined and selected by the Executive Committee. More details about group commitment and commitment KPIs can be found in Chapter 3 Case descriptions (p. 35). In this section, deficiencies of the commitment dashboard and commitment KPIs are discussed.

According to informal observations made by business analysts who build the commitment dashboards, they assert that a large number of commitment KPIs is aggregating complexities on management reports and confusing executives to make effective decisions and action plans. Both executives and operation managers suggest trimming down the number of KPIs to improve the effectiveness of management reports. Besides, existing commitment KPIs lack connections with business model designs and business processes. The company adopted a management tool named “Value Driver Tree (VDT)” that aiming to build links among business models, business processes and performance metrics via value drivers. Deloitte develops the original VDT framework to link strategy to values (Lukac & Frazier, 2012). However, the value drivers (e.g. revenue growth and asset efficiency) are too generic to indicate the specific focus of the company. Each value driver is linked with hundreds of metrics. It is difficult to tell which metric is the “key” to this value driver and what causal relationships are between strategic level metrics (commitment KPIs) and operational level metrics (metrics of business models and business processes).

Business model and performance metrics
“The concept of business models is relatively new to Philips and rarely being used by business groups,” quoting from a program manager working in the End2End business transformation team. Philips started its business transformation journey in 2011. Back then, more than 200 business models were defined based on the high diversity in products, for example, business model shavers or business model medical devices. To transform the company from a function-oriented organization to a process-oriented organization, a standard business process framework - Philips Excellence Process Framework (PEPF) is developed. Two hundred business models are simplified to four categories: Product, Services, Software and Systems. Each new business model is mapped with several business processes from the PEPF framework. However, after mapping business processes with different categories of business models, the operationalization of business models stopped. The company turns to focus on the design and implementation of new business process framework and integrated IT infrastructures.

Osterwalder (2002) identified “a business model is positioned as the conceptual and architectural implementation of a business strategy and as the foundation for the implementation of business processes”. At the current state of Philips, not only the design of
business processes and business model designs are reversed, but also the links between business strategy and business models are broken. Based on informal observations made by managers from different business groups, managers hardly use four new business models to pursue strategic focus and no specific metric is available to measure performance of business models. Existing business model designs at Philips are highly conceptualized with poor operationalization.

**Business process and performance metrics**

Performance metrics are defined and selected due to designs of the new business process framework (PEPF). The new business process framework (PEPF) contains 325 business processes, and each business process has 5 to 10 “key” performance indicators and multiple performance indicators. In total, the repository of Philips records in 2362 performance metrics (sum of key performance indicators and performance indicators) till December 2014, and the number keeps growing. The large number of business processes directly cause the large number of business process metrics. The implementation barriers resulting from the multiple actors involved in KPI designs indirectly impact the increasing number of metrics.

Actors from different business groups must have to be involved when designing a new and standard performance management system of a large technology company. Problems occur when these actors have difficulties in reaching consensus on standard KPI definitions due to conflict interests. When harmonizing multiple KPI definitions into a standard one, every actor has an opinion because the new definition may affect their performance and benefits in the future. Actors can spend months to discuss one single KPI. No consensus on KPI definitions means all former dissimilar metrics have to be maintained in the new system. No consensus on KPI selections also leads to the increasing number of metrics. For example, one actor prefers to use five metrics to measure a business process, but another one prefers to use seven other metrics. One single business process may end up with being measured with five or ten more metrics.

The large number of performance metrics is not only adding complexities in measuring performances of business processes, it will also take a considerable length of time and huge investments to implement all new metrics. Figure 1-1 shows the processes of KPI design and implementation. At the current state, the executions of these processes at Philips are slow and inefficient.

![Figure 1-1 the processes of KPI design and implementation](image)
Note for abbreviations:

BPO: Business Process Owner. Responsible for designs of business processes and approve KPI definitions provided by BPE.

BPE: Business Process Experts. Business Analysts belong to a BPO group, accountable to provide detail KPI definition as inputs to BPO.

BIE: Business Information Experts. Business Analysts belong to a BIO (business information owner) group. They handle mapping the logical KPI formula to the logical data model in the systems.

IT: Information Technology team. They are accountable to deliver the end report with BI tools or IT infrastructures.

As presented Figure 1-1, each KPI takes eight steps from the proposal to the implementation. The design and implementation of a new KPI require actors from four different groups (BPO, BPE, BIE, IT). The performance measurement team is positioned as a coordinator for the whole processes. According to a rough statistics of historical data, on average it takes six weeks to get approval for a new KPI definition (this implementation time can vary from 4 weeks to 12 weeks). It is unknown how long it will take to complete the implementations because the new integrated IT infrastructure is not available at this moment. As a temporary solution, a third party takes 12 weeks to build three dashboards with 26 KPIs. Based on this assumption, the design and implementation of over 2000 KPIs will take years. The design and implementation of a new performance measurement system will likely become less cost-effectiveness.

To conclude, the large number of performance metrics is a problem for executives, operation managers and the performance measurement team at Royal Philips. This large amount of performance metrics decreases the capability to track strategy executions, blurs the links between strategy and business models, and dilutes focus in design and implementation of a new performance measurement system. Problem owners are searching applicable method to identify which metrics are ‘key’ to track strategy executions and worth to be implemented, and how to assess the effectiveness of metrics and prioritize metrics based on certain criteria.

The research problem of this research is formulated based on the above descriptions as follows:

The large amount of performance metrics is adding complexities to the design and implementation of a new performance measurement system. The executives, operation managers and performance measurement team are losing focus and questioning the effectiveness of metrics in tracking strategy executions, measuring performance of business model designs and business processes. How to trim down the number of performance metrics, assess and increase the effectiveness of performance metrics which aligned with strategic focus are the main issues at the current state.

This research focuses on assessing the effectiveness and prioritization of performance metrics. It aims to explore how prioritization of metrics can evaluate and increase the implementation feasibility of a new performance management system, enable companies to effectively monitor strategic executions and align metrics with strategy, business models, and business processes. The research objective and research questions are defined in the next section.
1.2 Research objective and research question

In response to the problems revealed in previous sections, the aim of this study is:

“To improve the operationalization of business model designs and increase the implementation feasibility of a new performance management system by developing and evaluating a framework that trims down the amount of performance metrics while ensuring the alignments among strategy, business models and business processes.”

To achieve this research objective, this study focuses on the following main research question:

“How to trim down the amount of performance metrics and assess the effectiveness of metrics while aligning objectives of business strategy, business models, and business processes?”

Three sub research questions are defined to guide this study towards the desired end-state:

**RQ1.** What are the existing developments to align objectives of business strategy, business models, and business processes? What are the existing methodologies to trim down the amount of performance metrics?

First, literature studies are performed to explore existing developments on strategy, business models, performance metrics and performance management systems. Researchers have developed extensive performance management frameworks and metrics in past decades. To acknowledge what frameworks and methods have been applied and why execution gaps exist will help to understand the urgency of this study. The answer to these questions will contribute to identifying which methods or frameworks can be selected to develop the framework in this study.

**RQ2.** What methodology can be used and how the framework looks like, which trims down the amount of metrics and enables executives to assess alignments of business strategy, business models and business processes?

To answer this question, the research methodology is selected. By taking into account the characteristics of a multi-sector and complex enterprise environment, Multi-Criteria Decision-making Approaches are chosen. The insights gained in literature studies will provide a theoretical base for the selection. A case study is conducted to evaluate and validate the application of research methodology in empirical situations.

Therefore, the final question is formulated as:

**RQ3.** How to apply the proposed framework in a case to trim down the amount of performance metrics, assess the alignments of business strategy, business models and business processes? What can we learn from the case study to improve the
operationalization of business model designs and improve the implementation feasibility of a new performance management system?

The research methodology selected in RQ2 is applied in a case to answer this research question. Performance metrics of the strategic dashboard are prioritized by applying the Analytical Hierarchy Process (AHP) approach. Results of this prioritization are discussed and how the prioritization of performance metrics can contribute to achieving research objectives of this study is explained.

The research methodology selected in this study are introduced in the next section.

1.3 Research methodology and the scope

To align with research objectives and answer research questions, this study aims to: 1) reveal execution gaps identified in existing research and practical cases; 2) propose an assessment framework to fill the gap; 3) empirically validate the proposed framework in a case study. For the first point, it primarily relies on a theoretical review of existing studies and practical observations from problem owners. The second point requires a selection of research method and adjust the research method due to research domain requirements. The third point emphasizes the application of research method in a case with empirical data. Following paragraphs explain why this study integrates Multi-Criteria Decision-making Analysis and Analytical Hierarchy Process to design the framework and why chose case studies as an evaluation method. The scope of this research is determined according to the selection of research methods and are illustrated in the end.

Multi-Criteria Decision Analysis (MCDA) and Analytical Hierarchy Process (AHP)

Researchers develop various conceptual frameworks and methodologies to design and implement performance measurements in past decades, for example, the balanced scorecard proposed by Kaplan & Norton (1992). However, in practice, when a large number of KPIs is diluting the impacts on overall business and distracting the focus of executives and operation managers, few studies and frameworks are available to solve the problems. Shahin and Mahbod (2006) proposed an integration approach to identifying impacts of different performance indicators. They prioritized KPIs by utilizing the Analytical Hierarchy Process (AHP) analysis and goal setting with SMART (Specific, Measurable, Attainable, Realistic, Time-sensitive) criteria. The prioritization of KPIs with AHP approach is viewed as an application of multi-criteria decision-making analysis to minimize risks of goal settings (Shahin & Mahbod, 2006). The study of Shahin & Mahbod provides insights on the selection of research methodology in this research. Prioritizing the large number of KPIs may provide a solution to assess the effectiveness of performance metrics. Reasonings behind the choice of the Analytical Hierarchy Process (AHP) approach is explained as follows.

Firstly, the decisions on KPI prioritization and selection contain high levels of uncertainties and complexities, and MCDA is a suitable approach to providing support for dealing both. As introduced in the research domain section, actors from multiple business groups and
functions are involved in the design and implementation of KPIs and performance metrics. Uncertainties of the enterprise environment and conflict organizational interests bring a high level of decision complexities. It is unreliable for executives, operation managers, and the performance measurement to prioritize or choose KPIs based on “their guts”. A scientific methodology is needed to provide trustworthy results of decision makings. “MCDA is an activity that helps making decisions mainly in terms of choosing, ranking or sorting the actions” (Figueira, 2005). It is well-known by taking account into all criteria related to decision-making, which makes it as a suitable approach in this study.

Secondly, the prioritization and selection of KPIs contain qualitative and intangible criteria. AHP is an approach that enables to “use pairwise comparisons along with expert judgments to deal with the measurement of qualitative or intangible criteria” (Figueira, 2005). For example, Shahin & Mahbod (2006) use SMART criteria derived from goal setting theories as qualitative criteria for decision makings. The focus of this study is to trim down the number of performance metrics and assess alignments of business strategy, business models and business processes. Performances of business strategy, business models and business processes are usually measured by qualitative and intangible criteria. For example, an implementation of business process frameworks may require high data quality and sustainable designs. Thus, the selection of performance metrics to measure business performances is a decision activity contains qualitative and quantitative criteria as well. This study selects the AHP approach because it can fulfill the needs of decomposition, comparative judgment and synthesis of priorities (Shahin & Mahbod, 2006).

Thirdly, the MCDA and AHP approach are selected because of their extensive applications in the complex decision-makings environment in existing research. Montibeller and Franco (2010) suggest MCDA can support strategy workshops and facilitate the management team in making strategic decisions and shape strategic visions, as well as appraise strategic choices. The selection of performance metrics is part of strategic decisions to measure strategy executions. Thus, MCDA can be a suitable approach to support decision makings of performance metrics as well. Carlucci (2010) supports the possibility to apply MCDA and ANP (Analytic Network Process) in evaluating and selecting KPIs in his study. In 2013, Guo (2013) used AHP method to analyze the criteria design issues for the four domains (Customer, Technology, Service, Organization) of a business model. This application gives insights on exploring design criteria from the design of business models and business processes. Priority ranking of design criteria provides meaningful implications on improving business model innovations. The prioritization of performance metrics may support the assessment of alignments among business strategy, business models and business processes in a similar way.

**Case study**
The AHP method is selected as the research methodology of this study. To evaluate and validate the application of the AHP approach, a case study is performed. Schramm (1971) identified the essence of a case study: “it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result”. In this study, to
deal with the prioritization of performance metrics, it is essential to figure out: 1) why an AHP approach is taken, 2) how the AHP approach is applied, 3) and what results are due to such a prioritization. The main research question of this study is a “how” question, which is preferred to carry out case studies to increase the reliability of research (Yin, 1994).

Details of the case in this study are provided in Chapter 3 Case description. The application of the AHP approach is illustrated in Chapter 4 Research design.

The Scope

As mentioned in research domain section, the executives, operation managers and the performance measurement team at Royal Philips are facing problems in the design and implementation of a large number of performance metrics (over 2000 KPIs and performance indicators). In order to assess the effectiveness of existing metrics and identify the critical metrics for business strategy, business models and business processes, the prioritization of metrics is proposed as a solution. However, the large amount of metrics challenges the application of the AHP approach because existing studies have only applied this method with a relatively small set of KPIs or performance metrics (less than 20 metrics). Although the AHP approach has no theoretical limitations on the number of hierarchy levels and alternatives, pairwise comparisons of a large number of alternatives may become extremely time-consuming (Nikou, 2013). It is inefficient to ranking all 2000 KPI within one prioritization. The scope of the AHP application in this study needs to be specified and narrowed down to a feasible set of performance metrics.

Based on an analysis of commitment KPIs, business model metrics and business process metrics at Philips in research domain section, the scope of the AHP application in this study is determined to be the set of commitment KPIs from the Group commitment dashboard. This study chooses commitment KPIs as the scope because:

Firstly, Commitment KPIs are a feasible set of metrics with high maturity in design and implementations. All commitment KPIs (46 KPIs in 2015) recorded in the repository have clear strategic objectives and complete definitions (including business goals, description and calculation formulas). However, a majority of business process metrics (hundreds of metrics) recorded in the repository have either incomplete definitions or vague objectives. Meanwhile, no specific metrics are available or designed to measure performance of business models. Unlike the implementation of business process metrics lack the support from new IT infrastructures, the commitment dashboard is one of few management reports produced by the new IT infrastructures. The executives have used the results of commitment KPIs to manage business performances in 2014.

Secondly, Commitment KPIs bring most impacts on the design of business models and business processes. Philips conducts a top-down structure in target setting and goal cascading. For example, if the target of commitment KPI “increase sales growth” in 2015 is 10%, business group healthcare needs to deliver 7% sales growth and the rest needs to deliver 3% sales growth. Commitment KPIs are not only being used to measure performances across internal business groups and units, but also being used by external shareholders to assess the
overall performances of the company. The change and focus of group strategies are directly reflected in the selection of commitment KPIs. The results of commitment KPIs are leading the change and focus of business model designs and business processes.

To sum up, applying AHP approach to prioritize Commitment KPIs is suggested to bring the most impacts to reach research objectives - to trim down the amount of performance metrics while assessing the alignments of strategy, business models and business processes.

Assumptions for applying KPI prioritization in this case study are considered as follows:

1) The design and implementation of KPIs and performance metrics involve multiple actors and stakeholders. However, to ensure the prioritization can deliver effective and meaningful results, the scope of participants is limited, because the prioritization of commitment KPIs requires understandings of group strategies and performance management experiences. The Commitment dashboard is confidential and only accessible to executives and senior managers. Therefore, the participants for prioritizing commitment KPIs only take executives, senior operation managers and performance management teams into account.

2) Only the functionality of KPIs is being considered at this stage. Neither the implementation cost nor the technical IT infrastructure is being considered. This assumption is based on the fact that future financial investments are hardly estimated, and the IT infrastructures are still in transition when starting this study. Financial and technical context will impact the selection of KPIs, for example, budgets for IT implementations. However, when designing a new performance management system, business objectives are supposed to take the lead on selections of KPIs, not financial and technical boundaries. To secure the assessments of alignments among strategies, business models and business processes, KPIs are not allowed to be eliminated out of scope because they are too difficult or too costly to be implemented.

3) The change management of implementing new KPIs and a new performance management system is not considered of high importance in this study. Firstly, it is difficult to recognize strategic behaviors of managers when few KPIs are reported in a new fashion. Secondly, it is unclear how the transformed organization structure bring impacts on decision-makings and change management tactics. Those dynamics will become more significant once more new KPIs are implemented and put into practice.

The scientific contribution on academic research and the business relevance on management practice are revealed in the next section.
1.4 The scientific and business relevance

This study contributes to academic research by assessing the effectiveness of performance metrics while aligning objectives of business strategy, business models and business processes supported with empirical evidence. Although existing studies have developed various performance measurement models and systems, execution failures and a large number of performance metrics are still problems for managers in today’s practice. Large international companies with high diversity in businesses are facing difficulties with diluted and distracted performance management systems. Thus far, little attention has been paid to assess how to examine and improve the effectiveness and efficiency of performance metrics, while aligning strategic priorities with the selection of metrics. This study tries to improve the feasibility of operationalizing business models in management and add empirical evidence to theoretical developments.

In this study, Philips as a large technology company with multi-sector and complex enterprise environment, the diversity of businesses increases complexities but also creates opportunities to test theoretical frameworks and assumptions in practice. A majority of existing research and frameworks are developed based on qualitative analysis. To have more statically reliable and generalizable scientific findings, more quantitative methods are required. Thus, the application of Analytical Hierarchy Process approach contributes to adding developments of quantitative analysis in the field of business strategy, business models, business processes and performance management.

The business relevance of this study is to help the company trimming down the large amount of performance metrics by applying AHP approach in KPI prioritization. The application of AHP in the case study contributes to 1) improving the speed of decision-making processes, 2) providing scientific results on KPI prioritization and selection instead of based on managers’ guts, 3) providing an approach to assess the differences between what strategy makers think and what they actually executed and prioritized in operations. Besides, the prioritization of performance metrics is a sustainable approach that can be extended to other strategic decision makings, for example prioritizing of business model elements or business processes.
1.5 Outline of the thesis

Problems are identified from both theoretical and practical perspectives in this chapter. According to problems identified in the research domain and research objectives, research methodology is selected. As presented in Figure 1-2, Chapter 2 presents literature studies of existing research in strategy, business models and performance management. This literature review explores how strategy and business models are aligned with performance metrics, and what methods are developed to overcome knowledge gaps and execution failures. The findings of the review provide a theoretical base for selecting and applying AHP approach in the case study of this research.

![Figure 1-2 Outline of this thesis](image)

Chapter 3 describes the case in details. The structure of group commitments and commitment KPIs are illustrated as an empirical base for the research design in Chapter 4. By applying the AHP approach, group commitments and commitment KPIs are prioritized by senior operation managers, strategy makers and performance management professions. Results of the prioritization are discussed in Chapter 5. To assess alignments of business strategy, business models and metrics, the prioritization results of commitment KPIs are mapped with CSOFT-VIP business model perspectives. Chapter 6 concludes theoretical contributions of this study and provides managerial implications for managers to overcome execution gaps in the future. In the end, limitations of this study and suggestions for further research are discussed.
2 Theoretical development

This chapter reviews theoretical developments to answer the first research question “What are the existing developments to align objectives of business strategy, business models, and business processes? What are the existing methodologies to trim down the amount of performance metrics?”. Literature studies are structured as follows:

First, existing developments of strategy and performance management are elaborated. The balanced scorecard and recent studies on assessing the effectiveness of strategic KPIs are discussed. Section 2.2 reviews concepts of Business Model (BM) and developments of BM frameworks. To identify alignments of business models and business processes, researchers Solaimani and Bouwman (2012) develop a VIP framework to overcome the gap. In order to improve efficiency and feasibility of new business model designs and innovations, researchers categorize performance metrics into eight CSOFT-VIP perspectives. In Section 2.3, concepts of Performance Management and developments of performance measurement frameworks are discussed. This section focuses on methods developed for solving problems caused by a large number of metrics, KPI selection and prioritizations. Section 2.4 concludes the findings and contributions of this literature review. These findings aim to provide inputs for the choice of research methodology in Chapter 3 and the design in Chapter 4.

2.1 Strategy and performance management

This section contains two parts: firstly, a brief review on the influential balanced scorecard (BSC) is provided. It will focus on how BSC contributes to translating strategies into performance measures and what problems managers and executives are facing when adopting conceptual model into operations. Besides developments of BSC, researchers who have been working on assessing impacts and alignments between strategies and performance measures will be reviewed in the second part.

2.1.1 Strategy and strategy map balanced scorecard

Strategy becomes a field of study and practices in 1960s. Researchers, practitioners and organizations have extensively defined and discussed strategies and strategic management in past decades. In 1960s, Alfred Chandler defined strategy as “the determination of the basic long-term goals of an enterprise, and the adoptions of courses of action and the allocation of resources necessary for carrying out these goals”. In 1980s, Henry Mintzberg defined strategy with five Ps: plan, ploy, pattern, position and perspective, strategy in his words are more like a stream of actions and decisions rather than planning. In 2011, Max McKeown argued, “Strategy is about shaping the future” with human attempts to achieve “desired ends with available means.” At Philips, an operational manager defines strategy as how to help employees to contribute and achieve visions while a strategy maker from business group healthcare defines strategy as what a company aims to improve or achieve.

Kaplan and Norton (1996) perceive strategies as “the unique and sustainable ways which organizations create value”. They developed five principles for companies who want to
transform to strategy-focused companies with goals to pursue higher business performances, which are: 1) Translate the strategy into operational terms; 2) Align the organization to the strategy; 3) Make strategy everyone’s everyday job; 4) Make strategy a continual process; 5) Mobilize change through executive leadership. Strategy map is designed to help translate strategy into operational terms and the balanced scorecard (Figure 2-1) is designed for the second principle – align the organization to the strategy with objectives, measures, targets and initiatives.

Figure 2-1 the balanced scorecard

Figure 2-1 illustrates the key components of the balanced scorecard. It provides a way to analyze value-creation strategy in four perspectives: “

- Financial: the strategy for growth, profitability and risk, viewed from the perspective of the shareholder;
- Customer: the strategy for creating value and differentiation from the perspective of the customer;
- Internal business processes: the strategic priorities for various business processes, creating customer and shareholder satisfaction;
- Learning and growth: the priorities to create a climate that supports organizational change, innovation and growth” (Kaplan and Norton, 1996).

The four perspectives are not only helpful in combining traditional financial indicators and nonfinancial indicators in the performance management, but also have profound impacts on further designs of business models and business systems. For example, customer and financial perspectives are considered in various business model frameworks. Even though the balanced scorecard is one of the most influential business ideas in past 75 years (Harvard Business Review, 2001), it has pitfalls in implementations. Kaplan and Norton (2001) categorize those pitfalls into two groups: design failures and process failures.
**Design failures** usually happen in two situations. Firstly, failures occur when companies use too few or too many measures. Too few KPIs lead to an imbalance between the outcomes they want to achieve and the performance measures that drive the outcomes, and too many KPIs indicate the critical few are never going to be identified. Secondly, failures occur “when business units within the company are not aligned with an overall strategy” and each unit develops their own Balanced Scorecard due to their interests. In this situation, no common language is used across the organizations, and the balanced scorecard turns to “Scorecard Babel” (Kaplan and Norton, 2001). The two design failures are precisely described performance measurement problems at Philips. The company has too many KPIs and performance metrics, and different business groups lack alignments with the overall strategies.

**Process failures** often occur when organizations or scorecard projects:

- Lack of senior management commitment
- Too few individuals involved
- Keeping the scorecard at the top
- An over-long development process
- Treating the Balanced Scorecard as a systems project
- Hiring inexperienced consultants
- Introducing the Balanced Scorecard for compensation only (Kaplan and Norton, 2001).

Process failures are found in the case of this study as well. For example, the development process of Philips business transformation program is assumed to take five years, and too few individuals involved in implementations of a new performance measurement system. Only a group of less twenty members worked on this project at the beginning. “The journey (of implementing the balanced scorecard) is not easy or short, it requires commitment and perseverance, teamwork and integration across traditional organizational boundaries and roles” (Kaplan and Norton, 2001). Pitfalls are identified to help managers go through difficulties and make breakthroughs. However, the book does not explain how to avoid pitfalls and how to overcome failures in details. Further research and empirical studies need to explore actionable solutions or plans in practice.

**2.1.2 Studies on assessing alignments of business strategy and performance metrics**

Besides developments of new concepts and frameworks of strategies and performance management, researchers also focus on the operational performance of frameworks, the effectiveness and impacts of performance measurement in empirical studies. Literature reviews (Table 2-1) are given as follows to understand how researchers assess alignments of strategies and performance metrics and how these findings can contribute to solving research questions in this study.
<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Assessment studies</th>
<th>Methodology</th>
<th>Research findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venkatraman &amp; Ramanujam (1986)</td>
<td>Use a two dimensional classificatory scheme to analyze ten performance measurement approach in strategy studies First dimension: financial or operational Second dimension: primary data sources versus secondary sources</td>
<td>Conceptual model and literature studies</td>
<td>Highlight the advantages and limitations of different measurement approaches, including specific data-analytic issues and implications for operationalizing business performance. Limitation: not detail to metrics</td>
</tr>
<tr>
<td>McAdam and Bailie (2002)</td>
<td>Assess the effectiveness of performance measures and the alignments of metrics and business strategies Develop a business improvement model to be used as enablers for the alignment</td>
<td>Conceptual model</td>
<td>Studies confirmed performance measures linked to strategy are more effective, the alignment between measures, frameworks and the strategy must be viewed as a dynamic and complex issue Limitation: how this model contribute to improving implementations is not clear</td>
</tr>
<tr>
<td>Banker et al (2004)</td>
<td>Assess judgmental effects of performance measures linked to strategy, how strategically linked measures influence individuals' evaluations</td>
<td>Survey, Statistical analysis</td>
<td>Performance evaluations are influenced by strategically linked measures more than non-linked ones when evaluators acknowledge related business unit strategies Limitation: the balanced scorecard used in this study only contains few measures</td>
</tr>
<tr>
<td>Van der Stede, et al (2006)</td>
<td>Examine the relationship between quality-based manufacturing strategy and the use of different types of performance measures, as well as their separate and joint effects on performance</td>
<td>Survey</td>
<td>Performance measurement diversity benefits performance, companies that including objective and subjective nonfinancial measures has higher performance Limitation: assume all sample company are in equilibrium, can’t explain some subjectivity issues</td>
</tr>
<tr>
<td>Cavallieri et al (2007)</td>
<td>Align strategic profiles with operational metrics by using ASCOR model in after-sales service management</td>
<td>Conceptual model and case study</td>
<td>Strategic KPIs are aligned with operational metrics in four after sales B2C scenarios. Limitation: the framework is needed to be extended to more B2B industries and whole supply chain and service chain</td>
</tr>
</tbody>
</table>

A majority of studies listed in Table 2-1 use qualitative methods to assess the alignment between strategy and performance metrics, such as build conceptual models, conduct survey
and case studies. These studies provide a theoretical base to understand “why link strategy with performance measures” and “how the alignments contribute to improving business performance”. However, all above studies are analyzed based on a limited small set of performance metrics. It is unknown that whether or not existing methods can be applied to a larger set of metrics. Complex and an extensive set of performance metrics needs to be tested in further empirical studies. Next section will discuss how business model designs align with performance metrics, and reviews on how existing research assess the alignments are continued in section 2.3.3.

2.2 Business model and performance metrics

In this section, firstly, definitions of business models and business model developments are reviewed. To capture alignments between business model and performance metrics, the research with regards to business model and business processes alignments, especially the VIP model, are discussed. In the end, studies on a set of performance metrics proposed by researchers based on CSOFT-VIP business model are discussed.

2.2.1 Business model concepts and frameworks

The term “business model” was first appeared in an academic article in 1957 (Bellman, Clark, et al. 1957). It was most frequently used in relationship with Internet and technology during the 1990s (Osterwalder, 2005). Along with surge discussions of business model, academic researchers develop various definitions of business models. Influential ones are reviewed as follows.

"A business model is an architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues“ (Timmers, 1998).

"A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities“ (Amit and Zott, 2001).

"The functions of a business model are to articulate the value proposition, identify a market segment, define the structure of the value chain, estimate the cost structure and profit potential, describe the position of the firm within the value network and formulate the competitive strategy by which the innovating firm will gain and hold advantage over rivals“ (Chesbrough and Rosenbloom, 2002).

"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams“ (Osterwalder, 2004).

"Business model is a blueprint for a service (or product) to be delivered, describing the service (product) definition and the intended value for a target group, the source of revenue, and providing an architecture for service (product) delivery, including the resources required and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues“ (Bouwman et al., 2008).
Definitions of business models above contain several common elements, for example, value creation and proposition, customer needs and segments or the network structure of actors and partners. These elements have strongly influenced the design of business model frameworks. Table 2-2 briefly list some remarkable business model frameworks.

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>BM framework</th>
<th>Variables considered (business aspects)</th>
<th>Key methodological considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osterwalder and Pigneur (2002)</td>
<td>CANVAS Model</td>
<td>Value proposition; Target customers; Capabilities; Partner network; Key resources and assets; Information strategy; Distribution channels; Revenue model; Cost Structure and Profit model.</td>
<td>Brainstorming and applying changes to existing business models</td>
</tr>
<tr>
<td>Mitra (2005)</td>
<td>IBM Component Business Model (CBM)</td>
<td>Business competencies: Business administration; new business development; relationship management; servicing and sales; product fulfillment; financial and accounting; Accountability: Direct, Control and Execute. Business components</td>
<td>Define the concept of business components, provide the focus on both internal and external specialization.</td>
</tr>
<tr>
<td>Gordijn and Akkermans (2001)</td>
<td>E³-Value Model</td>
<td>Actor; Value Object; Value Port; Value Interface; Value exchange; Value offering; and Market Segment.</td>
<td>Integrate business and IT modelling</td>
</tr>
<tr>
<td>Bouwman et al. (2008)</td>
<td>STOF Model</td>
<td>Four domain in business models: Service domain; Technology domain; Organization domain and Financial domain.</td>
<td>Highlight value proposition and customer value creation</td>
</tr>
<tr>
<td>Heikkilä et al. (2005)</td>
<td>CSOFT Model</td>
<td>Customer segment or segments that are targeted. Service: Value creation of service and service types. Organization: knowledge, resources, roles and responsibilities. Financial: payment schemes, cost and revenue sharing between partners. Technology: Information and communication technology.</td>
<td>Adding long-term customer relationship into the business model design</td>
</tr>
<tr>
<td>Solaimani and Bouwman (2012)</td>
<td>VIP framework</td>
<td>Domain: Business Network; Resources &amp; Capabilities; Relations &amp; Interactions; Interdependencies &amp; Responsibilities. Oriented components: Value exchange Information exchange Business processes</td>
<td>An extended stakeholder analysis approach to analyze the interdependencies and dynamic operational arrangements</td>
</tr>
</tbody>
</table>

“Business model innovation is vitally important, and yet very difficult to achieve” (Chesbrough, 2010). Researchers and managers are confronting barriers when experimenting these frameworks in practice. The development of a new business model is often conflicted
with the traditional configuration of firm assets (Amit and Zott, 2001). Sometimes managers are even far from clear about “what the right business model ought to be” (Chesbrough, 2010). Companies are suggested to adopt an effectual attitude towards business model experimentations (Chesbrough, 2010).

Teece (2010) asserted, “The phenomenon (BM) is frequently mentioned but rarely analyzed”. The analysis of Business Model and its links with business processes or performance measurements are rarely developed (Bouwman and Van de Ham, 2003). Qualitative or design-focused approach has been frequently applied in new BM framework designs while the applications of quantitative approach and empirical studies are lacking.

The evolution of business model concepts and frameworks reflects the knowledge gaps as well. Gordijn et al. (2005) identified six phases of the evolution of business model research based on the previous study of Ostenwalder et al. (2002) (Figure 2-2).

Figure 2-2 presents changes from conceptualized business models to the application of BM concepts. Business model concepts and frameworks reviewed in previous part belong to phase 1-4. The knowledge gap, how to apply BM concepts and frameworks in Management and Information System are the focus of Phase 5-6. To conclude, practical implementation of concepts and ideas are the trend in the domain of business model research (Bouwman, 2013).

2.2.2 The alignments between business model and business process
To fill the gap “Business models are rarely analyzed” (Teece, 2010), recent studies focus on the relationship between business models and other business concepts. For example, how a business strategy can impact business model designs or what alignments of business models and business processes are. The alignments of business models and business processes are vital to identify alignments of business models and performance metrics because performance metrics are defined based on business process designs (The research domain (p. 4) mentioned in previous chapter introduces). Following paragraphs begin with studies of recent research
on the alignment of business models and business processes. Next, a review of VIP framework is given as theoretical base for further design in this study.

**Business logic triangle and missing links**
To clarify the relations between strategy, organization and system, a business logic triangle proposed by Osterwalder et al. (2005) is always used to illustrate the proposition of BM in the firms (Figure 2-3).

![Figure 2-3 the Business Logic Triangle (Adapted from Osterwalder (2005))]()

In this business logic triangle, business model describes the logics of a “business system” for value creation through actual processes. It is positioned as the conceptual and architectural implementation of a business strategy and as the foundation for the implementation of business processes (Osterwalder, 2002). The research of Heikkilä et al (2010) is one of the few studies which pointing out the missing links between business model and process models in the above triangle (Figure 2-4).

![Figure 2-4 the missing link in the business logic triangle (Adapted from Heikkilä et al. (2010))]()

In order to figure out the missing links, Heikkilä et al. (2010) propose a model to build up the alignments between business model and business processes based on the design the CSOFT model (Figure 2-5).
The five elements in CSOFT model are defined as follows (Heikkilä et al. 2010):

- Customers: the customer segment or segments that are targeted. The aim is to understand the need of the customer and what kind of customer relationship is established.
- Service: depicts the intended value of a service and the accompanying goods, and how it is created and provided. This includes defining the type, or different types, of services provided.
- Organisation: depicts the partners, knowledge and resources needed, as well as the roles and responsibilities.
- Finance: focuses on payment schemes, and cost and revenue sharing between the partners.
- Technology: depicts the information and communication technology that is embedded in the service, or supports the operations and collaboration.

Based on the design of CSOFT model, a six steps operational model is proposed to re-define the process from strategy objectives to business process modeling as follows (Figure 2-6).

**Strategy and Business Idea**

1. Define strategic objectives for the business model

**Market Segments**

2. Define customer segments with CSOFT
3. Recognize common service components
4. Determine KPIs

**Enterprise Architecture: Process, Information, Application, Hardware, Organization**

5. Analyze current and desired state of Enterprise Architecture
6. Determine KPIs

**Business Process Modelling**

Figure 2-6 Proposed operational for business model and business process alignment (Adapted from (Heikkilä, 2010))
The operational model presented in Figure 2-6 contributes to transform the conceptual model proposed by Osterwalder (2005) into a resource-based view on business process modeling, including required service components and investments in IT and other infrastructures (Heikkilä et al, 2010). The use of customer segmentation and service components also reflected the idea and design of Component Business Model (Mitra, 2005). However, the application of this operational model has limitations that require further empirical studies to verify and improve the design. First, the proposed model overlooks the impacts from stakeholders. For companies with small to medium sized organization structures, it is possible to gather all the CxOs to make decisions (Heikkilä et al, 2010). For companies with highly diversified and complex enterprise environment, every actor involved add complexities and uncertainties in the decision-making process. The alignments of business model and business processes need to take into account effects of stakeholders during the implementation, as well as the design of metrics.

On the other hand, key performance indicators are separately viewed as the final task on each level. Although the proposed model indicates that metrics are designed to “measuring the success of strategic goals” and KPI designs are combined into the alignment between business model and business process, the specification of metrics design and how to evaluate impacts of performance metrics on achieving strategic goals are missing. The interactions between different enterprise architecture elements are also overlooked.

The VIP framework – alignment of the business model and business process
Researchers Al-Debei and Avison (2010) share similar opinions as Osterwalder et al. (2005) on the relations between business models, business strategy and business processes. They drilled down the business logic triangle with two specific intersection points (Figure 2-7).

Al-Debei and Avison (2010) argue that “the BM is by no means independent; it intersects with the business strategy as well as the business processes including their supportive information system.” This study indicates the urgency to build and strengthen the alignments
between business strategy and business model, as well as the alignments between business model and business processes. Solaimani and Bouwman (2012) conclude two limitations for current studies on the alignment of business models and business processes. First, most alignment approaches are lacking theoretical foundation. The approaches are normally too generic to identify the most influential elements in the alignment. Second, those alignment approaches can hardly be adapted into a multi-actor environment. Comparing to a trans-sector-driven perspective, interpreting business in a mono-actor-driven perspective is less practical when dealing with a number of interrelations and interactions (Solaimani and Bouwman, 2012).

![Figure 2-8 the VIP framework (Adapted from Solaimani and Bouwman (2012))](image)

As shown in Figure 2-8, a VIP framework is proposed Solaimani and Bouwman (2012) to overcome the limitations of existing alignment approach. This framework addresses the close interrelations and interdependencies among three domain models: value exchange, information exchange and primary BPs.

**Table 2-3 Description of domain elements in VIP model (Adapted from Solaimani and Bouwman (2012))**

<table>
<thead>
<tr>
<th>Domain elements</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Exchange</td>
<td>&quot;What is offered by whom to whom and expect what in return?&quot; (Gordijn et al., 2000)</td>
</tr>
<tr>
<td>Actors (stakeholders)</td>
<td>An actor is an independent economic (and often legal) entity.</td>
</tr>
<tr>
<td>Value objects</td>
<td>Actors exchange value objects, which are money or goods.</td>
</tr>
<tr>
<td>Value activities</td>
<td>An actor performs a value activity for profit or to increase its utility.</td>
</tr>
<tr>
<td>(Value) goals</td>
<td>Intentions that should be achieved.</td>
</tr>
<tr>
<td>Value dependencies</td>
<td>How different actors are related to each other through goals, activities, and objects</td>
</tr>
</tbody>
</table>

Table 2-3 and Table 2-4 provide definitions per domain elements in the level of value exchange, information exchange and business process exchange (as presented in Figure 2-8).
**Table 2-4 Description of domain elements in VIP model (Adapted from Solaimani and Bouwman (2012))**

<table>
<thead>
<tr>
<th>Domain elements</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Exchange</strong></td>
<td><em>“To identify actors and their interactions and dependencies based on data, information, knowledge”</em></td>
</tr>
<tr>
<td>Information authorization</td>
<td>Access to data, information and knowledge.</td>
</tr>
<tr>
<td>Data objects</td>
<td>Numbers, characters, images, or other method of recording, in a form that can be assessed by a human or (especially) input into a computer, stored and processed there, or transmitted on some digital channel.</td>
</tr>
<tr>
<td>Information objects</td>
<td>The result of applying data processing to data, giving it context and meaning.</td>
</tr>
<tr>
<td>Knowledge objects</td>
<td>The objects, concepts and relationships that are assumed to exist in some area of interest.</td>
</tr>
<tr>
<td>Information flow</td>
<td>How information flows from one actor to another</td>
</tr>
<tr>
<td>Trust dependency</td>
<td>The relationship between two actors that expresses that information has to be exchanged (or an activity has to be carried out) by one actor before the other actor does anything.</td>
</tr>
<tr>
<td><strong>Primary BPs</strong></td>
<td><em>“how the activities are carried out, and how they are related to each other”</em></td>
</tr>
<tr>
<td>Process Unit Boundaries</td>
<td>Units are used to confine the scope of a set of related processes belonging to a particular system, task, or organizational unit and such</td>
</tr>
<tr>
<td>Business Process Behaviors</td>
<td>A set of graphical elements that represent the activities behavior, such as sequence flow, iterations, conditions</td>
</tr>
<tr>
<td>Primary Business Processes</td>
<td>The BPs of the first tier actors, which are required for creation and provision of the intended service or product</td>
</tr>
<tr>
<td>Business Process Dependencies</td>
<td>Within and between these process units all kinds of process dependencies emerge that requires the execution of one (or more) process (es) before another process (es) can be executed.</td>
</tr>
</tbody>
</table>

This VIP framework enables companies to conduct both descriptive and prescriptive applications in a multi-actor, networked-enterprise environment (Solaimani and Bouwman, 2012). A descriptive application will drive the business process design with the strategic and operational requirements. A higher level of inter-organizational and intra-organization coherency and consistency can be achieved based on a Business Model driven design approach. A Prescriptive application will be used to identify the misalignment of business process design and operational arrangements among multiple actors. The operational feasibility, viability and sustainability of the Business Model design can be estimated.

On the other hand, with concerns of identifying and clarifying the interactions and interdependencies in the Value, Information, Process exchanges, the application of this VIP alignment framework is able to deliver sustainable solutions with dynamic changes of needs and requirements. For example, changing strategic objectives, political forces, competitive environment and technological trends, all these changes will have impacts on the application methods and evaluation measurement criteria (Solaimani and Bouwman, 2012). However, in
this framework, Performance Metrics are positioned as a next step following the business process designs and are not well illustrated. In order to fill the gaps, a performance metric repository is proposed by Bouwman et al (2013) which aiming to help BM designers and managers to develop better business models with the help of a set of metrics. This set of metrics is discussed in 2.2.3.

2.2.3 Performance metrics to help BM designs

Based on previous studies on the alignment framework of Business Model and Business Processes proposed by Solaimani and Bouwman (2012), Bouwman et al. (2013) proposed metrics that aims to help managers and Business Model designers to achieve desired strategic goals and define relevant measurements for different level of operational implementations. By aligning with the components of CSOFT and VIP model, the set of metrics includes eight domain perspectives. Table 2-5 provides the detail description and example metrics per domain.

<table>
<thead>
<tr>
<th>Domain Perspective</th>
<th>Description</th>
<th>Metrics (example metrics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>Targeted customer segmentation; customer value creation; customer relationship management</td>
<td>Measures regarding to market segmentation, website usage, etc.</td>
</tr>
<tr>
<td>Service</td>
<td>Delivery, usage and effects of provided service</td>
<td>Customer satisfaction, loyalty and churn, the cost paid by consumers</td>
</tr>
<tr>
<td>Technical</td>
<td>Information and communication technology that enable products or service, supporting operations and collaboration.</td>
<td>System quality, data network capacity, enterprise architecture related metrics, etc.</td>
</tr>
<tr>
<td>Organizational</td>
<td>Available resources and capabilities to produce product and services</td>
<td>Network configuration, governance and commitment, supplier performance, etc.</td>
</tr>
<tr>
<td>Financial</td>
<td>Profitability and revenues</td>
<td>Measures regarding to cost factors, pricing schemes and models, etc.</td>
</tr>
<tr>
<td>Value exchange</td>
<td>Value exchange within the organizations and among suppliers and partners</td>
<td>Various value configurations</td>
</tr>
<tr>
<td>Information exchange</td>
<td>Data exchange, information flow and knowledge sharing</td>
<td>Information quality and information accessibility, data flow and value among actors, etc.</td>
</tr>
<tr>
<td>Process alignment</td>
<td>Inter-organizational process alignment among different operational-level of business activities, processes and systems</td>
<td>The number of process, process inter-dependencies between organizations, inter-organizational process coordination and compatibility</td>
</tr>
</tbody>
</table>

Table 2-5 Metrics for business model designs (Adapted from [Bouwman, 2013])

The proposed set of metrics is examined by four design case studies that are selected based on a replication principle and pragmatic considerations (Bouwman et al., 2013). The four cases not only include individual companies but also public organizations. For companies
with a focus on enterprise architecture design, interdependencies with other organizations, information exchange and process alignment are of high importance in achieving business model objectives. In all cases, performance metrics instrumentally help managers to design and implement of business models with the goal of achieving desired performance levels. However, the researchers also pointed out that proposed methodology needs more support and applications in empirical studies. The networked character and interdependencies within and among companies need to receive more attentions in the design of business model and performance metrics. The gap between conceptual business model design and empirical evaluations needs explorations.

2.3 Performance management and KPIs

Previous sections discuss existing developments from perspective of strategy and business models. Performance metrics or KPIs are frequently mentioned but rarely being integrated with same designs. In this section, to deep dive “the large amount of KPI” problem, firstly, concepts and frameworks of performance management and KPIs are reviewed. Next, executions gaps found in implementations of performance management systems are analyzed to provide insights on what problems are in the current state and what researchers suggest to overcome gaps. In the end, existing assessment frameworks of KPIs are briefly reviewed and elaborated. This review will provide theoretical bases and support on the selection of research methods and further research designs.

2.3.1 Performance measurement definitions and frameworks

The concept of performance measurement origins from the early accounting system, and has been extended to measure more than financial indicators based on the fast developments of industrial organizations. However, some researchers argued, “Performance Measurement is a topic often discussed but rarely defined” (Neely et al., 1995). Based on extensive literature studies, Neely et al. (1995) propose the following performance measurement and PM system definitions:

“Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action.”

“A performance measure can be defined as a metric used to quantify the efficiency and/or effectiveness of action.”

“A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions.”

Above definitions are precisely defined but hardly labeled in existing literature studies and frameworks. A review of existing performance measurement frameworks is provided as follows to provide a better understanding in developments (Table 2-6).
### Table 2-6 Performance measurement frameworks overview (Adapted from Neely et al. (1995))

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Framework</th>
<th>Dimensions and perspectives</th>
<th>Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross and Lynch</td>
<td>Performance Pyramid</td>
<td>SMART Strategic Measurement and Reporting Technique. Internal and external influences, both financial and operational information support the decision-making.</td>
<td>Link business strategy with day-to-day operations.</td>
</tr>
<tr>
<td>(1989)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitzgerald et al.</td>
<td>Results/Determinants</td>
<td>Five dimensions: Results (Financial performance, competitiveness); Determinants (Resource utilization, quality of service); Quality of service; Innovation; Flexibility.</td>
<td>Service businesses based. PM is part of feedback control in organizational learning and decision-making process</td>
</tr>
<tr>
<td>(1991)</td>
<td>Matrix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaplan and Norton</td>
<td>Balanced Scorecard</td>
<td>Four categories – Financial, Customer, Internal Business, and Innovation and Learning. Every category includes multiple measures and a goal.</td>
<td>Strategy and vision are addressed. Non-financial metrics are the same importance with financial ones.</td>
</tr>
<tr>
<td>(1996)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neely et al.</td>
<td>Performance Prism</td>
<td>Five perspectives – stakeholder satisfaction, stakeholder contribution, strategies, processes, and capabilities.</td>
<td>Developed from stakeholder’s perspective in a network view</td>
</tr>
<tr>
<td>(2002)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since 1980s, performance measurement frameworks were created to meet various needs for modern manufacturing techniques. The frameworks reviewed in Table 2-6 have more concerns on the overall performance of business instead of financially based traditional accounting measures (Neely et al., 1995). These frameworks can provide different perspectives for categorizing metrics, balance business needs and have been world widely implemented in companies. However, according to recent research, researchers claim nearly 70% initiatives to implement performance measurement system failed (McCunn, 1998). What are the barriers and gaps preventing successful implementations?

#### 2.3.2 Execution gaps in performance management

In order to figure out the barriers and gaps, researchers summarized following critical success factors and implementation barriers of performance measurement system based on case studies and consulting experiences of academic professions and practitioner (Table 2-7).

### Table 2-7 Critical factors and barriers of performance measurement implementation (Adapted from Neely et al. (1995))

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Critical success factors (CSF) and barriers of PM implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eccles (1991)</td>
<td>CSFs:</td>
</tr>
<tr>
<td></td>
<td>• Developing an information architecture with supporting technology</td>
</tr>
<tr>
<td></td>
<td>• Aligning incentives with the new measurement system</td>
</tr>
<tr>
<td></td>
<td>• The lead given by the CEO</td>
</tr>
</tbody>
</table>
Table 2-7 provides insights of these implementation barriers in 1990s. According to a recent research, most these barriers are still valid, and Neely et al. (2008) reframe these barriers into nine EPM (Enterprise Performance Management) gaps (Figure 2-9).

![Diagram](image.png)

*Figure 2-9 the drivers of the execution gap in Enterprise Performance Measurement (Adapted from Neely et al. (2008))
The execution gap: Most companies have the visions, but are facing troubles in executing it.
The advocacy gap: The level of measurement advocacy is highly influenced by the organizational hierarchy.
The trust gap: The passion of EPM is not passed on across the organizations. Biggest gaps exist between management teams and senior managers, senior managers and middle managers.
The credibility gap: 40% of respondents think their performance measures are based on poor quality data.
The technology gap: Integrated technology is lacking; the spreadsheet is still the most widely used PM tool.
The alignment gap: Organizations are struggling with integrate various operational and management systems.
The perception gap: Over-confidence. Few companies report their performances are worse than competitors.
The insight gap: Nearly half respondents lack a complete understanding of the causal relationships between performance measures.
The performance gap: EPM has very limited impacts on strategic decisions, unlike the dominant roles in operational decisions and key performance indicators.

Researchers claim that although significant progress have been achieved in Enterprise Performance Measurement, for most companies and practitioners, there are still long ways to go to overcome execution gaps. More academic research and practical case studies are needed to overcome the barriers and fill the gaps.

2.3.3 Assessment framework for key performance indicators

Besides those frameworks, some assessment models are built to measure the effectiveness of performance measurement system and performance metrics. In previous section 2.1.2, Table 2-1 reviewed the assessment studies with a focus on alignment of strategy and measures. In this section, Table 2-8 will provide a brief overview especially focus on assessment of metrics and KPIs.

Table 2-8 Performance measurement and KPIs Assessment Framework

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Key methodological considerations</th>
<th>Implications</th>
<th>Constrains and limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bititci et al. (2001)</td>
<td>Evaluate the performance of alternative strategic choices by using Analytical Hierarchy Process (AHP) approach</td>
<td>Applied a quantitative model for performance measurement system with strategy management</td>
<td>Performance criteria only contains cost, quality, delivery and flexibility, quite generic with no detail metrics</td>
</tr>
<tr>
<td>Cai et al. (2008)</td>
<td>Use a KPI accomplishment cost transformation matrix to explain interdependencies among KPIs</td>
<td>Quantitatively analyze the interdependent relationship of KPIs and propose performance improvement strategies</td>
<td>The framework applied in an actively deployed SCM environment; Only the iterations are simulated, hardly influence the mechanism details of KPIs</td>
</tr>
<tr>
<td>Shahin and Mahbod (2006)</td>
<td>Use SMART criteria as goal setting and Analytical Hierarchy Process (AHP) to prioritize organizational KPIs</td>
<td>Provide step-by-step guidelines for decision makers to conduct the prioritization process of SMART KPIs.</td>
<td>The framework does not provide guidance on appropriate action plan to address deficiencies; only SERVQUAL dimension is adopted in the framework.</td>
</tr>
</tbody>
</table>
Combine reviews in previous assessment studies on strategy (Table 2-1), it can conclude that both qualitative and quantitative models contribute to overcome the gaps in the design and implementation of performance measurement system. Conceptual models are more often being used to assess the alignment between strategic goals and performance metrics, and being validated by interviews, surveys or cases studies. Quantitative models are more likely being used to assess the effectiveness of performance measurement system and metrics, for example, the AHP approach or other mathematical iterative models. However, most assessment frameworks are built with a specific focus on certain business scenarios, for example, the after-sales service or business improvement initiatives (TQM, TPM, Six Sigma, et al.). The assessment models need to be extended in a much broader and generic way. On the other hand, past studies indicate that it is feasible to use multi-criteria decision-making approaches to prioritize and select KPIs, especially the application of AHP. Even though existing applications of AHP have limitations in providing sufficient guidance on action plans and managerial implications, these studies provide insights on the application of quantitative methods and point out potentials in further research.

2.4 Conclusion

This chapter reviews knowledge gaps between strategy and strategic KPIs, business model and performance metrics, and execution gaps in the design and implementation of performance measurement systems. To deep dive the gaps, existing theories and frameworks concerning strategy, business model and performance measurements are discussed. Literature studies reveal the need of building alignments between business models and performance metrics, the urgency to prioritize KPIs, and apply a generic set of metrics in more empirical studies. From perspective of theoretical development, it is argued that existing frameworks are not performing effectively and efficiently to enable managers and BM designers to 1) prioritize and select a set of performance metrics which aligned with strategic focus with goals of business models; 2) assess the effectiveness of performance metrics in practice. To overcome identified knowledge gaps and execution gaps, this study proposes an application of AHP method in prioritizing strategic key performance indicators in a multi-actor, multi-sector and networked environment. In the next chapter, the detail case description of the company and its strategies, business model and performance metrics are discussed. The case description will be used as a reflection of knowledge gaps in practice and provide contexts for further research designs.
3 Case description

Practical gaps of the research domain are identified in Chapter 1.1. By combining the inputs of literature studies, this chapter will describe the case of this study in details. How strategies, business models and performance metrics are being designed and implemented at Philips in the current state will be discussed. The case is described from three perspectives: strategy, business models and performance metrics. Case descriptions will provide an empirical base for research design in Chapter 4.

3.1 Strategy and strategic KPIs

In previous research domain section, we introduce that Philips defines its strategy with visions, missions and group commitments. The executive committee defines commitments and select commitment KPIs for tracking strategy executions every year. In this section, we will explain the contexts of Group commitments and Commitment KPIs in details, including what group commitments and KPIs are and how they are being used in the current state.

Group commitments

Group commitments of Philips in 2015 are: 1) Accelerate business growth and improve business performance, 2) by executing the *Accelerate!* Transformation, and 3) progressing on strategic priorities. Each group commitment contains several sub commitments (Table 3-1).

Table 3-1 Group Commitments and sub commitments

| Table 3-1 presents the Group commitments and sub commitments. Sub commitments are defined as detail explanations of Group commitments. For example, in order to “accelerate |
growth and improve performance”, the company need to “meet financial targets and gain market share”. Each business group and function team need to define their commitments by translating group strategies into specific business goals.

**Commitment KPIs**

In order to track strategy executions, each sub commitment uses a set of performance metrics (KPIs) to measure business performance. The Executive Committee and the global performance management team select and decide the commitment KPI list together every year. The structure of group commitments and commitment KPIs are presented in Figure 3-1.

![Figure 3-1 Group commitments and commitment KPIs](image)

**Figure 3-1** shows the structure of group commitments and commitment KPIs. For example, to measure the performance of sub commitment “Meet our 2015 financial commitments”, 7 KPIs are reported on the commitment dashboard, including EBITA, ROIC and other financial indicators. (Table 3-2). Detail definitions of commitment KPIs are listed in Appendix 1.

**Table 3-2 Group commitment KPIs - part 1**

![Table 3-2](image)

Table 3-2 shows that most KPIs belong to the first group commitment “Accelerate our growth and improve our performance” are financial indicators, for example, earnings per share or working capital. These financial indicators are not only being decomposed to targets for lower management groups, but also being used for external stakeholders and investors to compare and assess business performance of the company in the market. Another two KPIs that related to sustainability and improved lives metrics are special measures to reflect “how
many lives improved through innovations”, they are calculated and reported separately on the dashboard.

Table 3-3 Group commitment KPIs – part 2

Table 3-3 presents KPIs belong to the second group commitment “Executing the Accelerate! Transformation”. In this category, more operational KPIs are taken into account. These KPIs highlight the strategic focus of Philips on improving operational excellence, for example, KPIs related to customer service (NPS or Customer Service Level) and KPIs related to quality management (significant external inspection). On the other hand, some KPIs are used to focus on the measurement of internal operation efficiency. For example, “End2End – business model implementation” is a measure to track the progress of business model projects, “Value from E2E transformation” is a measure to reflect the direct benefits from transformation programs and “Blueprint activated” is a measure to indicate how far they are working towards separating one company into two.
Table 3-4 presents KPIs belong to the third group commitment “Progressing on our strategic priorities”. For this group commitment, KPIs are selected with two focus: 1) sales growth in specific business units and markets, for example, KPIs such as “profitability of turnaround business” or “realization of SPoR (Strategy Plan of Record)”; 2) increasing digital capabilities and digitalizing business processes in marketing and sales. The sub commitment “Transform Philips into a ‘digital’ company” is prioritized because the company aims to leverage the power of data and boost sales from online platforms, and KPI “sales/orders from online channels” is specifically defined to track online sales performance. Other KPIs such as “digital scale adoption” and “digital strategy” are measures to track general implementation rate of this strategy.

Most commitment KPIs are reported quarterly along with the publication of company’s quarterly revenue. Some KPIs are reported monthly because they are project related and need more timely reporting, for example, customer service level and value of E2E transformation program. A specific IT team builds the dashboard and the global performance management team collects data via managers and market controllers. The commitment dashboard has a limited number of business users because the confidentiality of information and its reporting tool is different from the other management reports at Philips.

Comparing these group commitments with the balanced scorecard reviewed in Chapter 2, it can conclude that the balanced scorecard has strong impacts on the design and selection of commitment KPIs. They all start with “vision and strategy” as a core. The commitment KPIs can be categorized into four perspectives (financial, customer, internal business processes and learning and growth) as well, for example, EBITA and market share are financial indicators, NPS and customer service level are customer related, implementation of business models are internal business processes and employee change adoption and integrity are learning and growth related. However, the failures and pitfalls of balanced scorecard exist on current commitment dashboard as well. For example, too many KPIs (in total 46) and the scorecard
is kept at the top level. As stated in research domain, it is unclear how to prioritize commitment KPIs and how to make sure the real important performance drivers align with strategic priorities and business models. Therefore, we need to propose a method to deal with the prioritization problem and overcome pitfalls. In the next section, the descriptions of business models at Philips are discussed in details.

3.2 Business model and performance metrics

In the current state, they are four business models designed by a group of business analysts at Philips in 2013. They are:

- **Products:** including components, OEM (Original Equipment Manufacturer), consumables, e.g., toasters, toothbrushes, bulbs;
- **Services:** e.g., consulting, training, maintenance contracts;
- **Software:** e.g., clinical decision support, health and wellness apps (SaaS and Saas);
- **Systems:** including configurable systems, e.g., imaging systems, lighting installations.

The definition of a business model at Philips is “Business Model (BM) describes how the company creates and delivers value to customers”. For example, creating and delivering values by providing a catalogue of products (BM products), by providing knowledge and expertise (BM services), by providing a functionality without assets (BM software) and by addressing customer-specific challenges (BM systems). The BM designs include value proposition, customer segments, customer relations, channels, revenue streams, activities, resource partners and cost structure. **Figure 3-2** is an example of business model software.

![Figure 3-2 An example of business model software](image)

As showed in Figure 3-2, business analysts at Philips designed business models based on the IBM’s Component Business Model. This IBM CBM (Pohle, 2005) mapping is used to assess
capability maturity levels and prioritize capability initiatives of business models, for example, the red columns in Figure 3-2 indicate that maturity of these components are basic, orange means they are developing, blue means they are practicing and white means those components are not available for this business model. Each business model has a CBM mapping of the current state and the future state. Action plans are made to improve business model designs from the current state to future state (Pohle, 2005). But how are these business model frameworks aligned with performance metrics?

In the documents of these business models, we found business analysts wrote, “IBM partners with APQC (American Productivity and Quality Center) to deliver Open Standards Benchmarking based on one common set of benchmarking definitions available to all organizations globally. Open Standard process definitions are set out in the Process Classification Framework (the PCF) managed by APQC (a global, non-profit organization with more than 30 years’ benchmarking experience). As a result, further insights and information for most of the KPIs provided is available through APQC and IBM…” Based on this explanation, we noticed that in the current design and implementation, performance metrics of a business model is based on the KPIs aligned to correspond End2End processes. Table 3-5 shows an example of KPIs derived from IBM and APQC frameworks.

Table 3-5 KPIs aligned to E2E processes – business model software

Table 3-5 gives an example of KPIs belong to business model software. EE07 is a process prioritized in BM software and based on the inputs of APQC, these metrics are defined. However, we can easily and immediately notice a problem: these metrics are way too generic, not specific to business model software and not specific to the company. According to the current design of business model and performance metrics, we can hardly figure out the alignments of business model objectives and strategic focus. The links between generic metrics and the commitment KPIs are unknown as well. One of the business transformation managers from Philips told that until recently they just start to define specific performance
metrics per business model per business group, and it is a long journey to go. In the current state, business models to Philips are simply frameworks and mappings. To efficiently operationalize the design and meet specific business requirements, it is important to identify how to design effective business models for operations and how to leverage the power of performance metrics in the alignments between strategy and business model designs.

### 3.3 Performance management and KPIs

Previous sections describe how strategy and business models are being designed and executed at this moment. In previous chapters, one of the problems stated in research domain is the total amount of KPIs in the repository is too large (more than 2000 KPIs) at the current state. Besides the commitment KPIs and business model metrics mentioned before, other KPIs are defined and selected from business processes and deployment program. This section explains where the large amount of KPIs comes from and how managers perceive the problems of these KPIs.

*Why there are so many KPIs and where do they come from*

At Philips, business models are mapped with End2End business processes and metrics are defined to measure the performance of business processes. Figure 3-3 presents the Philips Excellence Process Framework, an integrated framework including all End-to-End Operating Processes and Management and Enabling processes.

![Figure 3-3 Philips Excellence Process Framework](image)

Processes showed in Figure 3-3 are all level 1 and level 2 processes. For example, the first level named “Process Category” and one of the process categories is “Order to Cash (O2C)”; the second level named “Process Group” and one of the process groups under category O2C is “From strategy to Supply Chain”. Within each process group, several business processes on the third level are called “L3 processes”. Most KPIs are defined and selected based on designs of L3 business processes, which means they are only “key” performance indicators to certain processes. Table 3-6 explains the different levels of PEPF framework and the number of KPIs per level.
Based on design principles provided by the performance measurement team, each L3 business process has a business process owner (BPO) and a group of business process experts (BPE). BPOs are responsible to design business processes, select and define KPIs and support implementations of management reports. As showed in Table 3-6, in the current state, in total 793 KPIs directly linked to business processes, which measure the productivity of business processes. Besides, 1042 output KPIs, which measure the effectiveness or specific outputs of business processes, and 616 outcome KPIs, which reflect the overall results or efficiency of the company’s business performance. Strategy and Business Model KPIs are mostly outcome KPIs, few output KPIs and none process KPIs. Figure 3-4 explains the different types of KPIs and lists some examples.
Although different types of KPIs have specific goals and definitions, these categories do not provide sufficient focus and control on increasing number of KPIs. The standard business process framework (PEPF) is one of the few things completes its design in the beginning and being implemented, which is far before the starts of new business model designs and new commitment dashboard. To some extent, the large amount of business processes and the process-based design principle together lead to the large amount of KPIs in the current state.

3.4 Conclusion

In this chapter, a case description is provided from three different perspectives: strategy, business model and performance metrics. These descriptions are presented to show how strategy, business model and performance metrics are being designed and implemented in the current state, and descriptions will provide an empirical base for further research designs. At Philips, strategies are interpreted with Group commitments and commitment KPIs are used to track strategy executions. Business models are quite new to the company during business transformations. Most business model designs and related performance metrics are too generic and lack of alignments with strategic goals. From the perspective of performance measurement, the large amount of business process and process-oriented design approach lead to the large amount of KPIs. Managers describe one of the key root causes of this problem is the lack of focus. In this study, we propose KPI prioritization as an approach to help managers regain focus and trim down the total amount of KPIs. The detail research design based on above case descriptions is discussed in the next chapter.
4 Research design

In Chapter 1.3, it explains why a multi-criteria decision-making approach, more specifically, the Analytical Hierarchy Process (AHP) is the most suitable approach to explore the existing performance measurement problems. This chapter will focus on how the AHP method is applied in the real case and what steps are for the research design. A flow chart to illustrate these steps are presented as follows:

**Step 1:**
Review Analytical Hierarchy Process Approach and its application in practice

**Step 2:**
Identification of hierarchy structure, questionnaire and sample of participants

**Step 3:** Data collection
1. Set up 1-1 interview sessions with participants identified in Step 2
2. Informal interviews and hardcopy questionnaire
3. Questionnaires collected during sessions or later at participants’ office

**Step 4:**
Data analysis – an AHP analysis tool Expert Choice 11.0

*Figure 4-1 Steps of research design in this study*

As presented in Figure 4-1, in step 1, a brief review of AHP is provided to create a better understanding of this approach. Then, the method is applied in the real case, the questionnaire and sample of decision-makers are determined based on inputs from case descriptions. In step 3, interview sessions are set up to conduct informal interviews and complete hardcopy questionnaires. Data collected in step 3 are analyzed in step 4 with the help of an AHP analysis tool - software Expert Choice 11.0. Examples are given to explain how the software process data analysis. In the end, the consistency ratio is provided to check the degree of logical respondent opinions and eliminate illogical respondents.
4.1 Analytical Hierarchy Process

Analytical Hierarchy Process (AHP) is a structured approach developed in 1970s by Saaty. It helps decision makers in analyzing complex problems and systems, based on mathematics modeling and psychology theories (Saaty, 1980). In past decades, the AHP approach and the PC-based software Expert Choice have been widely used by both the public and private sectors, in more than 30 diverse decision-making area including strategic planning, resource allocation and policy makings (Shahin and Mahbod, 2006). Recent studies verified that AHP method can provide a systematic procedure to represent the elements of any problems in multiple decision-making situations, such as choice, ranking, prioritization, benchmarking etc. (Saaty, 1983; Gass, 2011). By applying the AHP approach, both quantifiable and intangible criteria are well utilized in problem-solving frameworks (Vargas, 1990).

The characteristics of the performance measurement problems in the research domain of this study fell in one of the decision-making situations mentioned above. When strategic planners or business model designers build a performance measurement system, both quantifiable and intangible criteria are taken into account. On the one hand, the performance measurements are required to present real facts with reliable data. On the other hand, the practitioners are eager to know which measures or metrics are actually “key” for them to measure and improve the performance of systems. The multi-actor, multi-sector, networked-enterprise environment makes the decision of prioritizing or selecting key performance indicators a complex problem. The application of AHP method can provide solid mathematical and psychological bases for decision-makings with a particular focus on prioritizations, which greatly contributes to avoid the selection and design of KPIs that are only based on designers’ “gut feelings”. Meanwhile, recent studies reviewed in Section 2.3.3 have shown the feasibility to select or prioritize KPIs with the AHP method, and confirmed the selection can deliver meaningful guidance and managerial implications (Shahin and Mahbod, 2006; Carlucci, 2010). Therefore, it is suggested that AHP will be a significantly useful method to prioritize the performance indicators, provide insightful guidance and actions for performance management, and contribute to fill the conceptual and execution gaps between business goals and performance measurement.

In order to organize a decision and generate priorities, Saaty (2008) propose four steps to decompose the decisions: “1) Define the problem and determine the kind of knowledge sought; 2) Structure the decision hierarchy from top to down. Top with the goal of the decision, then the objectives from a broad perspective, followed by the intermediate level criteria on which subsequent elements depend, to the lowest level, a set of alternatives; 3) Construct a set of pairwise comparison matrices; and 4) Use the priorities obtained from step 3 to weigh the priorities until the final priorities of the alternatives in the bottom level are obtained.

To adapt above steps in this study, the procedures are formulated as follow:

1) Structuring the hierarchy
2) Paired comparison on each hierarchy level
3) Combining the comparisons into a comparison matrix
4) Implementation with AHP software
The detail designs of these steps are elaborated in the next section 4.2.

4.2 Hierarchy, sample and questionnaire

By following the steps of applying AHP method in a case, this section explains the detail design of the hierarchy tree and the questionnaire for data collection. The sample of decision-makers who join the prioritization is determined as well.

4.2.1 The hierarchy tree

Since the scope of this study is to prioritize commitment KPIs and assess the alignments among strategy, business models and performance metrics, the evaluation goal of this AHP application is determined as “Select the most suitable KPIs for tracking strategy executions” and it is presented as the first level of the hierarchy tree. Generally speaking, a designer can design as many levels as needed in a hierarchy tree (Nikou, 2012). However, in this research, disregard the first level “evaluation goal”, there are another three levels: evaluation factor, evaluation attribute and evaluation measurements (alternatives). The hierarchy tree is presented as follows.

![Figure 4-2 Hierarchy tree in research design](image)

The above hierarchy tree is derived from the structure of group commitments and commitment KPIs presented in Figure 3-1. Three top Group commitments are designed as “evaluation factors” on the second level, and sub-commitments are designed as “evaluation attributes” on the third level and the commitments KPIs are designed as evaluation measurements (so-called alternatives) on the fourth level. Detail information of commitment KPIs is described in Chapter 3.1, the definitions of commitment KPIs are in Appendix 1.

4.2.2 The questionnaire

After the problem is decomposed into a hierarchy tree, elements (factors, attributes and alternatives) on each level have to be pair-wise compared. Elements are pair-wise compared based on its relative importance to the parent level. The scale below is used to express the level of relative importance in pair-wise comparisons (Table 4-1). This scale is designed based on past AHP studies and the setup of questionnaires in Expert Choice 11.0.
Table 4-1 Scale for pair-wise comparison (Adapted from Nikou, 2012)

<table>
<thead>
<tr>
<th>Intensity of Importance</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two activities considered equally important</td>
</tr>
<tr>
<td>3</td>
<td>Moderate importance of one over another</td>
<td>One activity is marginally favored over another</td>
</tr>
<tr>
<td>5</td>
<td>Essential or strong importance</td>
<td>One activity is strongly favored over another</td>
</tr>
<tr>
<td>7</td>
<td>Very strong importance</td>
<td>One activity is very strongly favored and its dominance is demonstrated in practice</td>
</tr>
<tr>
<td>9</td>
<td>Extreme importance</td>
<td>The evidence favoring one activity over another is of the highest possible order</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values between two adjacent judgments</td>
<td></td>
</tr>
</tbody>
</table>

Hardcopy questionnaire was used in this research to collect data from pair-wise comparisons (see Error! Reference source not found.). The questionnaire was designed based on the study of Nikou (2011). First, a draft questionnaire was designed. After the test of experts and some potential participants, the questionnaire was revised based on the feedback and comments. Table 4-2 is an example of the questionnaire:

Table 4-2 Example of the pair-wise comparison questionnaire

Please compare the relative importance with respect to group commitment “Accelerate our growth and improve our performance”.

<table>
<thead>
<tr>
<th>Accelerate our growth and improve our performance</th>
<th>Increase brand preference and gain market share</th>
<th>Meet our EcoVision sustainability targets and improve the lives of 2 billion people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet our 2015 financial commitments on sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>growth, profit and cash generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 6 8 7 5 9 3 7 2 1 6 5 7 2 3 5 8 6 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meet our 2015 financial commitments on sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>growth, profit and cash generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 6 8 7 5 9 3 7 2 1 6 5 7 2 3 5 8 6 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase brand preference and gain market share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 6 8 7 5 9 3 7 2 1 6 5 7 2 3 5 8 6 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the decision maker strongly favors “Meet our 2015 financial commitments on sales growth, profit and cash generation” than “increase brand preference and gain market share”, the number 5 from the left side is used for this pair-comparison, vice versa.
4.2.3 The sample

Because commitment KPIs and dashboard are strictly focused on the strategic level, the amount of its owners is quite limited. Also, it is not mandatory to use a representative sample because the AHP method is used to have decisions made instead of who made the decision (Nikou, 2011). Researchers assert that many AHP studies had used a small sample of data. It is always required that participants have a certain level of knowledge with respect to the topics (Nikou, 2011). In reality, it is a small group of managers who know and work with company strategy and strategy KPIs. Most of the participants are senior managers or directors who are owners of commitment KPIs from different business groups or functions in the company. Table 4-3 lists information of participants. Questionnaires are distributed and collected via face-to-face meetings at Philips in February 2015.

*Table 4-3 Information of participants*
4.3 Data collection

In order to increase the response rate, one-on-one interview sessions were set up to meet participants identified in section 4.2.3 and collect hardcopy questionnaires. While participants were filling in the questionnaires, informal interviews were conducted to gather their opinions on “a large number of KPIs” and “KPI prioritizations”. The sessions are structured as follows (Figure 4-3).

![Diagram of interview sessions]

Figure 4-3 the structure of interview sessions

As presented in Figure 4-3, informal interviews were conducted before participants completed the questionnaire. Because the outputs of informal interviews have no impacts on the research design and research results, the summary of interviews will not be presented in this section. Details of interviews are presented in Appendix 6. In total, 15 participants join the interviews, and 11 questionnaires were completed and collected during the sessions. Four participants did not respond to the questionnaires due to limited amount of time.
4.4 Data analysis in software environment

After collecting all the pair-wise comparison questionnaires from participants, data are analyzed in AHP software – Expert Choice 11.0. Expert Choice is a decision-making tool developed by Saaty and Forman in 1983. It has been widely used in different areas of decision-makings in the past. Below screenshot gives some examples of how data is analyzed in the software environment.

1) Structuring the hierarchy tree in the software (Figure 4-4)

![Figure 4-4 the hierarchy tree in Expert Choice](image)

Figure 4-4 shows how the hierarchy tree is structured in Expert Choice 11.0. For example, the goal of this prioritization “Select the most suitable KPIs for tracking strategy execution” is structured on the top level. Under the goal, the Group commitments and sub commitments are structured. In order to simplify paired comparisons for decision makers, we rearrange the categorization of KPIs when a sub commitment contains more than 5 KPIs. For example, we categorize 7 KPIs into two groups under sub commitment “Meet our 2015 financial commitments” based on different business goals. 5 KPIs are in Group 1 “Profit and cash generation” and another 2 KPIs into Group 2 “Sales growth” for paired comparisons.
2) Paired comparison on each hierarchy level (Figure 4-5)

After building the hierarchy tree in the system (Expert Choice environment), results of paired comparisons collected from hard paper questionnaires are entered into the system. Figure 4-5 presents an example of the interface of questionnaires in Expert Choice. The setup is the same with a hard paper questionnaire. For example, if a decision maker prefers “Accelerate our growth and improve our performance” is “moderately” more important than “Executing the Accelerate! Transformation” and he/she circled 3 in the hard paper questionnaire. Same answers are entered into the system as well. When all the comparison results are copied from hard paper questionnaires to the system, all questionnaires are combined into a comparison matrix and run the prioritization results.
3) Run the prioritization result (Figure 4-6)

Figure 4-6 shows the prioritization results of all commitment KPIs. Based on the inputs of hierarchy tree and paired comparison questionnaires, the system can run the programs and deliver prioritization results per hierarchy level according to AHP approach. The software present results in two modes: distribution mode and ideal mode. “The distribution mode is based on historical AHP approach, which adopts an additive aggregation with normalization of the sum of the local priorities to unity. The ideal mode uses a normalization by dividing the score of each alternative only by the score of the best alternative under each criterion” (Ishizaka, 2009).

Millet and Saaty (2000) provide some guidance on which mode should be chosen for analysis of the results. It is suggested to choose the distribution mode when 1) it is a closed system and no alternative will be added or removed, or 2) it is an open system and preferences for alternatives are allowed to be dependent on other alternatives. It is suggested to choose the ideal mode when it is an open system and no other alternative is expected to affect the outcome (Ishizaka, 2009). The two modes may deliver different ranking results. Because the commitment dashboard in this study is more like a closed system and executives are not willing to add or remove any KPIs at this moment, we choose the distributive mode to show the results.
4.5 Consistency

The consistency ratios (CR) of questionnaires are presented in Error! Reference source not found. in details. According to existing research, a majority of AHP studies use 0.10 as acceptance consistency ratio. However, in practice, the consistency ratios exceed 0.10 quite often, specifically if the logic at state is complex (Nikou, 2012). Therefore, we decide to accept questionnaires that had an overall consistency ratio up to 0.19 for data analysis. Questionnaire 2 and Questionnaire 5 have too high consistency ratio (i.e. participants give inconsistent answers) and are excluded for data analysis. The overall consistency ratio of a combined result is 0.02, which is quite acceptable for priority ranking and weightings.

In this chapter, first, the research method AHP approach is reviewed. By following this research method, other sections explain how to the AHP approach in the case of this study. A hierarchy tree is structured based on the case description of group commitments in Chapter 3. The hard paper questionnaire is set up for data collection and sample size for decision makers is decided. After all the hard paper questionnaires are collected, data analysis is processed in the software environment – Expert Choice 11.0. Some screenshots are given to show how to process AHP prioritization in Expert Choice 11.0. Section 4.4 presents results of consistency tests, and we only take the questionnaire that pass the consistency ratio in data analysis. In next chapter, findings in priority ranking results of group commitment and commitment KPIs will be discussed.
5 Results and discussions

In this chapter, the results of applying AHP approach in KPI prioritization will be discussed and elaborated. Section 4.1 presents the priority ranking and weight of main strategies (Group commitments and sub commitments). To explore the alignment of strategy and business model designs, the priority ranking of KPIs are categorized in section 4.2 based on the CSOFT-VIP business model perspectives. Section 4.3 presents the priority ranking and weight of commitment KPIs. Each section is followed up with a short discussion on results. A combined view of the results can be found in Error! Reference source not found.. In the nd, section 4.4 shortly concludes the prioritization results. Conclusions of this study are in Chapter 5.

5.1 Priority ranking and weight of strategies

The scope of this AHP application is the prioritization of Group commitments and commitment KPIs at Philips. The Group commitments represent strategies of the company. Therefore, the priority ranking of Group commitments indicates preferences of decision-makers on the importance of each strategy. Tables below present the combined results of priority rankings and weight of Group commitments and sub commitments.

Table 5-1 Priority ranking and weight of evaluation factor – Group Commitments

Table 5-1 indicates that participants see “Accelerate our growth and improve our performance (strategy 1)” as the most important strategy at Philips. Strategy “Progressing on our strategic priorities (strategy 3)” and “Executing the Accelerate! Transformation (strategy s)” ranked the 2nd and the 3rd with little differences. The results indicate that participants strongly favor the strategies with objectives such as growth, improvement or progress, and strategies with objectives such as operations and transformation has a lower preference. According to one of the informal interviews conducted during the pair-wise comparison, the manager of operational models from global performance management team defined strategies as “to help employees to find how to contribute to achieve visions”. Another business strategy analyst from Group Healthcare, she defined strategies as “what you want to improve or achieve as a company”. Their definitions of strategy help to explain why “Accelerate our growth and improve our performance” ranked the top priority. Because this Group commitment gives the idea about the visions of the company, another two commitments tell more about how to contribute to achieve the visions.

Usually for strategic planning, visions and growths are always related with targets, because the top management team needs to make sure visions and growths measurable and can be
decomposed to the lower management to operationalize them (said by the head of global performance management team). Therefore, financial indicators still take the lead in the strategic dashboard. On the one hand, financial indicators provide the performance of a company for external stakeholders to evaluate the business. On the other hand, they have been heavily used in goal cascading of strategic objectives and target setting for business units and function groups (according to the information collected in informal interviews). Meanwhile, strategy “Execute Accelerate! Transformation” has been raked with the lowest priority, this indicates the company is still lacking focus on the operations, which verified the problems stated in research domain (Chapter 1.1). The priority ranking results of sub group commitment support the statements above as well (Table 5-2).

Table 5-2 Priority ranking and weight of evaluation attribute – sub Group Commitments

Table 5-2 shows participants see “Meet our 2015 financial commitments on sales growth, profit and cash generation” as the most important sub commitment. “Increase brand preference and gain market share” and “Grow sales in systems and services” are prioritized as
second and third. This result indicates that, besides financial targets, Philips also has strong focuses on customers and business categories, which provide the trend and directions for strategy executions. Out of 11 sub commitments, top 5 strategies are related to sales growth, market share, customer value, investment and business plans. By combing the current state of the company (split one company to two), second group of priorities focus much more on the value creation of separate portfolios and how to transform into a ‘digital’ company. Sub commitment “Increase operational performance” has the lowest priority on the list. On the one hand, this priority clearly reveals the problems; on the other, if the company aims to improve operation excellence, the managers and strategy makers need to take actions to balance the proportions of performance metrics on the commitment dashboard. Managerial advice on this point will be discussed in Chapter 6.

In summary, the priority ranking of commitments clearly reveals the preferences of participants in strategy planning. Strategies can provide operational directions for the lower level of management teams in different business units and function groups by interpreting visions and goals to financial targets and market plans. However, the lack of focus on operational excellence has already become a severe problem for the company for quite a long time. How performance metrics can help to overcome the execution difficulties and how to build alignment of strategy and business model via performance metrics, these questions are discussed in the next section.

### 5.2 Mapping priority ranking of strategic KPIs in business models

The Group Commitments provide insights into the strategies of a company and Commitment KPIs show that performance metrics are being used for tracking strategy executions. But how strategies link to business models and how this link is aligned via performance metrics will be discussed in this section. Firstly, the CSOFT-VIP business model will be used to map all the commitment KPIs with different perspectives. The mapping aims to explain that which business model perspectives are considered in each strategy and what focus each strategy has on business model designs. Secondly, a discussion will focus how these mappings contribute to figure out the alignment of strategy and business models at Philips. Insights are elaborated from both academic and practical views.

#### 5.2.1 Mapping strategic KPIs to CSOFT-VIP model

Existing developments of business models and frameworks are reviewed in Chapter 2. Recent studies show that researchers are focusing on how to fill in the gap and build alignments between strategy and business model, business model and business processes. CSOFT-VIP model is one of them that providing insights on how business model is aligned with business processes and how the alignment help with business model designs. Based on the insights from this business model, Bouwman et al. (2013) develop a set of performance metrics which aiming to enable business model designers to design business models that can focus on the “desired strategic outcomes and define relevant performance levels for operational implementations.” Performance metrics in this set are categorized in eight perspectives,
including customer, service, technical, organizational, financial, value exchange, information exchange, and process alignment. Examples of metrics in each perspective are given in Table 2-5. Based on these inputs, the priority ranking of commitment KPIs are mapped as follows.

Table 5-3 Priority ranking of commitment KPI and business model perspectives – Customer Value

Table 5-3 shows the priority ranking of commitment KPIs that belong to customer value perspective. **Customer Value** has the most KPIs and the highest priority ranking KPIs, for example, “market share” and “order intake growth”. These KPIs are evenly distributed in three Group commitments and most of them strongly focus on value creation and market segmentation. The priority ranking results are aligned with the strategic focus “customer-centric” of the company.

Table 5-4 Priority ranking of commitment KPI and business model perspectives – Finance
Table 5-4 shows the priority ranking of commitment KPIs that belong to finance perspective. These commitment KPIs are common financial indicators that being used by a majority of companies. *Finance* KPIs above mainly focus on “profitability” and “cost”, “network value” and “risk” related KPIs are lacking on the commitment dashboard.

*Table 5-5 Priority ranking of commitment KPI and business model perspectives – Process alignment*

Table 5-5 shows the priority ranking results of commitment KPIs that belong to process alignment perspective. *Process alignment* KPIs are used to track implementation performance of certain projects and throughput time of business processes. However, the lack of measures on process variety and number of primary processes exactly reveal that Philips has problems in identifying primary process and lack of the control of process standardization and process dependencies.

*Table 5-6 Priority ranking of commitment KPI and business model perspectives – Service*

Table 5-6 presents the priority ranking results of commitment KPIs that belong service perspective. *Service* related KPIs are measures used to track performances of operational excellence. Only “improved lives metric” and “Improve sustainability index” have high priorities, but they are not related to customer service in operations. The low priority rankings of “customer service level” and “Significant External Inspections/audit outcomes” exactly reveal the deficiency of operations and lack of quality governance at Philips.
Table 5-7 show the priority ranking results of commitment KPIs that belong to value exchange perspective. We put “China - CSG” and “North America” into value exchange perspective because that two KPIs are not only indicate the strategic focus on certain markets but also measuring the value generation and value exchange with stakeholders and partners in these markets. Another KPI “Realization of SPoR (Strategy Plan of Record)” is used to track the status of strategy execution and implementation and it is highly related to value exchange as well.

Website-related indicators are no show on the commitment dashboard. Most of the website-related indicators, such as “number of repeat visitors” or “click-throughput” are treated as process KPIs used on the operational level. Although one of the Group commitments is “transform Philips into a digital company”, only “sales/orders from online channels” is used to track strategy executions.

No commitment KPI belongs to “Technology”, “Organization” and “Information exchange” perspectives. Most information or data related metrics are designed for specific business processes. They are not included in business model designs and do not address any strategic concerns. The performances of internal and external organizations are lacking clarities.

Based on discussions above, it is concluded a gap exist between what strategic concerns are covered in business model perspectives and what should be covered in business model designs. How these mappings contribute to understanding the alignment of strategy and business model at Philips are discussed in Section 5.2.2.

5.2.2 The alignment of strategy and business model at Philips

As mentioned in research domain (Chapter 1.1), one of the program managers of End2End business transformation team at Philips said, “There is no direct or visible link between strategy and business models, but they are linked in a more implicit way”. According to feedback from informal interviews conducted during the collection of questionnaires (see Appendix 6 for informal interview summary), managers reckon the indirectly or invisible links can be found in:

Objectives and target settings
Strategies define the visions and goals of the company and strategy KPIs are used to track executions. Each commitment KPI has a target, and this target is cascaded down to the lower level of business groups (BG) and function teams. Commitment KPIs and targets lead the
way BG owners to adjust their focus and priorities in business models and operations. Metrics for measuring business model performance are determined based on prioritized business processes.

Value driver tree
Value driver tree (Figure 5-1) is a goal cascading tool used at Philips to build all the links among different business concepts or frameworks, for example, linking strategy objectives with business model goals.

![Figure 5-1 Value Driver Tree at Philips](image)

Figure 5-1 gives an example of different levels in the Value Driver Tree. In a complete Value Driver Tree, L2 has four elements including: “increase sales growth”, “improve cost productivity”, “optimize assets & liabilities” and “improve organizational health”. L3 explains objectives of these value drivers in more details. For example, to increase sales growth, we should improve “acquire, retain and grow customers/consumers” via “improve sales” or “improve innovations”. Goals and objectives of business processes are linked the L4 value drivers. The granularity in the figure above explains the different detail level of these value drivers. Links between business processes can be tracked by checking objectives and KPIs mapped in each value driver tree level. Commitment KPIs are mapped to L1-L4 value drivers. In practice, if a business model has goals linked to “improve organizational health”, but the commitment dashboard or business processes do not contain any organizational KPIs, then broken links can be detected due to strategy and business model designs.

Mapping the priority ranking of strategy KPIs with business model perspectives provides a way for business model designers and strategy makers to cross-check their focus and the balance of objectives. For example, some business models may focus too much on attaining the customer values and lose focus on improve service and information exchanges.
Concerning to the poor operationalization of business models at Philips, it is suggested for managers to design or select specific metrics to measure performances of business models and assess the alignments between strategic focus and business model designs. Next section will deep dive the prioritization results of commitment KPIs from performance management perspective.

5.3 Priority ranking and weight of strategic KPIs

Previous sections discuss findings of prioritization results of strategies and impacts of strategic KPIs on business model designs. This section will strongly focus on discussions of priority and ranking results of commitment KPIs. Table 5-8 presents the priority ranking and weight of commitment KPIs at Philips. How the AHP approach and KPI prioritization contribute to solve research questions of this study will be explored as well.

Table 5-8 Priority ranking and weight of evaluation measurements – Group Commitment KPIs
(Note: Group Commitment 1: Accelerate our growth and improve our performance; Group Commitment 2: Executing the Accelerate! Transformation; Group Commitment 3: Progressing on our strategic priorities).

**Imbalance between financial metrics and operational metrics**

Firstly, Table 5-8 shows the imbalance between financial metrics and operational metrics, which correspond to findings in previous sections. Table 5-8 presents priority-ranking results of 46 commitment KPIs. Within the top ten commitment KPIs, only one indicator (Improved Lives Metric (BN people)) is not financial related. In last ten KPIs in the table above, only two or three KPIs are directly linked to financials (e.g. procurement savings and value from E2E transformations) and others are operational KPIs (e.g. productivity related measures) or project related KPIs (capability maturity or business model implementation). On the one hand, this prioritization results confirm alignments of strategic KPIs and strategic focus on customer values and value generations. On the other hand, this indicates decision makers on the executive management level have not given enough attention on operational issues. Metrics presenting performances of operational excellence and customer satisfactions still stay in the dashboard with low priorities, for example, customer service level (33\textsuperscript{rd}/46) or complaint rate (34\textsuperscript{th}/46).

**Low availability of data leads to low priority rankings**

Secondly, we find the data availability of performance metrics impacts the preferences of decision makers. Executives and senior managers are more likely to choose existing performance indicators that have been frequently used in the past than new metrics that are just being defined or developed. Within top 20 commitment KPIs, only a few metrics are relatively new, for example, “BMC enablers on Track” (15\textsuperscript{th}/46) or “Realization of SPO\textsuperscript{R}
(20th/46)”, others are common metrics used in the industries. Change management is one of the significant issues that can explain this finding. But, besides change management, we find out the large impacts of data availability on KPI selection preferences. According to discussions with managers, some KPIs are extremely difficult in finding the right data, for example, Sales funnel health (36th/46), Significant External Inspections/audit outcome (37th/46), Forecast Accuracy on Sales (42nd/46) or Procurement savings (44th/46). Either these metrics are “forecast” related and it is difficult to predict future performances or business analysts simply have no idea how to get the data, and too many human interventions are involved in data collection. Managers are expecting a fully automated IT infrastructure to enhance data availability. However, the prioritization of performance metrics should not be data-driven. Strategic priorities and business goals should drive the selection of performance metrics.

5.4 Conclusion

Based on the case descriptions and research method identified in previous chapters, the results of applying AHP approach with group commitment and commitment KPIs at Philips are presented. Findings are discussed from three perspectives: strategy (group commitments and sub commitments), business model (the impacts and links of commitment KPI and business model perspectives) and performance metrics (the KPI selection criteria and insights from KPI prioritization rankings).

According to the priority ranking results, the study finds that managers and decision makers at the company have strong preferences on strategies with financial targets and less interest in strategies related to operational activities. By mapping commitment KPIs with CSOFT-VIP business model perspectives, it is identified that business strategies at Philips do not cover by all the eight perspectives of business model design. The developments of business model design and its alignments with strategies need to be improved. In the discussions of priority ranking results of commitment KPIs, we identified the imbalance between financial and operational metrics and data availability of performance metrics influence managers’ preferences on KPI selections.

Conclusions of this AHP application in group commitment and commitment KPIs are discussed in the next chapter. How the AHP approach and KPI prioritization contribute to overcome knowledge gaps in theoretical developments and practical problems of the research domain will be answered in Chapter 6.
6 Conclusions

In this chapter, discussions will focus on how this study answer the research questions formulated in Chapter 1 and to what extent the research objectives have been achieved. Firstly, main research findings of the AHP application in the case are briefly summarized based on previous discussions. In section 6.2, the main theoretical contributions are articulated. Next, practical implications of this study are provided with actionable managerial advice in section 6.3. In the end, research limitations are discussed in section 6.4 and recommendations for future research are concluded in section 6.5.

6.1 Main research findings

Many studies have explored concepts of strategy, business model and performance metrics, providing a wide variety of definitions, approaches and frameworks, etc. However it is far from clear to researchers and practitioners how to overcome pitfalls when translating strategy into performance metrics (Kaplan & Norton, 2001), how to build and measure alignments of strategy and business model via performance metrics (Bouwman et al, 2013), and how to ensure performance management system efficient and effective (Neely et al, 2008). All these how-to questions signify at least one essential quest for researchers, and that is to study and develop analytical approach to understand how to solve problems when implementing and operationalizing business model designs and performance measurement system in practice. As extensively discussed in chapter 2, existing studies and frameworks are mostly high-level conceptualized with empirical studies in individual organizations. Studies on networked organizations with quantitative analysis and actionable advice are lacking.

The research domain of this study is an example of a large networked company facing problems in design and implementation of a new integrated performance management system. Philips as a technology company with multi-actor, multi-sector, networked environment, is striving to improve operational excellence via business transformation programs. Performance measurement plays a significant role in tracking business strategy executions and reflecting reliable performance results of operations. However, as described in chapter three, managers and performance measurement team at Philips are currently losing focus and drowning with a large amount of KPIs for management reporting. Strategies are interpreted as Group commitments and measured by commitment KPIs, but besides financial targets, objectives and performance metrics of strategies and business models are hardly linked or aligned. The maturity of business model designs and implementations is low and only metrics of business processes are linked to business models. Executives and managers keep asking questions such as “what the real key important metrics are driving performance improvement” and “how many KPIs and metrics are enough to effective Performance Management”.

In respond to the knowledge gaps between conceptual business model frameworks and operational problems in practice, particularly with considerations of a real case, we formulate the research question as follows in section 1.2:
“How to trim down the amount of performance metrics and assess the effectiveness of metrics while aligning objectives of business strategy, business models, and business processes.”

In order to answer this research question and provide actionable solutions for researchers and practitioners, we set up the objective of this study is:

“To improve the operationalization of business model designs and increase the implementation feasibility of a new performance management system by developing and evaluating a framework that trims down the amount of performance metrics while ensuring the alignments among strategy, business models and business processes.”

Existing frameworks and studies on alignments of strategy, business model and performance metrics are reviewed in chapter two. Only a few studies take the alignments of business models and business processes into consideration, and several studies point out the Analytical Hierarchy Process approach can be applied in selecting strategy alternatives and prioritizing performance metrics. Based on the findings of literature reviews, chapter three describe the case in details, including how the strategy, business model and performance metrics are designed and implemented in the company at this moment. One of the most server problems of performance management at Philips is the large amount of KPIs dilute the focus of executions and operations. To help managers regain the focus, we choose the AHP approach as a research method to prioritize KPIs. To make the prioritization feasible and effective, the scope of this AHP application is limited to group commitment KPIs. How to apply AHP approach with KPI prioritization is discussed in research design chapter four.

The findings in the prioritization results of group commitments and commitment KPIs are discussed in chapter five. From the perspective of business strategy, we find decision makers strongly prefer strategies with objectives such as financial growth, improvements or progress and strategies related to operations and transformation have lower priorities. The preferences of financial strategy and operational strategy lead to the imbalanced number of metrics on commitment dashboard. From the perspective of business model designs and alignments of strategy and business model, we find out not all the business perspectives defined in theoretical research are covered in business model designs of this case. Business models, in this case, have much more focus on customer value, finance, service, and value exchange and process alignment. However, other perspectives such as organization, technology and information exchange are missing when aligning strategic metrics with business models.

To a large technology company like Philips, strategies and strategic KPIs are defined and reported at a higher level. Detail technology and information exchange metrics are defined to measure performances of business processes, not business strategy or business model. From the perspective of performance metrics, the prioritization results indicate the imbalance between financial metrics and operational metrics. Meanwhile, we find besides change management concerns, the selection and preferences of performance metrics are influenced by the data availability of management reporting. Low availability of data collection leads to low priority rankings of KPIs and low willingness to implement and use the KPIs as well. In general, the KPI prioritization provides a quantitative approach to assess the alignment of
strategy and business models. Also, this AHP application enables managers to check and speed selections on KPIs as well. How these findings contribute to existing academic research and what practical benefits of this approach are will be discussed in the next two sections.

6.2 Theoretical contribution

Researchers Al-Debei and Avison (2010) pointed out “the business model is by no means independent; it intersects with the business strategy as well as the business processes including their supportive information system” (Figure 6-1).

![Figure 6-1 Business Model intersection points](image)

As presented in Figure 6-1, existing research have studied the second intersection point by exploring the alignment of business model and business processes. Solaimani and Bouwman (2012) proposed a VIP (Value, Information, Process exchange) model identify the conceptual gap between business model and business operations. A set of performance metrics is proposed based on COSFT-VIP model in the follow up studies to help managers and business model designers to (re) design business models with the focus on achieving desirable strategic outcomes (Bouwman et al., 2013). However, existing studies do not give a clear picture on how the first intersection point works, in terms of how business strategy align with business model designs. Most existing research put the strategy planning and strategic performance indicators in a highly conceptualized level and is not adaptable to solve operational problems in practice. This study contributes to existing studies by focusing on how to assess the alignment of business strategy and business models via performance metrics.

Mapping the strategic KPIs with business model perspectives provides a way to figure out how strategic objectives are reflected in business model designs. The priority ranking of strategic KPIs enables business model designers to check their focus and priorities in different business model perspectives. The results of this study show not all the business perspectives in conceptual designs are being considered in the business model implementation of a real case. On the one hand, this study enables business model designers...
to check the deficiency of current business model designs; on the other hand, the study provides insights for researchers to improve their conceptual frameworks due to feedbacks of empirical studies.

6.3 Practical implications

The large amount of KPIs is not a new problem, but it is a problem still existing in practice today. The problem has a sense of urgency to investigate why problems still happen and how to deal with them. The study of KPI prioritization contributes to solving practical problems in this case and other management environments in three ways:

1. Provide scientific results on KPI prioritization and selection instead of managers’ guts

“How many KPI’s and metrics are enough for effective Performance Management to occur?” is a question has been asked by managers so many times. Bob Champagne (2008), as a consult with over 25 years of performance management experience, he pointed out that when this type of questions is being asked, most of the time, “they believe ‘in their gut’ that their measurement system has gotten a bit unwieldy, and is starting to create breakdowns, confusion and loss of whatever momentum they once had. And they are usually right”. Too many KPIs, the quantity itself created a dilution of focus, so how to regain the focus and set up clear priorities?

To get the measurement framework leaner, one of “healthy” practices proposed by Champagne (2008) is to “Set aside time for ‘pruning’”. KPI pruning includes 1) dropping measures which are no longer relevant or no long adding value, 2) evaluating and strengthening the unclear linkages upward and downward, and 3) replace old measures when new business objectives identified (Champagne). To prioritize and select a set of KPIs and performance metrics with AHP approach shares similar initiatives with KPI pruning. The ultimate goal of KPI prioritization is to trim down the large amount of performance metrics and improve efficiency and effectiveness of performance measurement system.

In this study, 46 commitment KPIs are prioritized based on managers’ preferences on the importance of metrics. Although the final priority-ranking list of KPIs does not directly tell which KPI should be removed or replaced, the prioritization results can provide insights on which KPI is relatively more important for KPI selections and eliminations. According to a business analyst from operational excellence team at Philips, she told us most KPIs in her team were selected by managers based on their experiences and their “feelings”. The managers from global performance management team and business process management team told us, too many KPIs are directly picked up from industry standards and academic research, but those KPIs are too generic to address the specific focus and needs of the company. The Analytic Hierarchy Process is an approach that capturing both qualitative and quantitative criteria for decision-makings. The KPI prioritization based on AHP approach will be able to back up further KPI selection decisions with scientific evidence rather than solely based on managers’ gut feelings.
This KPI prioritization study is sustainable and can be extended to other sets of performance metrics as well. For example, the prioritization approach can be applied to metrics of business models and business processes. On the one hand, the prioritization of different sets of metrics can be compared to check the alignments of business model designs and process designs. On the other hand, if a set of metrics frequently has low priorities, and being confirmed by managers that these metrics are no longer useful or have added value according to current business objectives, then those metrics can be pruned. By following these steps, low priority KPIs can be removed or replaced due to the change of business objectives. In the end, the large amount of KPIs can be trimmed down through multiple prioritization tests.

2. Provide a way to regain focus and assess differences between their thoughts and actions

Metrics with low priorities can not only give indications on KPI elimination, but also can be used to assess differences between what managers think are important and what they prioritize in practice. For example, in the results of this study, operational Commitment KPIs have relatively low priorities that are contradictory to one of their strategic priorities “improve operational excellence”. Some managers argue that comparisons between financial indicators and operational indicators are like comparing an apple to a pear. But the AHP is an approach enables decision makers to compare apple to pear due to certain criteria. Besides, the prioritization result itself can be used to reveal some unreasonable designs of dashboards. For example, to prevent data driven behaviors, some metrics are ranked with low priorities are not caused by their importance but caused by the difficulties in data collections; to reduce human interventions on dashboard designs and strategic behaviors on KPI selections, some metrics are ranked with low priorities may be caused by personal interests or conflicted interests. Comparing the strategic priorities defined by executives and priorities of metrics ranked by managers, the objectives and focus can be assessed and aligned.

3. Improve the speed of decision-making process to reach real time performance tracking

Another problem pointed out by a business analyst from performance measurement team, he said one of the difficulties to trim down the number of KPIs is because business analysts are reluctant to take ownership of problems and make decisions. Because this is a large company with complex organization structure and various decision-making boards, it is easy to understand why the decision-making processes are slow. But how to help managers to speed up when they have so many priorities at hand with only limited time? The KPI prioritization provides a way to help managers make decisions faster and reliable. The effectiveness of AHP approach has been testified and verified in multiple areas in past decades, but few studies apply AHP in the selection of a large set of performance metrics. This study shows the potential to use multi-criteria decision-making approach to quickly select the most suitable indicators based on criteria of business goals and objectives.

Moreover, this study provides actionable managerial advice. Opinions regarding to solve “the large amount of KPI” problems are collected during informal interviews. One of the program manager from Global Performance Management team mentioned, “in order to trim down the number of KPIs, we need to ‘cut the dead wood’: 1) decrease duplicate KPI definitions, 2) withdraw the KPIs which are not implemented”. “Cut the dead wood” shares same thoughts
with KPI pruning. Another manager from performance measurement team suggests “to link performance metrics with job descriptions of individuals” in order to add more clarity in responsibility and performance controls. This suggestion is coherent with the KPI selection criteria SMART. Make sure all metrics are well “assigned” could be a way to prevent indecisive behaviors. We suggest that the company should adjust the balance of performance metrics and update the frequency of management reporting. It is essential to keep tracking all the existing financial indicators for stakeholders. But in order to solve internal operational issues, at least one or some operational metrics should be able to reflect daily or weekly business performances. In this fast-changing world, data should be used to leverage business capabilities instead of constraining the power of analysis.

6.4 Research limitations

The findings of this study should be interpreted with the following caveats in mind as well. Firstly, this study is limited in the fact that the proposed KPI prioritization is only applied in one large technology company in the Netherlands. The limitation is defined by differences between different companies, industries or countries. Although the metrics prioritized in this study are possibly adaptable to similar cases, the analysis and conclusion of prioritization results are only relevant when considering particular strategic focus and business model designs of a company. Secondly, this study is restricted by limitations of AHP approach. For example, the only way to formulate problems and the hierarchy structure is to follow the perception of the individual (or the group of individuals) and it is critical that when to aggregate opinions in AHP applications (Hartwich, 1999). When the number of pairwise comparisons increases, the whole process of AHP may be time consuming. Researchers suggest applying simpler multi criteria methods to avoid this limitation.

Moreover, the impacts of performance metrics on strategy making process are limited due to other multi-actor decision-making aspects. Even though the AHP approach provides a way to prioritize performance metrics based on preferences of strategy makers, the results of prioritization can hurt interests of a small group of stakeholders. To some extent, the strategy making process and discussions may end into a stagnant status with no further agreements achieved. Instead of intensifying the conflict interests during strategy making, we suggest practitioners periodically use the KPI prioritization as a reflection of dynamics in strategy makings. The prioritization of performance metrics can be used as a starting point to initiate discussions, but it can only bring limited impacts on the choice of business strategy or the change of strategic focus. Big data innovations and developments make it possible to measure all kinds of metrics and processes. The KPI prioritization can be positioned as a bottom-up data-driven method to identify problems in strategy makings. However, a top-down approach starts with visions and particular focus on operational efforts may become a beacon in big data analytics. Combing the top-down approach and bottom-up finding, the big data insights can eventually be transformed into meaningful managerial actions with desired strategy makings.
6.5 Recommendations for future research

Further suggestions for future studies concern the consideration of applying the AHP approach with metrics directly defined from business models and business processes designs. The proposed AHP-based model has limitations on assessing alignments of business models and business process via performance metrics. Therefore, a further development of the research should be related to improve the model by particularly focus on business model designs aspects and the selection of related metrics while addressing the barriers of a large amount of metrics. Finally, the model is open and replicable for future development.

In conclusion, this paper proposed a KPI prioritization framework with the application of an AHP approach. This KPI prioritization can help with the selection of performance metrics and assess the alignments of business strategy, business models and business processes. This study contributes to providing exploratory evaluations of a quantitative approach to the developments in managerial decision-making and performance management.
Bibliography


Appendices

Appendices are not available for the public version due to confidentiality. Please contact the author for further information.