PHILIPS SMARTPATH

A Circular Economy Business Model Case

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Executive Summary

This report presents the case study of Philips' SmartPath business model for MRI scanners. SmartPath for MRI was chosen as the focus for the case study because:

- MRI systems have been a key focus for the implementation of circular economy models within Philips, and are an important line of business for the company.
- The SmartPath portfolio of upgrades focus on keeping products at their highest value throughout their lifetime, which is a core principle relevant to the circular economy.

The SmartPath portfolio contains a number of circular business model patterns – some of which have been operational for many years at Philips. Nevertheless it is a model which is improving and evolving, and thus offers insights for Philips as well as other businesses.

Insights for business guidelines

This case study highlights the following key insights relevant to companies in similar industries or sharing a similar context:

- Significant value can be created by taking a lifecycle and service-centric approach to serving customers. This requires re-balancing priorities from focusing on new product sales towards maximising the value for customers from products already installed (the installed base). With this new focus, the installed base becomes a key resource to be 'cultivated' over its entire lifecycle. This creates the foundation for developing solutions and services that are consistent with the principles of circular economy:
    - Enhancing the utility and value of products at different stages of their lifecycle
    - Enabling the upgrade and life-extension of products
    - Establishing mechanisms to incentivise the take-back of products at end-of-cycle so that their value can be re-captured – for example through refurbishment and re-sale
- Product development and design needs to be consistent with a lifecycle approach, for example ensuring that future solutions are backward-compatible with systems already installed, and that these are equally upgradeable when new hardware or applications become available. This requires additional investment, however creates significant benefits including:
    - Ensuring systems in the installed base can maintain or enhance their value over the lifecycle
    - Improving customer experience and satisfaction
    - Creating opportunities for new and recurring revenue streams
- Transitioning from a product focus to a service/solutions focus (a form of 'servitisation') is a key enabler for circular business models. Offering products as a service creates a focus on value generation and customer satisfaction based on delivering overall performance and outcomes, rather than on the specifications of a product. This allows manufacturers the

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opportunity, for example, to offer and deploy refurbished assets as part of an equipment fleet.

- Transitioning toward a lifecycle, service-focused model requires a shift in mindset, processes and behaviour with respect to sales and customer relationship management. Customer relationships need to become long-term partnerships, and sales teams need to be supported and incentivised to sell solutions at the right time within the product lifecycle (this may include refurbished systems, or incentives to trade-in equipment for refurbishment and re-sale). In addition to change management, decision support tools and incentive systems are key resources that may be required to enable this shift.

Insights for policy recommendations

Key issues arising from this case study which have direct policy implications are those that relate to EHS regulations; public sector procurement practices; and sector-specific funding policies that aren't aligned with circular economy.

- **Compatibility of Environmental, Health and safety (EHS) regulations with long-lifecycle assets sold back into the market**. Regulation such as RoHS and REACH do not yet make allowance for 'second use' / refurbished systems which may no longer comply when they come back into the market. This is particularly the case for products with very long lifecycles, such as MR equipment in this case study. Manufacturers potentially run the risk of setting up models for product take-back which they may find challenging to re-sell in the European market. EHS rules and regulations may therefore need to consider new models for addressing the refurbishment or remanufacturing and re-sale of long lifecycle equipment.

- **Public sector procurement practices**. Current procurement is designed to ensure technical and price comparability around technical specifications and requirements, and typically requires hardware and services to be evaluated separately. This can create a challenge for product/service propositions which are bundled and benefit-focused, as opposed to focusing on specifications and cost. Public procurement processes may therefore need to find new metrics and approaches to assessing the value of vendor bids if governments wish to promote circular economy. This requires changes to rules and guidelines, as well as improving awareness and education of procurement managers.

- **Public funding practices that prioritise new over 'circular' equipment**. Public sector funding rules and practices may not be keeping pace with the development of circular products and solutions. In an example from the MR equipment market, public hospitals in some countries receive government funding specifically earmarked for capital expenditure on new systems. In other cases funding rules consider a life-extended machine as 'old' and at a disadvantage to new equipment (not taking into account services that can bring equipment up to the latest state-of-the art functionality). Public funding rules and guidelines therefore need to be examined to ensure they do not put circular solutions at a disadvantage.

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1 Introduction

1.1 Background and context

R2π – Transition from Linear to Circular is a European Union Horizon 2020 project focused on enabling organisations and their value chains to transition towards a more viable, sustainable and competitive economic model in order to support the European Union's strategy on sustainability and competitiveness.

R2π examines the shift from the broad concept of a Circular Economy (CE) to one of Circular Economy Business Models (CEBM) by tackling market opportunities and failures (businesses, consumers) as well as policy opportunities and failures (assumptions, unintended consequences). Its innovation lies in having a strong business-model focus (including designing transition guidelines) as well as in the role of policy development (including designing policy packages).

The ultimate objective of the R2π project is to accelerate widespread implementation of a circular economy based on successful business models and effective policies:

- to ensure sustained economic development,
- to minimize environmental impact and
- to maximize social welfare.

The mission of the project is therefore to identify and develop sustainable business models and guidelines that will facilitate the circular economy, and to propose policy packages that will support the implementation of these sustainable models.

A core part of this project is to work with organisations who are on the journey towards developing circular economy business models, as well as those who have the ambition to do so but haven't yet begun. The project has conducted case studies of 18 selected organisations.

The 18 chosen cases covered all five priority areas highlighted in the EU Action Plan on the Circular Economy: plastics, food waste, biomass/bio-based, important raw materials, and construction & demolition. Additionally, the cases were selected to ensure learning in each of the seven business model patterns defined by the R2Pi project: re-make, re-condition, circular sourcing, co-product recovery, access, performance and resource recovery, and these will be discussed in more detail in this report. To gather wide-ranging lessons from differing company sizes and maturities, the following were selected: 7 large corporations, 8 small, medium enterprises, 1 public entity, 1 entire value chain with both public and private organisations and 1 ongoing social project.

This report presents the case study of Philips' SmartPath portfolio of solutions – and associated business models – for MRI scanners. SmartPath for MRI was chosen as the focus for the case study because:

- MRI systems have been a key focus for the implementation of circular economy models within Philips, and are an important line of business for the company.
- SmartPath focuses on keeping MR systems at their highest value throughout their lifetime, which is a core principle relevant to the circular economy.

SmartPath contains a number of circular business model patterns – some of which have been operational for many years at Philips. Nevertheless it is a model which is improving and evolving, and thus offers insights for Philips as well as other businesses. The next section provides a more detailed overview of the case organisation's business.

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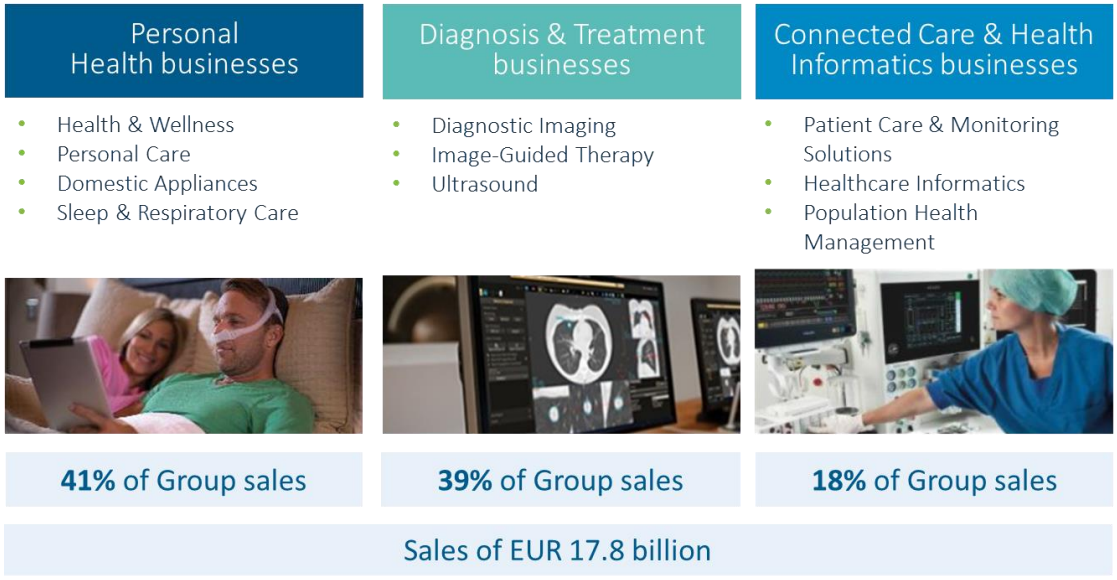
1.2 Business overview

1.2.1 Company background

Philips total sales in 2017 were EUR 17.8 billion across three businesses (see Figure 1 below). Within the Diagnostic & Treatment businesses, Diagnostic Imaging (which includes MRI – the focus of this case study), is a significant contributor to revenues.

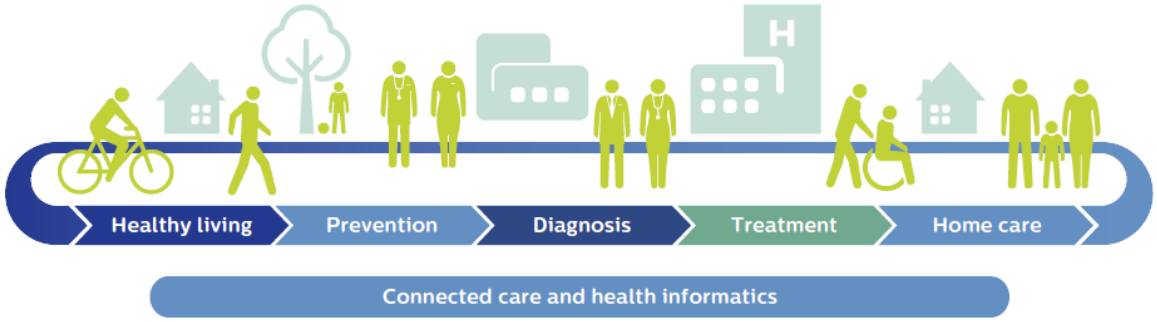
FIGURE 1 PHILIPS BUSINESSES



Source: Data from Philips Annual Report 2017.

Philips is on a journey to transform its business model from a diversified business portfolio to a more focused health technology and solutions provider. Philips has the vision to make the world healthier and more sustainable through innovation, providing solutions across the health continuum. The company's overarching aim is to improve the lives of 3 billion people a year by 2025.

FIGURE 2 PHILIPS – WORKING ACROSS THE HEALTH CONTINUUM



Source: Philips

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1.2.2 Sustainability at Philips

Philips has a 5-year sustainability programme – called "Healthy people, sustainable planet" – running over the period 2016-2020. This builds on a strong legacy of sustainability:

- At the end of the 19th and the majority of the 20th century, Philips has continually focused on social programs for employees.
- From 1970 onwards, Philips began to develop a more focused environmental agenda. This included the EcoVision programs where Philips addressed energy efficiency and hazardous substances – initially within its our operations and then with regards to its products.
- Since 2000, Philips broadened its sustainability activities, including within its supply chain.

The "Healthy people, sustainable planet" programme incorporates the principle of reducing environmental impact and maintaining the planet's resources. Specific objectives for 2020 include:

- To have 70% of turnover coming from solutions that meet EcoDesign principles
- **To have 15% of turnover coming from circular economy related solutions**
- For 95% of Philips' revenue to be linked to the UN Sustainable Development Goals
- To be carbon neutral in its operations, employing 100% renewable electricity
- Recycling 90% of operational waste and sending zero waste to landfill
- Striving for a zero injury, zero illness work environment with a preventative mindset
- Taking a collaborative approach with suppliers to ensure improvements along the value chain.

1.2.3 Circular economy

In addition to the **2020 objective of realising 15% of turnover from circular economy and related solutions**, Philips has also led and signed the 'Large Capital Equipment Pledge', whereby it **pledges to take back and repurpose all the large medical systems that its customers are prepared to return**. This is part of a World Economic Forum initiative called PACE (Platform for Accelerating the Circular Economy) which is chaired by Philips' CEO.

> *We firmly expect the circular economy to replace the traditional 'take-make-dispose' scheme. So at Philips we aim to take back all capital equipment from our hospital clients.*
>
> Frans van Houten, CEO Philips

The importance of circular economy to Philips is further recognised within the company's publically stated 'Materiality Matrix' (Figure 3 below). The matrix identifies the environmental, social, and governance topics which have the greatest impact on the business and the greatest level of concern to Philips' stakeholders along its value chain.

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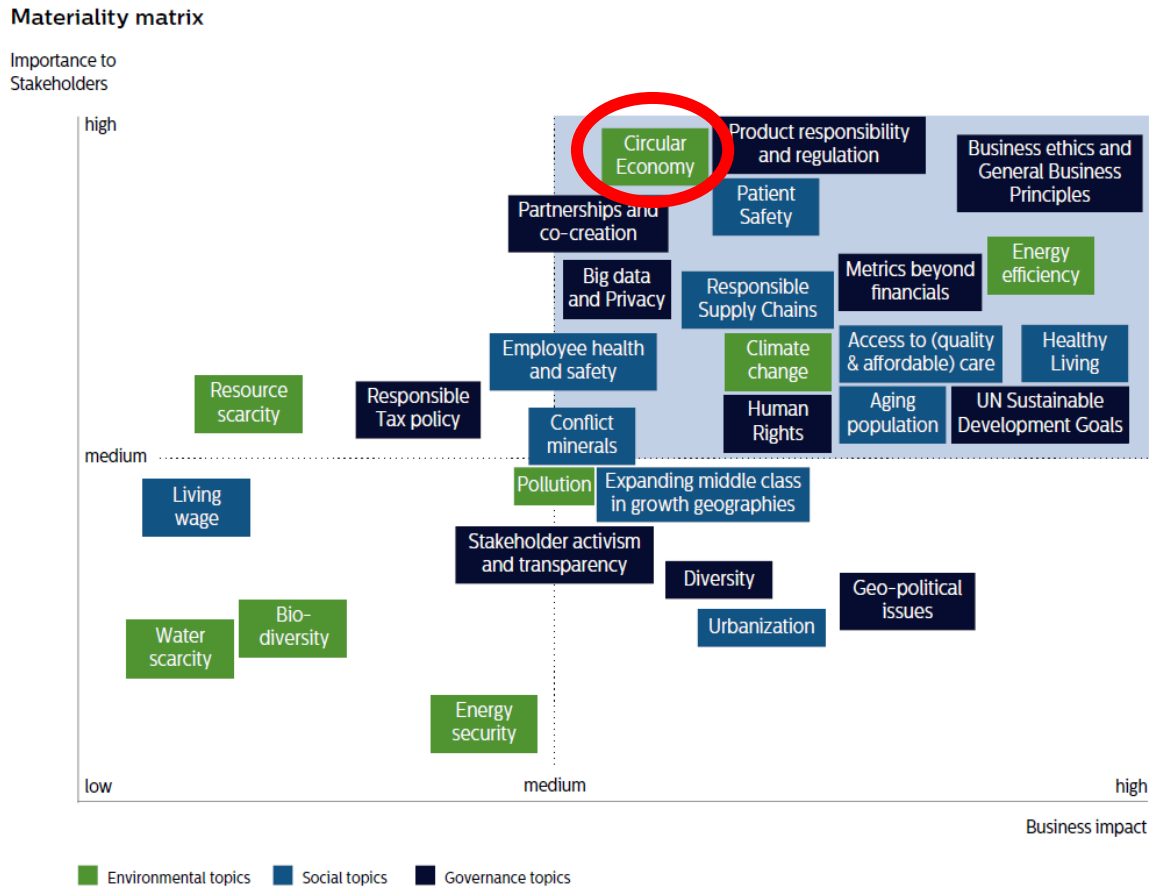
FIGURE 3 PHILIPS' MATERIALITY MATRIX



Source: Philips Annual Report 2017

1.2.4 Focus of the case study

The focus of this case study is on understanding and assessing the circular business models Philips employs for MRI systems through its SmartPath portfolio.

SmartPath focuses on enabling customers to enhance their investment in MRI equipment throughout its lifetime. This is done by keeping equipment functionality updated; extending the lifetime of equipment; and enabling customers to easily upgrade to the latest technology.

SmartPath sits within a spectrum of solutions Philips offers to customers. This ranges, for example, from service and maintenance contracts for specific assets, through to large-scale multi-year services provided to entire Hospital departments.

In the context of the MRI business, the characteristics of SmartPath compared to other solutions are:

- It is focused on *enhancing the value* customers get from their *MRI assets* (it is not focused on maintenance and 'uptime', but it is focused on the assets themselves).
- SmartPath is designed to serve throughout the product's lifetime with the customer, adjusting to changing needs and context.
- SmartPath solutions can combine with and incorporate other Philips services such as maintenance service contracts, financing, etc.

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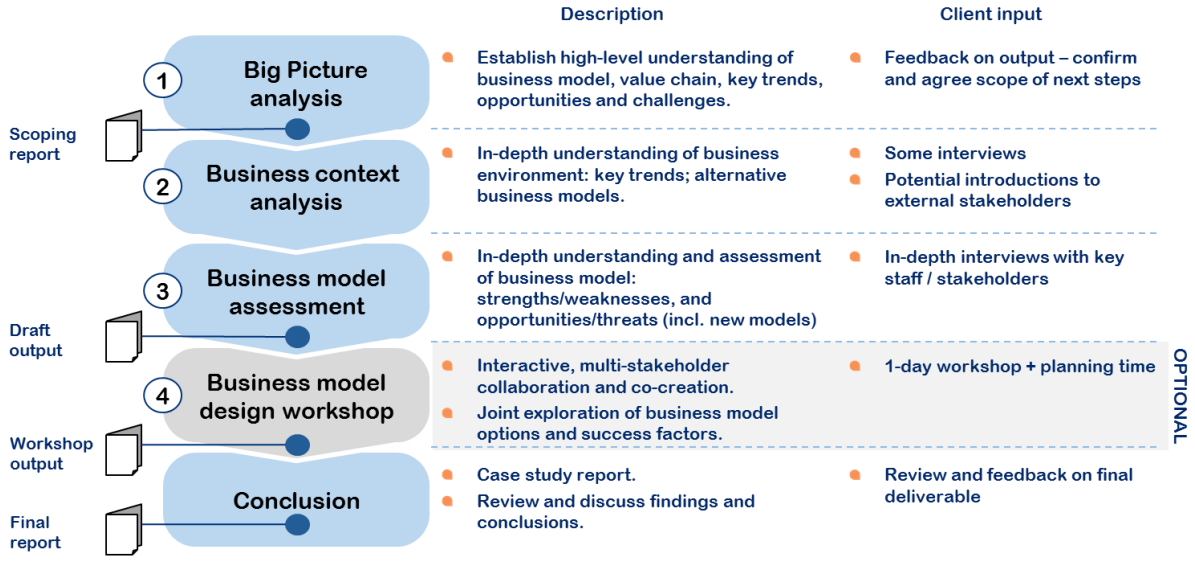
Philips provides the SmartPath portfolio of upgrades to other modalities (product categories), based on the same principles above.

1.3 The case study analysis process

The case study process was structured in three main steps, plus an optional workshop, and concludes with this document as the final report (see diagram below).



1.4 Report outline

The first chapter introduction has provided a high level overview of the case and case study process. Chapter 2 presents the big picture surrounding the business, showing the context in which it operates and the key external factors. Chapter 3 is an analysis of the business at the building block level of the business model, including the circularity of the business, the financials and the strengths and weaknesses. Chapter 4 draws conclusions about the current state of the business and its future potential.

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Glossary of terms

Capex	Capital expenditure
Modality	A term used to indicate a category or type of equipment used for medical imaging (e.g. in areas such as magnetic resonance imaging, radiography, ultrasound, nuclear medicine, computed tomography, etc.)
MR	Magnetic Resonance. Used as an abbreviation for 'MRI'
MRI	Magnetic Resonance Imaging
Opex	Operating expenditure
PMC	Philips Medical Capital. A joint venture providing lease financing to customers.

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2 Philips Healthcare's MRI business context analysis

2.1 Scope of the business context analysis

The objective of the context analysis is to identify the main external factors that are to be considered in order to explain the success (or failure) of Circular Economy Business Models (CEBM), as well as their potential role in accelerating the transition towards a Circular Economy.

The business context research included a combination of interviews with relevant key stakeholders of the case organisation as well as complementary desk research where required. The objective was to identify relevant factors (geographic or sector-specific) within which the business model operates today, as well as key trends that may influence how it evolves in the future.

2.2 Contextual factor analysis

2.2.1 Demographic trends

Aging population, as well as availability of new medical treatments, is increasing demand for MRI scans (e.g. for neurological and cancer treatments). In the UK for instance, demand for scans is increasing at a rate of 7-12% per year.

2.2.2 Rules and regulations

Healthcare policy

There is a high degree of public policy attention on creating a 'future fit' healthcare system that is responsive to changing patient needs (including more age-related illnesses), advances in medicine, and healthcare practices.

Managing rising costs of healthcare against tight public spending is impacting publicly-funded healthcare systems. In the US, the largely privatised healthcare system is also under scrutiny to provide more affordable and cost-effective care. One of the outcomes of public policy trends is increasing linkage of public investment to performance metrics demonstrating value-for-money and patient outcomes.

Policies driving investment behaviour in MRI

MRI equipment is a key technology within hospitals. As such, is it often targeted by government policy to ensure healthcare providers have equipment that effectively caters to patient needs. These policies vary across Europe in terms of how prescriptive they are, and influence how hospitals manage their equipment's lifecycle. This results in a relatively heterogeneous policy landscape driving customer behaviour in different ways. Below are recent examples at time of writing that illustrate this point:

- **France**: Policies previously prescribed that hospitals could not claim reimbursements for procedures conducted on machines that were older than five years. This incentivised renewal of machines within a relatively short lifecycle (regardless of whether they were still fit for purpose). As of January 2019, all CT or MR authorisations can now be extended to

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machines of up to seven years of age, which is a positive development for Philips' upgrade programmes under SmartPath.

- **Belgium**: After seven years of purchasing MR equipment, hospitals are required to invest a further 50% of the initial purchase budget to keep their technology up to date. This enables hospitals to consider upgrading the equipment without needing to purchase a new system.

2.2.3 Economy and environment

Increasing role of private sector radiology providers within public healthcare markets

Private sector providers of radiology services and MRI scans are playing an increasing role in the market. Public sector hospitals outsourcing to private providers has been a significant driver of this growth. For example in the United Kingdom, MR diagnostic imaging was previously done mainly by the National Health Service (NHS), with private sector providers only representing 10% of the installed base of MRI machines. This is now significantly higher, including arrangements such as the NHS outsourcing the provision of imaging to private hospital groups (e.g. Nuffield, BMI) and paying suppliers per procedure; or hiring mobile scan units from private suppliers to increase capacity on site.

Hyper-consolidation of private healthcare providers

Private healthcare providers are consolidating into large-scale groups. This is particularly the case in North America and South America, as well as other geographies.

2.2.4 Competition

Philips' MRI business operates in a competitive market with other vendors such as GE Healthcare and Siemens Healthcare. Non-traditional players are beginning to enter the medical imaging and diagnostics market, especially digital solutions companies from the 'tech sector' such as Apple, Google and Microsoft. This follows the trend of increasing digitisation of the sector, discussed below.

2.2.5 Technology trends

Improvements to MRI hardware

The imaging capability of MRI machines has until recently been mainly determined by the hardware – in particular the power of key magnet components. Improvements in magnets are however beginning to plateau, and imaging quality and capabilities are increasingly being improved through software (see below).

One recent change in hardware which has created a step change in benefit for hospitals is an increase in bore size and shape (the tunnel within which patients must lie). This development enables hospitals to cater for larger patients as well as providing a better patient experience. The latter reduces stress and the potential for disruption to MRI procedures, which has consequences for scheduling and operational efficiency of radiology units.

Digitisation of MRI technology

As noted above, improvements in MRI imaging performance and functionality are increasingly driven by software. MRI machines are not only becoming fully connected to hospital software platforms (for storage and processing of images), but are also increasingly reliant on software to effectively operate the machines.

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2.2.6 Customer needs

Focus on managing and reducing costs and expenditure

Healthcare providers, particularly in the public sector, are under pressure to 'do more with less'. Hospital are experiencing a steady decline in reimbursements for procedures (the monetary amount they receive from public healthcare schemes for conducting a given procedure). This is resulting in a strong focus on driving operational and cost efficiencies within hospital operations (for example, by improving workflow and throughput of patients).

This pressure is leading to three observed trends which have implications for Philips' business model, discussed in more detail below:

- MRI lifetime in operation is increasing
- Demand for refurbished MRI is increasing
- Third party leasing and service arrangements are gaining popularity (vs. buying own equipment)

MRI system lifetime in operation is increasing

Hospitals seek to maximise the value and utilisation of key medical systems and assets such as MRI machines. This means not only maximising their utilisation, but also operating them for as long as possible. In the past, the typical lifetime of an MRI machine in operation was between 8-10 years. Hospitals are now often continuing to run their MRI machines for 15 years or longer.

Demand for refurbished MR systems is increasing

In the past, markets for refurbished medical equipment typically centred on emerging and developing economies. Now, customers in the EU and other developed markets look favourably on refurbished MRI systems if they enable them to meet their radiology requirements. This is particularly true for cost-sensitive 'value segment' customers and specialised imaging centres which focus on conducting high volumes of standardised procedures. Demand for refurbished MRI machines is particularly strong in North America, Russia and Germany, and is likely to grow in other large markets such as the UK.

Third party leasing and service arrangements are gaining popularity (vs. buying own equipment)

MRI machines are a significant investment for healthcare providers. Because of pressure on budgets, hospitals are seeking to minimise large capital expenditure (capex) outlays and investments. Delaying purchase of new machines by extending the lifetime of MRI equipment in operation is one approach being taken by customers. In addition, hospitals are increasingly choosing to gain access to MRI systems without spending on capex by shifting spend to operating expenditure (opex) budgets.

Two example of this are:

- Leasing: Hospitals entering leasing arrangements whereby MRI machines are located in and controlled by the hospital, but owned by a third party and paid for through lease financing.
- Outsourcing: Paying for access to mobile MRI units (typically deployed by suppliers located in trailers on site) or outsourcing procedures to private partner hospitals.

Leasing and outsourcing arrangements are also approaches hospitals can use to de-risk investment in MRI capacity expansion.

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Increasing customer focus on value and outcomes

Healthcare policy and funding is increasingly focused on delivering patient outcomes and value-for-money. Traditionally, publicly funded healthcare schemes reimburse hospitals on the basis of the volume of procedures undertaken. This transition in funding is described as going from being 'volume based' to becoming 'value based'.

The trend towards value-based medicine is not only observed in countries with national public healthcare. In the US for example, the sector acknowledges that healthcare costs are unsustainably high and need to be better managed.

This change in healthcare focus and funding is translating into three relevant issues for healthcare customers, described further below:

- Radiology departments are becoming cost centres
- Increasing focus on improving patient experience
- Increasing standardisation of MRI procedures

Radiology departments are becoming cost centres

As described above, Public healthcare systems traditionally tie reimbursements to each MRI procedure conducted, thereby generating revenue for hospitals based on volume. Under this model, radiology departments act as revenue-driving profit centres for hospitals.

Many healthcare providers are transitioning towards a value-based medicine model where reimbursements are no longer tied to procedures, while at the same time experiencing overall funding pressure. In this situation, Radiology departments become cost centres needing to focus on efficiently generating clinical outcomes within a defined budget. This trend is relevant for solutions that enable customers to maximise value from existing assets, which is consistent with Philips' SmartPath offering.

Increasing focus on improving patient experience

Hospitals are looking to improve the experience of patients undergoing an MRI scan. This is leading to decisions to upgrade or re-invest in new systems that offer larger bore sizes; less noise; and reduce the time a patient needs to be in an MRI machine. Better patient experience is seen to improve throughput and workflow of procedures, therefore improving overall efficiency.

Increasing standardisation of MRI procedures

In order to improve consistency in quality, clinical outcomes, and operational efficiency, Healthcare providers are seeking to standardise protocols and procedures within their radiology departments. The focus on value-based medicine as well as consolidation among healthcare groups are important drivers for this trend. Standardisation of radiology protocols is a potential enabler of future MRI solutions within the industry (e.g. 'MR-as-a-service') as will be explored later in the report.

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3 Business model assessment

The business model assessment has been conducted through a combination of publicly available information, interviews with employees and stakeholders of the case organisation and internal documents provided by the organisation.

The objectives were to gain a deeper understanding of the circular business model and to map out the value chain and interactions in more detail in order to enable an analysis of the strengths and weaknesses as well as to consider the replicability and transferability of such a model to other entities and sectors.

3.1 Business model overview

The focus of this case study is on understanding and assessing the circular business models Philips employs for MRI equipment through its SmartPath portfolio of upgrades.

MR machines are high-end pieces of equipment which require substantial capital investment to procure and install. From an industry perspective, MRI equipment can cost over EUR 1 million (this will vary based on the vendor, machine model, as well as options and configurations). In addition to this, MR machine installation requires substantial investment in the infrastructure of a hospital building. For example, the building structure typically needs to be reinforced due to the weight of the machine; walls may need to be removed in order to install it; and MRI rooms needs to be upgraded with shielding.

FIGURE 4 ILLUSTRATION OF AN MRI MACHINE

Source: Philips

The SmartPath portfolio incorporates four elements: Optimise; Enhance; Transform; and Trade-In. The value each provides to customers is described in Figure 5 below.

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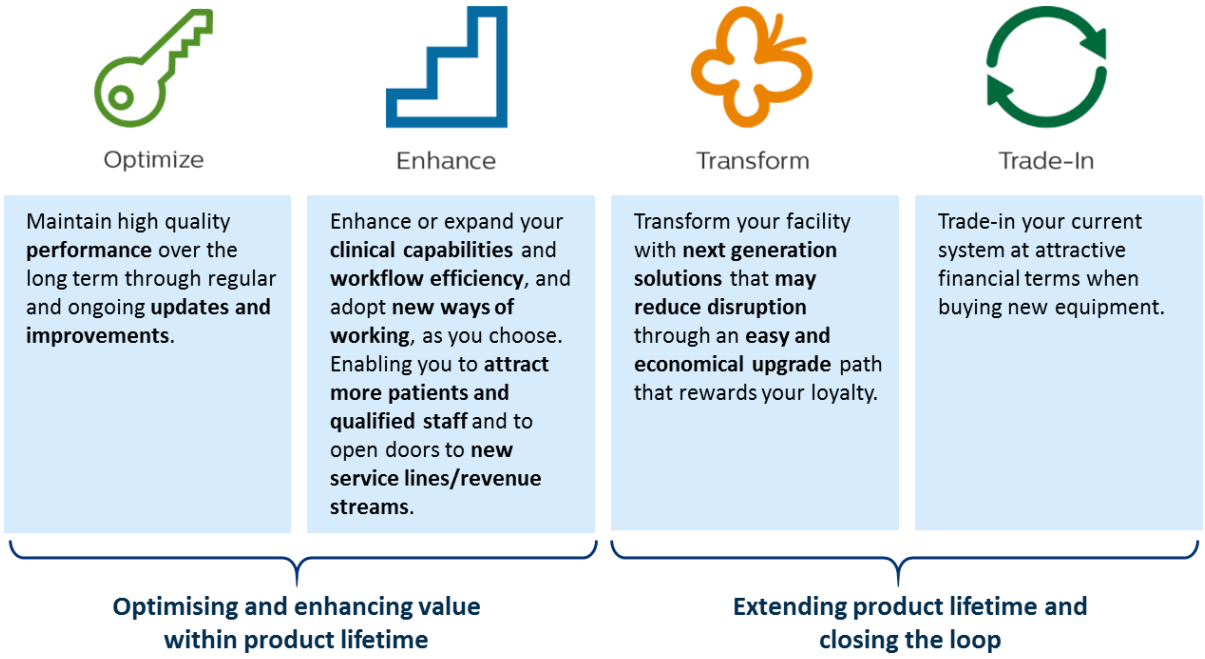
FIGURE 5 SMARTPATH ELEMENTS



Source: Adapted from Philips

SmartPath's **Optimise** and **Enhance** elements enable customers to enhance and maximise the value they get from using MR machines during the equipment's lifetime. This is done through a combination of software and hardware updates which keep the machines at their highest potential performance and functionality.

The **Transform** and **Trade-In** elements serve to extend the lifetime of MRI systems, but do so in different ways:

- **Transform** enables customers to extend the lifetime of the most costly and high-value hardware component of the MRI system – the magnets – while a significant part of the hardware around it is replaced and upgraded. The latter can be harvested for spare parts that can be used to service other systems across the installed base.
- **Trade-In** enables the MRI system to be taken back, refurbished, and re-deployed with another customer, thus extending the lifetime of the equipment through a 'second life'. The Trade-In element of SmartPath therefore enables a further **Refurbishment** circular business model, and redeployment of the machine with a new customer.

The SmartPath elements and their corresponding business models are described in the following sections. Sections 3.2 and 3.3 respectively describe the building blocks of Philips' SmartPath business models focused on the two key aspects of circularity indicated above:

- Optimising and enhancing value within the product lifetime ('Optimise' and 'Enhance')
- Extending product lifetime and closing the loop ('Transform' and 'Trade-in')

The business models are described using the structure of the Business Model Canvas, with each building block of the canvas (and element therein) described in sub-sections.

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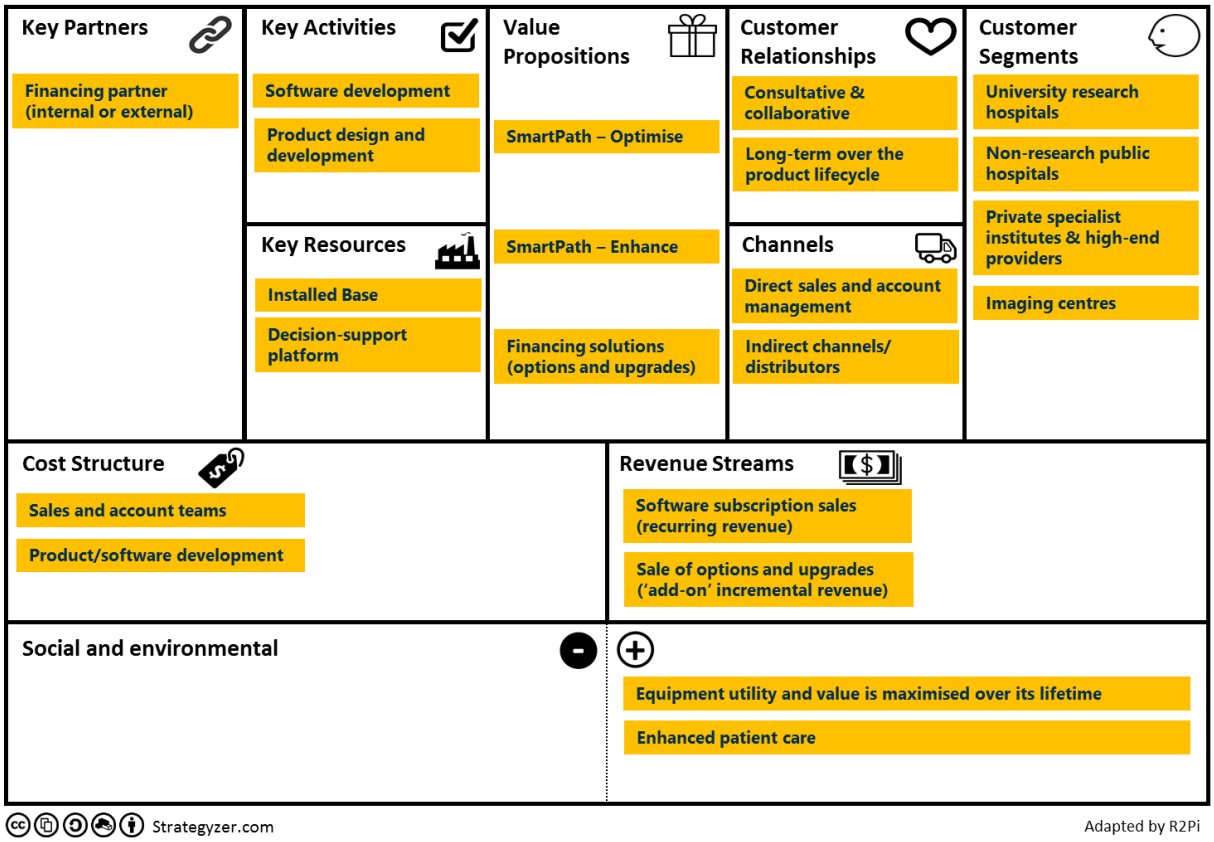
It should be noted that the traditional nine-block canvas for circular business models has been adapted to include an additional building block – Social and Environmental. This is designed to capture key social or environmental benefits or costs which arise from the application of the circular business model. Discussion of non-financial outcomes is covered in Section 3.7.

3.2 SmartPath – Business model elements for optimising and enhancing value within product lifetime

The business model canvas below summarises the key elements relevant to optimising and enhancing value within the product lifetime ('Optimise' and 'Enhance' within the SmartPath solution). Each business model element is described below.

FIGURE 6 BUSINESS MODEL CANVAS



Source: R2Pi Project analysis, company interviews

3.2.1 Customer segments

The R2Pi project assessed Philips customers for MR systems as broadly falling within two dimensions determined on the one hand by their level of technology requirement, and on the other by whether they are public or private sector institutions. Figure 7 below illustrates the key needs and requirements of customers across these dimensions, based on the analysis and research conducted by the R2Pi project.

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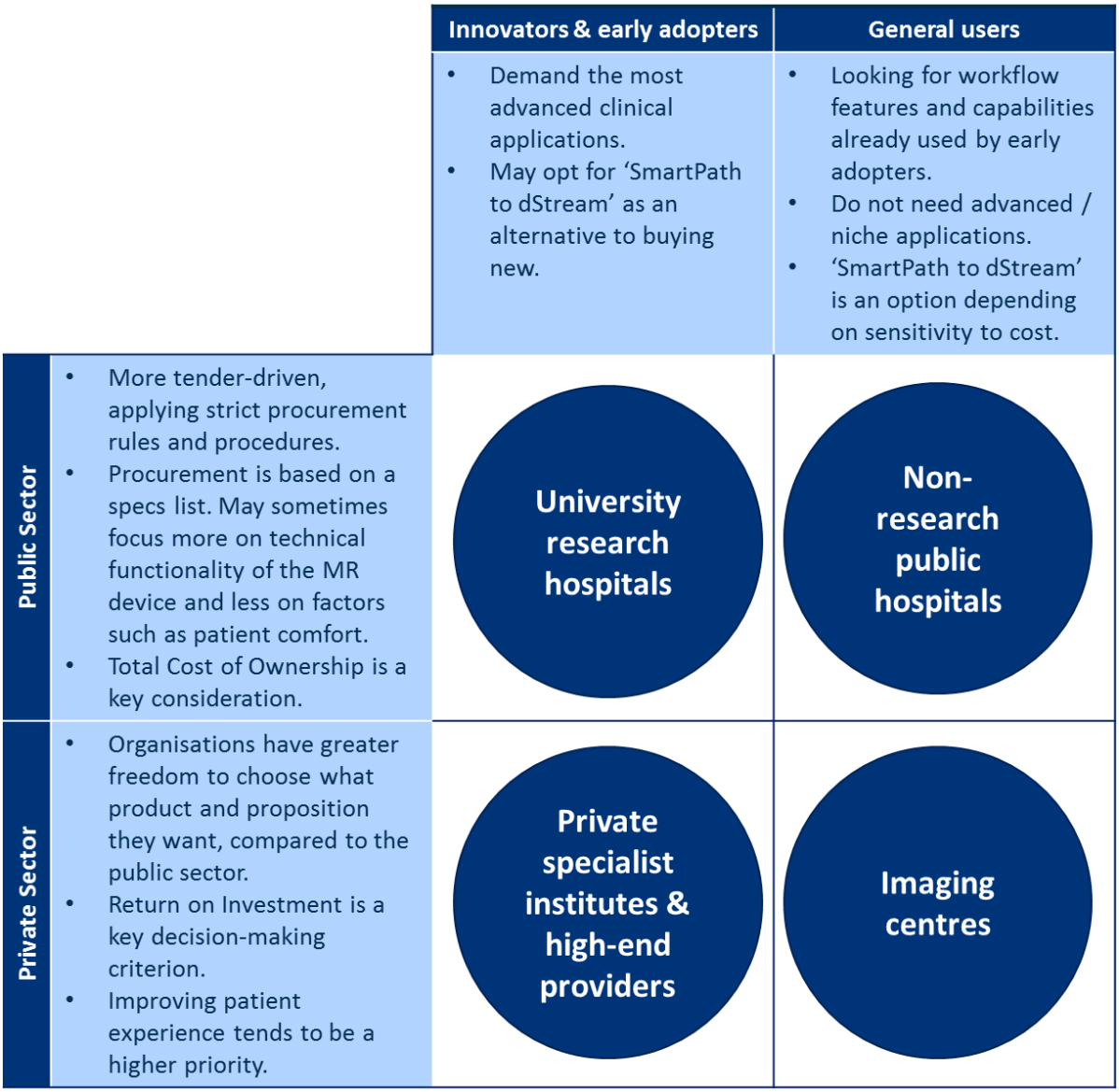
FIGURE 7 R2PI CASE STUDY ASSESSMENT OF PHILIPS' CUSTOMER SEGMENTS



Source: R2Pi Project assessment of customer segment based on Philips stakeholder interviews

3.2.2 Value proposition

The overall value proposition provided to customers through the 'Optimise' and 'Enhance' elements is to keep MR equipment at the highest level of utility and providing maximum value for customers throughout the machine's lifetime. This is done through a mix of software and hardware upgrades explained below. Together with software and hardware options, financing solutions are a key part of the value proposition offered to customers so that they can take advantage of these offerings.

Optimise

Customers have the option to purchase the '*Technology Maximiser*' subscription service with their MR equipment, generally bundled as part of a service contract at point of sale. Technology Maximiser provides customers with continuous software and hardware upgrades when they become available. From a software perspective, this follows a 'Software-as-a-service' (Saas) model. This offering enables

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customers to keep MR systems in state-of-the-art condition for a full 5 years after installation. This can optionally include receiving the latest specialty clinical software applications.

In addition to the Technology Maximiser subscription model, customers can separately purchase other updates and upgrades. These provide deeper improvements to machine performance, reliability, serviceability, and operating system.

Enhance

In the years following the purchase of an MR machine, customers may wish to add functionalities due to new requirements they may have. To cater for this, Philips' 'Enhance' offering provides hardware or software upgrades enabling fundamental improvements to machine functionality and performance. This includes improvements to machine capabilities, workflow, new software applications, etc.

If budget is available, these upgrades may be purchased as an add-on when required. If the customer doesn't have available budget, these options can be sold as part of a financing contract such as a 'sale and lease-back', or bundled into a new service contract (see Financing Solutions below).

Financing solutions (options and upgrades)

MR systems are a substantial investment, often leaving customers with little budget available for procurement of follow-on options and updates. One of the choices customers can make is whether to finance their investment through capital expenditure (capex) budgets, or operating expenditure (opex) budgets, in accordance to local tax regulations.

Financing for procurement of new MR machines

The majority of customers installing MR machines on their premises purchase and own the MR machine, financing this from their own balance sheet. This is considered a capex investment.

A proportion of customers lease their machines, where funding is drawn from their opex budget and the machine is owned by the leasing company (appearing as an asset on the latter's balance sheet). Depending on the market, the timeframe for MR leasing arrangements is between 5-7 years.

Financing of options and updates

Customer can purchase options and upgrades outright, as an add-on to their equipment purchase. Where required, customers can also finance this purchase through existing service contracts for their MR equipment. This allows the upfront cost to be spread over a number of years and incorporated into operational expenditure.

3.2.3 Channels

Philips has a direct sales team within key markets (countries or regions). Account managers and sales staff are responsible for developing and managing customer relationships and generating business opportunities across the suite of Philips 'modalities' (products and systems) and services. In some markets, Philips sells its equipment through distributors (indirect channel).

3.2.4 Customer relationships

Philips' aim is to be a life-long solution provider to healthcare organisations. As indicated within the introduction section above, this extends beyond just the MRI modality, and incorporates the broad range of products, systems and services used by healthcare providers. This requires Philips to

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maintain close and long-term relationships with customers at various levels of the organisation. For MR, this includes C-Suite; Radiology department leadership; radiologists, and operators. The objective is to continually understand and anticipate their needs and requirements, and offer the right solution at the right time.

Over the past years, Philips has transitioned towards selling solutions and developing long-term partnerships with customers. This includes consultative sales, including analysis of the customer situation, problem-solving and implementation (as illustrated in Figure 8 below).

FIGURE 8 PHILIPS APPROACH TO CUSTOMER ENGAGEMENT

Source: Philips

The sub-section below describes some of the solution and partnership development Philips engages in, including a specific example of developing a circular solution to MRI procurement with a leading customer.

We also describe below how account managers and sales teams anticipate needs and proactively engage customers during the lifecycle of an MRI product.

Approach to long-term relationships and solution development

Philips actively participates in open innovation through relationships with academic and industrial partners, and considers itself to be a technology solutions partner of choice to major hospitals looking to increase their effectiveness and efficiency. Examples of such long-term collaboration include:

- Health care partnership with Stockholm County Council and Karolinska University Hospital.
- 15-year partnership with Reinier de Graaf hospital in the Netherlands to enhance future patient care.

Philips is now extending this approach to develop circular solutions for customers, as illustrated in Box 1 for the procurement of MRI machines.

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BOX 1 CASE EXAMPLE: COLLABORATIVE CIRCULAR DESIGN WITH A LEADING MEDICAL UNIVERSITY

Philips undertook a collaboration to 'circularise' procurement of radiology solutions with a leading medical university. The hospital's C-Suite has been forward-thinking on sustainable development, and even hired a senior C-Suite executive to specifically drive the sustainability agenda.

The hospital had stated a goal to go completely circular by 2030 (across hospital functions, not only radiology/MR). As part of this, the hospital has been looking at developing proof points and test cases for circular economy, including:

- Taking a circular approach to building a new Emergency Department.
- Undertaking a circular procurement project for furniture.

The collaboration

Philips took the opportunity of working with a like-minded customer with a shared ambition on circular economy to jointly explore how radiology could be 'circularised'. This included extensive stakeholder interviews and workshops, in particular exploring the following:

- Servicing and optimisation at MR at end-of-life
- Servicing and optimisation of MR utilisation during its lifetime
- Returning MR systems for re-use
- Circular purchasing of MR

The initiative identified a set of priority short term practical actions to explore in detail, as well as longer term strategic topics. This is still in progress and the intention is to co-develop solutions and gain learnings which can be applied more broadly.

Key insights gained

The initiative highlighted both areas of challenge and opportunity related to the SmartPath Porfolio as well as new service-based business models:

- While there is a strong partnership between Philips and the hospital, the relationship felt somewhat transactional at times rather than consultative and having a lifecycle value perspective. This therefore needs to be actively built into the sales process.
- Addressing the procurement of new, 'non-standard' value propositions requires clarity of who the key stakeholders are as well as their needs and interests. For example, one area of concern was how new service models would impact radiologists' access to MR machines for research purposes (generally done out-of-hours).
- Understanding how budgeting and financial management processes work internally within the customer is important, as this influences how costs and benefits are perceived by different parties.
- Philips needs to show a clear case for what the benefits are to specific stakeholders within the customer organisation (who will have different needs and requirements).
- Undertaking a co-creation journey with a customer, separate from the commercial relationship, enabled issues to be explored in a way that would not have happened in the context of a standard sales discussion. This highlighted the importance of consultative sales, and potentially replicating this approach with other customers.

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3.2.5 Revenue streams

As described above, the SmartPath Upgrade Portfolio enables Philips to maintain ongoing touchpoints and develop a long-term collaborative relationship with customers. The Optimise and Enhance elements of SmartPath create value for customers by enhancing the utility and value they gain from their investment in MR equipment by ensuring software is kept up-to-date and, where required, adding additional functionality.

In exchange for creating and delivering this value, Philips is able to generate further revenue from products and services provided to customers over the lifetime of the MR equipment.

3.2.6 Key resources

Installed Based of MR machines

Placing attention on the installed base of Philips MR equipment, rather than mainly new sales, has been a significant change in Philips' mindset.

SmartPath Upgrade offerings during the initial years of an MR machine's lifecycle create incremental value for customers. Furthermore, customer touchpoints and conversations focused on helping them gain the most value out of their MR equipment also creates additional opportunities for cross-offering services and co-developing broader solutions. This contributes to Philips' aim of being a solution provider and long-term partner for healthcare institutions.

The installed based is therefore a key resource as it creates mutual opportunities: enhancing value to customers, as well enabling Philips to grow and develop lifecycle solutions.

Decision-support Platform

One of the key challenges to shifting from a 'new sales' to a 'lifetime value' model is empowering account managers and sales teams – making it easy for them to identify and execute revenue opportunities profitably and efficiently.

Philips have developed a decision-support platform to help account managers and sales teams identify ways in which SmartPath upgrades can enhance the value and functionality of MR machines during their lifecycle at a customer site, as well maximising value when the customer wishes to replace the machine at end-of-life.

The platform has been developed by a team working across multiple functions within Philips, including: IT, Business Intelligence, Sales, Marketing, etc. This has enabled the platform to be designed in a way that is relevant and practical for sales team end-users. The tool integrates with Philips' Salesforce CRM platform. It was initially deployed to the MR business and has since been rolled out to other modalities.

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3.2.7 Key activities

Key activities that support the SmartPath offering for optimising and enhancing MR equipment are software development; and product design and development.

Software development

Software plays an increasingly important role in creating value for customers using MRI equipment. Software can improve the operation of the machine and imaging outputs; the processing and management of image data; as well as providing diagnostic applications. As described in the Value Proposition, software is a key part of the Optimise and Enhance elements. This generates value to customers thorough improved functionality and performance.

Product design and development

Focusing on adding value to customers throughout the lifecycle of an MR machine has driven Philips to focus not only on new product development, but also on how new hardware and software technology can be 'backward compatible' with existing machines in the installed base.

Philips' philosophy is that new features and functionalities should not only be available to customers buying new machines, but also to existing customers. This is part of the SmartPath Value Proposition and underpins Philips' goal of supporting customers over the lifetime of the relationship.

3.2.8 Key Partners

MRI machines are generally sold to customers who pay for this out of their capital expenditure (capex) budget and own the asset.

There is an increasing trend for customers to finance the purchase of MR machines from their opex (operating expenditure) budget. In this situation, customers will seek lease financing from a third party to procure the machine (lease payments will be accounted for as opex). This procurement model can be driven by internal budgetary constraints or tax regimes that provide a financial advantage from leasing rather than buying the asset.

When customers who have purchased an MR machine wish to update or upgrade the hardware or software later in the lifecycle, they may not be able to draw on capex budget either because it is not available or they would need to initiate an onerous procurement process. In this case, lifecycle updates and upgrades may be financed by drawing on lease financing.

Financing is therefore a key aspect of the value proposition offered to customers. Philips offers this financing through a mix of external as well as internal financing partnerships.

3.2.9 Cost structure

The key costs of the SmartPath model relate to the following elements of the business model:

- Direct sales and account management teams (Channels).
- Product and software development to ensure upgradeability of MR equipment, and for developing lifecycle upgrades (Key Activities).

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3.3 SmartPath – Business model elements for *extending product lifetime and closing the loop*

MR machines have a lifetime of approximately 10 years, which has been extending to 15 years or more in some cases as customers increasingly wish to maximise value and utilisation of their assets. Software and specific hardware upgrades are relevant in the early years and up to approximately year 8 of an MR system, keeping it up to date. However after this point, the main bottlenecks are the capabilities of the underlying hardware.

One of the key steps taken by Philips in developing the SmartPath solution for the full lifecycle of an MRI product was to clearly define certain milestones, what these mean for the customer, and what Philips could offer in order to maximise mutual value. Key milestones include:

- **End of life**: Philips guarantees product support up to the 10 year mark from the date of purchase of an MR system. One of the ways of continuing spare parts provision beyond end of life is to harvest and redeploy spare parts from traded-in MR systems.
- **End of service**: At a point following End of Life, Philips will cease servicing and supporting the MR system entirely.

To address customer needs at the latter stages of an MR machine's lifetime, Philips has developed two propositions:

- **SmartPath to dStream upgrade** where the MR system is significantly overhauled at the customer's location. The majority of the system hardware is replaced, from which parts are harvested and reused to refurbish equipment for re-sale as well as for servicing the existing installed base.
- **Incentivising trade-in for a new system**. If done early enough in the product lifetime, the older MR machine can be taken back, refurbished, and resold under Philips' 'Diamond Select' brand. Parts can also be harvested for servicing the existing installed base. In return, Philips provides the customer a trade-in value that can be used towards purchasing a new MR system.

The business model canvas below summarises the key elements relevant to these propositions which extend product lifetime and support closing the loop. A number of business model elements are the same or similar to that of the business model for Lifecycle updates and upgrades covered in Section 3.2 above. These are shown in grey in Figure 9 below. To avoid duplication, elements in common with SmartPath Updates and Upgrades ('Optimise' and 'Enhance') are only described where these are substantially different.

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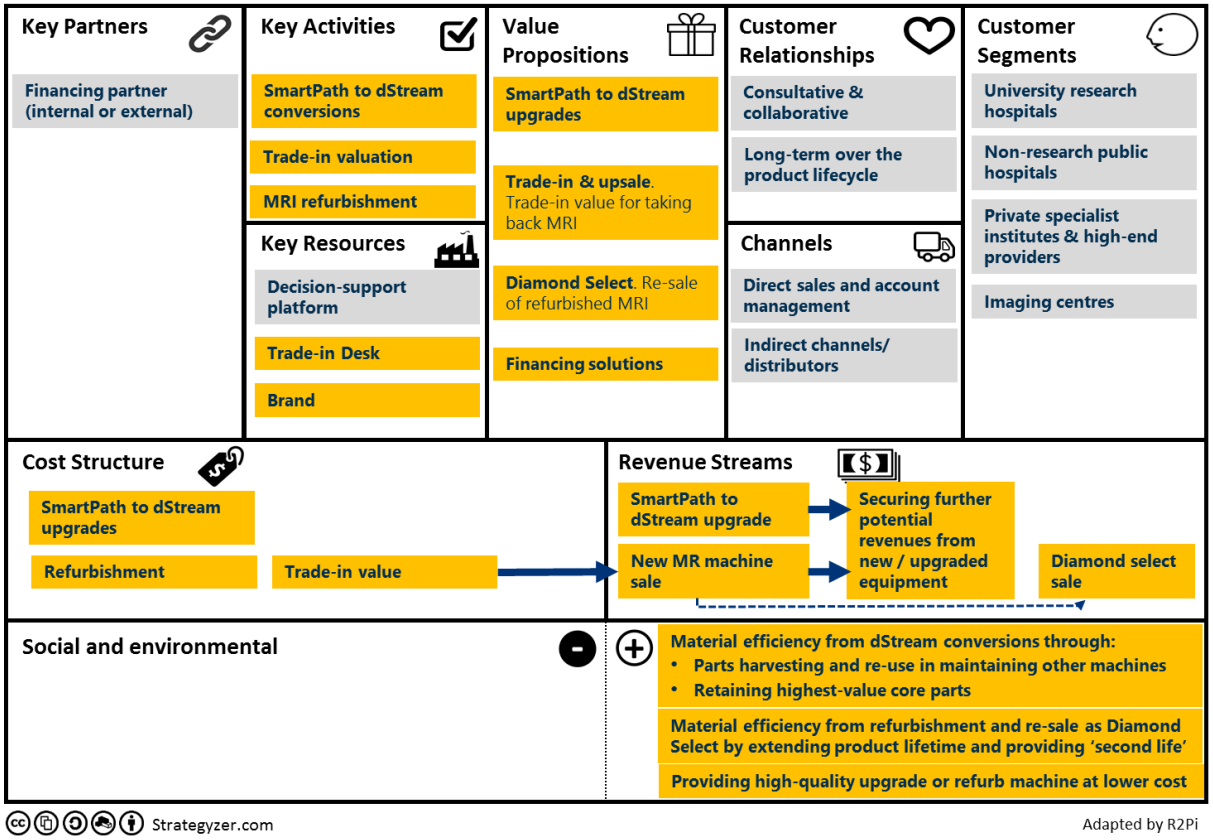
FIGURE 9 BUSINESS MODEL CANVAS



Source: R2Pi Project analysis, company interviews

3.3.1 Value proposition

The key elements of the value proposition for extending product lifetime and closing the loop are:

- 'Transform': Providing a full on-site overhaul of the hardware and software, with only the core magnet remaining from the original equipment.
- 'Trade-in': Incentivising the trade-in of an existing MR machine for a new machine. Depending on age of the existing MR equipment, this can then be refurbished and re-sold by Philips under the 'Diamond Select' brand.

These value proposition elements are described below.

Transform: The SmartPath to dStream proposition

As an MR system becomes older, customers face the challenge of how to access the latest available technology in an affordable manner while delivering value for money.

A SmartPath to dStream upgrade provides a cost-effective way for hospitals to bring their equipment up to date. As part of this, customers retain the large magnet component of the MR machine while a significant portion of other components are replaced. The degree to which these need to be replaced can vary, providing the potential for further reduction in material consumption. Benefits of SmartPath to dStream to a customer include:

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- Upgrading of the MR machine to the latest technical specifications and functionalities.
    - dStream upgrades incorporate digitisation of equipment functions, making them further upgradeable in the future.
    - Scanning speeds are increased, enabling better throughput of procedures and workflow.
    - Image quality and definition is improved, enabling better diagnostic capabilities.
- SmartPath to dStream is less costly than buying a new machine, less disruptive, and quicker to undertake. In contrast, when a new MR system is installed this typically requires re-construction of the whole room or parts of the hospital wing; installation of new building systems (e.g. air conditioning); and can take several weeks.

dStream upgrades can be applied to MR machines that are up to three product generations old. This provides significant scope for upgrading a large spectrum of Philips' installed base of MR systems.

Trade-in and customer loyalty

Philips has traditionally offered value to customers wishing to trade-in and replace their equipment. Valuations and pricing are overseen by the Trade-in Desk. Building on this, Philips has developed a customer loyalty programme creating a comprehensive and attractive offer to customers, while also allowing Philips to capture additional value from taking back the machines. Sources of direct value to Philips include:

- Extending service revenues for a further period (lifetime of the new machine)
- Capturing stock of used parts and equipment for refurbishment, reuse, and re-sale

Extending service revenues for a further period

A key rationale behind the customer loyalty programme is that it is easier and less costly to keep existing customers, compared with the marketing and sales spend needed to capture market share from competitors. Furthermore, retaining a customer with a new MR machine offers the opportunity for service revenue for a further period of the equipment's lifetime.

Capturing stock of used parts and equipment for refurbishment, reuse, and re-sale

A further area of value that is factored into the customer loyalty programme is that, by incentivising early trade-in, MR equipment has sufficient life and market value that it can be refurbished and re-sold to a second customer.

For example: Philips guarantees support for its MR systems for a period of 10 years. If a customer trades it in close to this end-of-life term, it cannot be re-sold. However if they decide to trade in earlier, the MR system has sufficient lifetime so that it is worthwhile refurbishing and re-selling, enabling it to be used for a further period (i.e. it will have had 'two lifetimes').

Diamond Select refurbished machines

The "Diamond Select" proposition, applied across all Philips refurbished systems, is strongly recognised by the market, and customers know what they are getting in terms of quality. This also enables sales teams to understand and communicate the proposition more effectively.

Diamond Select refurbished machines are officially part of the Philips product-line up and feature on the product catalogue.

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Financing solutions

Similarly to the lifecycle updates and upgrades describe above, financing solutions are a key part of the value proposition as they enable customers to take up these offerings.

Financing of a SmartPath to dStream upgrade: Sale and Leaseback

Customers may not have the budget available for substantial capex investment in updates/upgrades after the initial purchase. In this case, a leaseback arrangement can be provided enabling capital to be released and re-invested in upgrading the equipment. National tax regimes can drive this type of sale and leaseback arrangement, where hospitals pay less tax by paying for the lease through their opex budget.

BOX 2 FINANCING CASE EXAMPLE: MRI SMARTPATH TO DSTREAM CONVERSION VIA SALE & LEASE BACK

A Philips financing partner buys a customer's MR system. Philips then conducts the SmartPath to dStream conversion and leases it back to the customer at an operational monthly lease rate. Benefits for customers include:

- Freeing up customer balance sheet and releasing cash.
- Taking pressure away from the capex budget; as new equipment is leased on the opex budget.
- The upgraded MR machine is like new, with the latest technology, and a new system life of more than 10 years.
- Low building reconstruction costs and quicker installation
- The equipment upgrade provides the benefits of moving to a digital system, enabling better workflow, image quality, etc.

Financing of an end-of-life up-sell

When an MR system is close to end-of-life it becomes more costly for Philips to service, compared to servicing an upgraded or newer model. Philips provides a mutually beneficial solution: Enabling customers to use this ongoing service cost differential to finance the upgrade or replacement of the machine. Key benefits for customers are that they can upgrade their MR system at minimal capex and operational expense, without disruptive changes to the budgeting process. This enables Philips to reward customer loyalty and drive retention in a relatively seamless manner.

3.3.2 Revenue streams

Product life extension through SmartPath to dStream and trade-in generate both direct/immediate as well as follow-on revenue streams for Philips by maintaining Philips' installed base (so-called 'socket') within the customer's site.

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SmartPath to dStream upgrades

A SmartPath to dStream upgrade will provide Philips with sales revenue either immediately, if paid for via a customer's capex budget, or spread over a period of months/years if it is bundled into a new service contract (as described above).

Furthermore, because upgrading a customer MR with dStream will bring it fully up to date in terms of software/IT and hardware, it also then opens up the possibility of further revenue streams from lifecycle updates and upgrades (as described under 'Optimise' and 'Enhance' in Section 3.2), over a further period of 5 or more years. This incorporates Philips' philosophy of designing both new equipment and SmartPath to dStream upgrades to be 'forward-compatible', and upgrades to be 'backward-compatible' for the installed base.

Trade-in

Trade-in potentially generates two revenue streams. The first is revenue from sale of a new MR system. If the MR system is traded in early enough in its lifecycle (around year 8 or earlier), it will have higher residual value and demand in the market to be re-sold as a refurbished machine, generating a second revenue stream. Refurbished machines are sold under Philips' 'Diamond Select' brand, which is a core part of the product line-up offered to the market.

Similar to machines that are transformed with SmartPath to dStream, refurbished machines will also be updated and can generate further incremental revenues through add-on updates and upgrades.

3.3.3 Key resources

Decision-support Platform

As described under the SmartPath value proposition for optimising and enhancing the lifecycle value of MR machines, once a system has been sold and installed on-site, Philips' SmartPath tool enables account managers to proactively offer relevant options and upgrades.

This includes trigger points for account managers to propose a dStream upgrade or an early trade-in for a new MR system. The SmartPath tool is a key resource here because it facilitates these conversations in a timely and consistent manner.

Trade-in Desk

The Trade-in Desk is a function within Philips which supports sales and account manager teams determine the trade-in value of MR machines that can be offered to customers wishing to buy a new system. It also defines the Trade-in value that can be offered to customers to incentivise early trade-in. This process is explained under 'Key Activities' below.

Brand (Refurbished systems)

Philips has an established and recognised brand for selling refurbished MR systems called 'Diamond Select'. Developing this brand as a sign of quality is an essential component enabling Philips to distinguish itself from other dealers selling refurbished MR machines.

Furthermore, the Diamond Select brand is supported by Philips' overall brand and recognition for quality. The power and importance of the brand is recognised by the market – in 2016 it was ranked as the third most purposeful brand, and most valuable Dutch brand.

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3.3.4 Key activities

SmartPath to dStream conversions

SmartPath to dStream conversions are conducted by Philips teams at the customer site. The MR system is fully taken apart, essentially leaving just the magnet. The MR machine is then re-assembled on-site using up-to-date parts, imaging technology, IT hardware, software, etc.

MRI refurbishment

The refurbishing of MR equipment is done within Philips' factory operations in Best, Netherlands. MR machines are fully disassembled at the customer site and removed (including the magnet), to be refurbished and reassembled at the Philips factory. Similarly to SmartPath to dStream, refurbished machines also have their hardware and software updated.

Trade-in valuation

As described above, the Trade-in offering is important to incentivise the early trade-in of MR systems so that these may be refurbished and re-sold. Even at later stages of the lifecycle, the right trade-in value offered to customers will enable Philips to preserve its installed base (so-called 'socket') at the customer site by replacing it with a new Philips system.

3.3.5 Cost structure

The key elements of cost structure for this aspect of the SmartPath upgrade portfolio are:

- Manufacturing of hardware for SmartPath to dStream on-site transformations.
- Refurbishment of MR systems at Philips' factory in Best, Netherlands.
- Trade-in Value and Enhanced Trade-in Value provided to customers towards purchasing a new MR machine. This in turn enables sales revenue and further incremental revenues (described under Revenue Streams).

3.4 The Value Network

The SmartPath upgrade portfolio and associated elements such as the refurbishment business drive two key principles of circular economy:

- Keeping products and materials at their highest value for as long as possible: encompassing Optimise, Enhance, Transform, and Trade-in.
- Returning products and materials back into production and eliminating waste: including Trade-in, refurbishment, and re-sale via Diamond Select; as well as harvesting and reusing parts for maintenance of the installed base as well as machine refurbishment in factory.

Figure 10 below illustrates the flow of materials through this network. Figure 11 overlays onto this illustration key areas of financial value creation and transfer. These include:

- New MR machine sale.
- SmartPath updates and upgrades (Optimise and Enhance).
- SmartPath to dStream (Transform).
- Trade-in value / Enhanced Trade-in Value to incentivise trade-in and upselling, retaining Philips' socket.
- Re-sale of refurbished MR machine (Diamond Select).

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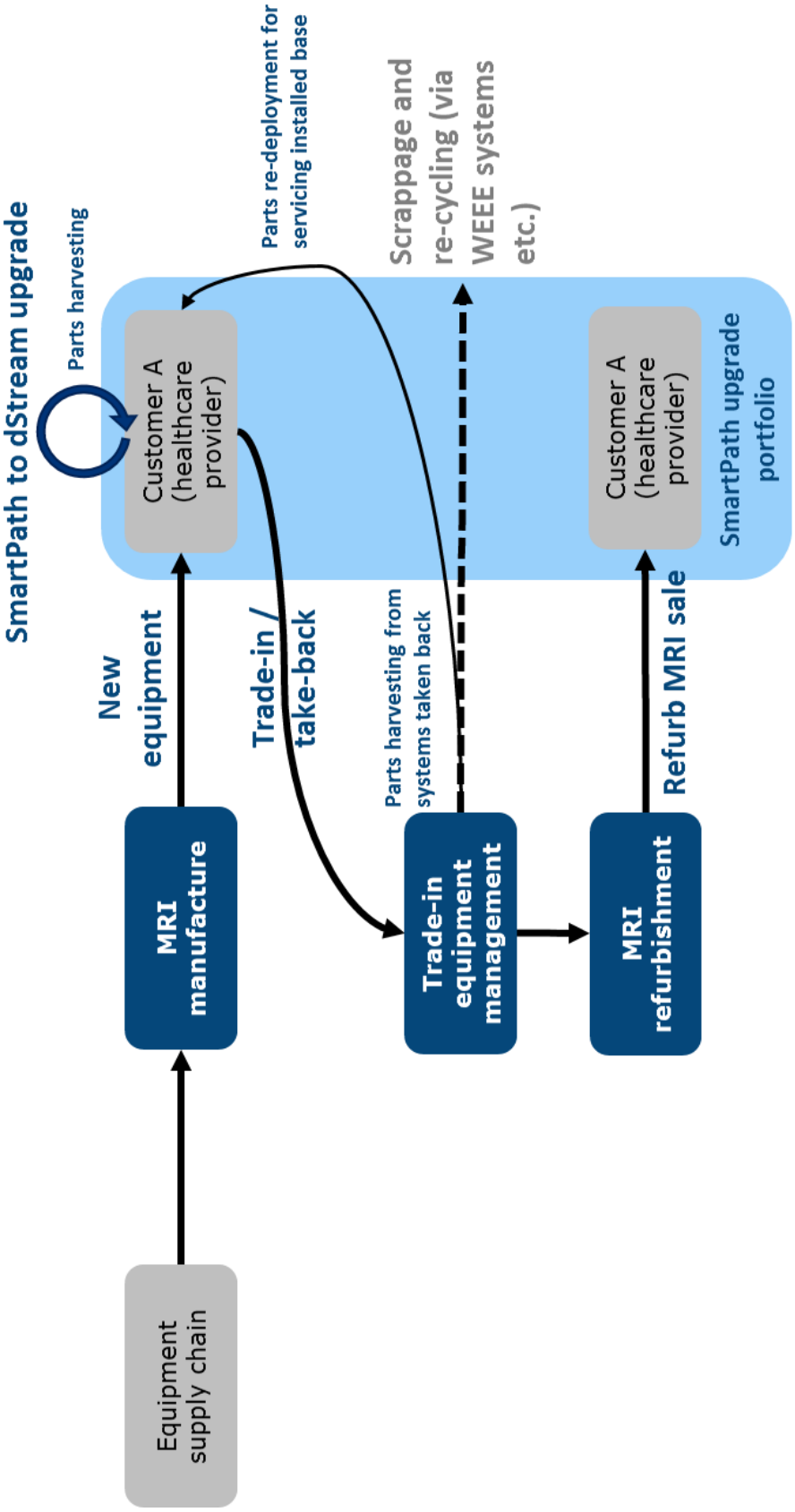
FIGURE 10 EQUIPMENT AND MATERIAL FLOWS FOR MRI SYSTEMS WITH SMARTPATH



Source: R2Pi Project analysis; company interviews

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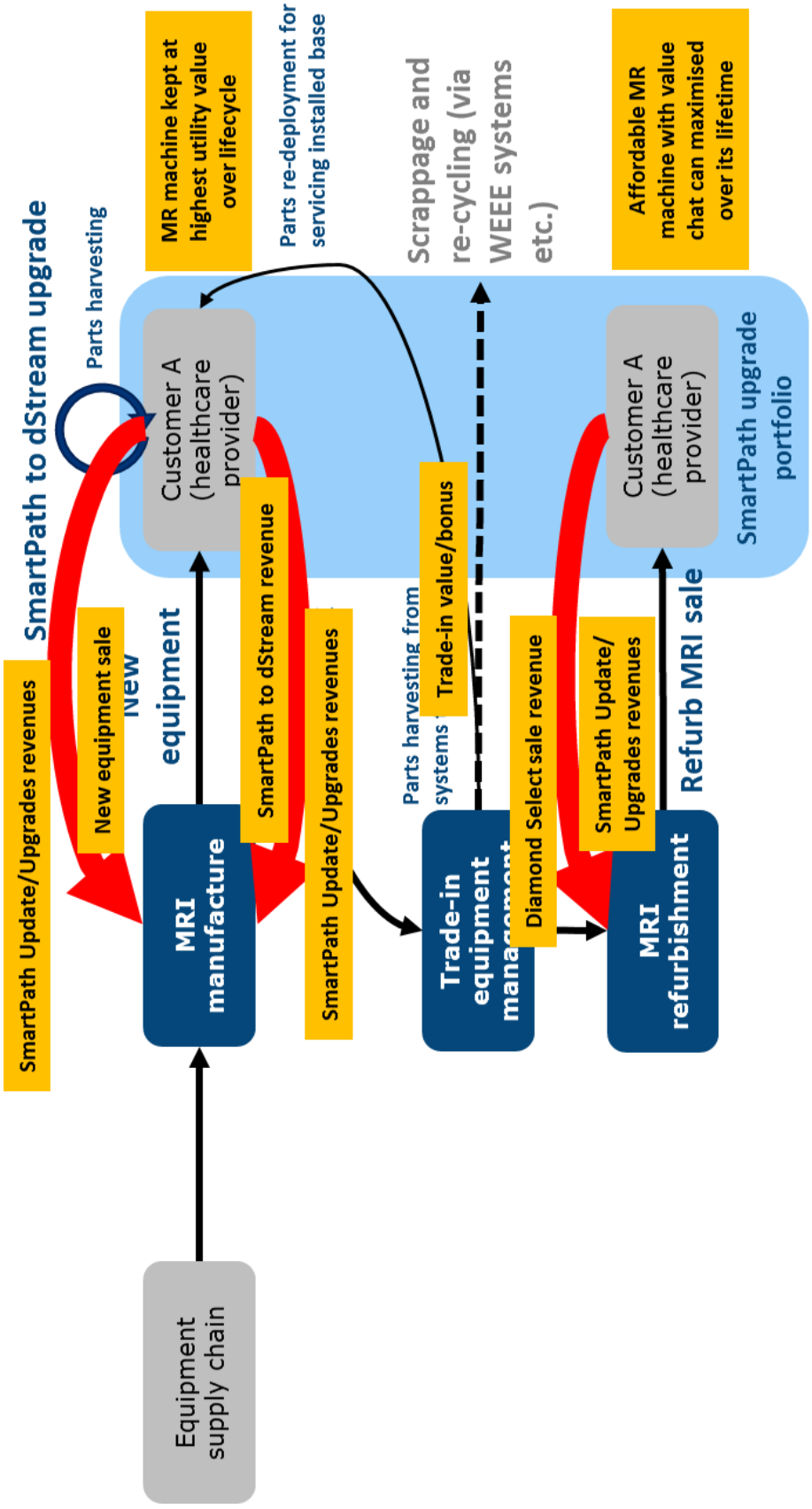
FIGURE 11 KEY AREAS OF VALUE FLOW AND CREATION



Source: R2Pi Project analysis; company interviews

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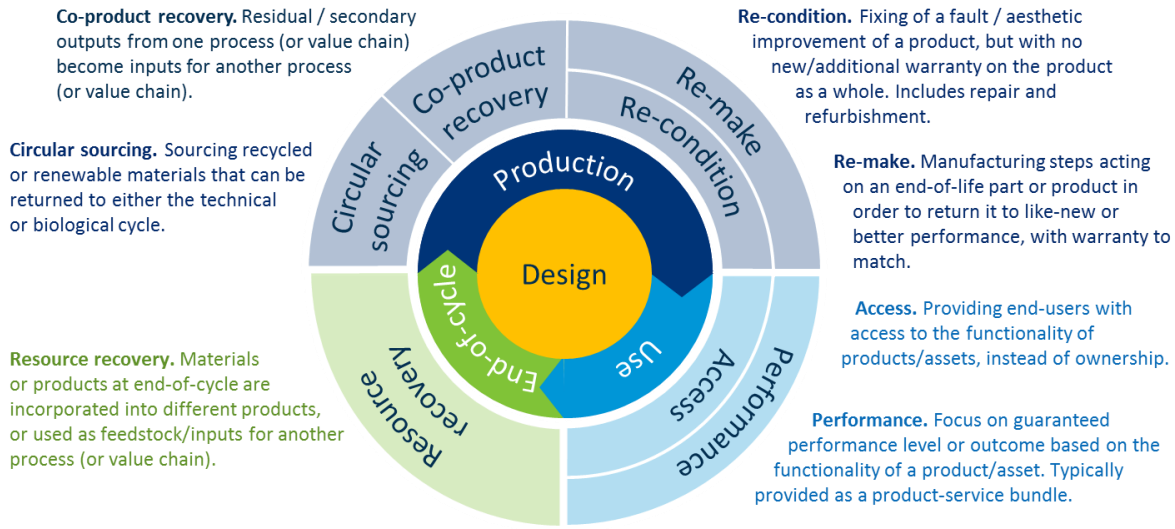
3.5 Business model circularity assessment

The R2Pi project has established seven key patterns of circular business model, described in Figure 12 below.

FIGURE 12 THE SEVEN CIRCULAR BUSINESS MODEL PATTERNS



Source: R2Pi Project

Philips' SmartPath offering maps against a number these circular business model patterns, as illustrated in Figure 13 below. In addition, Philips also offers additional services that can be combined with elements of the SmartPath offering such as leasing and financing, managed service models, and emerging 'pay-per-scan' models.

Figure 13 illustrates the relationship between the various parts of the SmartPath upgrade portfolio (and related offerings) with relevant circular business model patterns.

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FIGURE 13 MAPPING OF CIRCULAR BUSINESS MODEL PATTERNS AGAINST PHILIPS' SMARTPATH AND OTHER RELATED SOLUTIONS

CBM pattern	SmartPath: Optimize	SmartPath: Enhance	SmartPath: Transform	SmartPath: Trade-In	Related solutions	
Circular sourcing				**Harvesting parts and components** from traded-in MRI systems enables the refurbishment model.		
Co-Product recovery						
Re-condition			**On-site overhaul and refurbishment** of the MRI system	Enables **refurbishment** model in the factory through traded-in MRI equipment.		
Re-make						
Access					**MRI leasing and financing models** provide options for customers to shift ownership to third parties.	**Pay-per-scan / MR as-a-service**. Philips is currently considering how to address requests for pay-per-scan emerging in the marketplace
Performance	**Enhances performance and functionality** of MRI equipment throughout its lifetime.		Enables step-change improvement in **performance and functionality**.		**Managed Service model** focuses on achieving performance objectives	
Resource recovery				Incentivises **return and take-back** of MRI equipment.		

Source: R2Pi Project; company interviews

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3.6 Financial outcomes assessment

SmartPath has been commercially successful and profitable for Philips, and promises to yield substantial future benefits.

The use of the decision-support platform in particular has been a key driver of commercial benefit, enabling Philips to identify thousands of leads, improving customer touch-points and relationships, and providing the intelligence for running coordinated sales campaigns and programmes.

3.7 Non-financial outcomes assessment

SmartPath provides substantial material resource efficiency benefits, as well as broader social and other non-financial benefits, described below.

Optimising and enhancing value within product lifetime ('Optimise' and 'Enhance')

Equipment utility and value is maximised over its lifetime. Updates and upgrades enable machines to improve functionality in keeping with medical requirements during their lifetime. Philips' strategy of ensuring new software and hardware are backward-compatible with machines in the installed base also ensures healthcare providers can enhance asset value for as long as possible until they choose a SmartPath to dStream conversion or trade-in for a new machine.

Enhanced patient care. Updates and upgrades enable healthcare providers to provide better patient care in a cost-effective manner. For example, they can improve diagnostic outcomes as well as enable operational efficiencies in radiology departments so that MRI equipment is better utilised.

Extending product lifetime and closing the loop ('Transform', 'Trade-in' and refurbishment/re-sale)

Parts harvesting and re-use in maintaining other machines. Parts are harvested from SmartPath to dStream upgrades or cannibalised from traded in machines, and can be re-used either in maintaining the installed base or refurbishment of systems for re-sale. In particular, harvested parts can enable older machines in the installed base to be serviced beyond their designated end of life.

Retaining highest-value core parts. SmartPath to dStream transformations preserve the highest cost component of the MR machine (the large magnet) with the customer, and extend its lifetime for a further lifecycle.

Material efficiency from refurbishment and re-sale as Diamond Select by extending product lifetime and providing a 'second life'. Refurbishment of traded-in MR machines enables the core components to be updated and re-used by a second customer for a further lifecycle. Refurbished MR machines are sold under the 'Diamond Select' brand.

Providing high-quality upgraded or refurbished machines at lower cost. In the context of budget pressure in hospitals, especially in the public sector, dStream conversions or Diamond Select refurbished machines enable healthcare providers to procure improved or additional MR diagnostic capabilities at a significantly reduced price.

Customer satisfaction and deepening relationships

The lifecycle approach of SmartPath creates a foundation for ongoing and more collaborative relationships between Philips and its customers. This enables better understanding of customer needs and how to serve them effectively, improved patient outcomes, and higher customer satisfaction.

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3.8 Role of ICT and technology in improving profitability and material efficiency

3.8.1 Decision-support Platform

One of the key challenges to shifting from a 'new sales' to a 'lifetime value' model is empowering account managers and sales teams – making it easy for them to identify and execute revenue opportunities profitably and efficiently.

Philips have developed a decision-support platform to help account managers and sales teams identify ways in which SmartPath solutions can enhance the value and functionality of MR machines during their lifecycle at a customer site, as well maximising value when the customer wishes to replace the machine at end-of-life. Specifically:

- At initial stages of the lifecycle: Assessing relevant software and hardware options and upgrades that will keep a customer's MR machine working at its highest performance levels.
- When an MR machine's technology and/or functionality has been maximised but its performance is significantly lower compared with new machines (typically midway through its lifetime): proactively providing options for a full overhaul (SmartPath to dStream).
- When an MR machine is close to or at end-of-life and the customer is considering, or likely to consider, replacing it: Offering attractive terms for trade-in and take back of the MR equipment.

The platform has been developed by a team working across multiple functions within Philips, including: IT, Business Intelligence, Sales, Marketing, etc. This has enabled the platform to be designed in a way that is relevant and practical for sales team end-users (e.g. integrating with Philips' Salesforce CRM platform. It was initially deployed to the MR business and has since been rolled out to other areas.

The decision-support platform is being further developed and extended to incorporate characteristics of customers' operating environments which influence their current and longer-term requirements. This includes, for example: demographics and socio-economic context.

Key benefits to Philips of deploying this platform are:

- Effective decision support for account managers selling options and upgrades. The platform enables more rapid and easier processing of transactions, enabling managers to focus on the customer relationship and offering the right service.
- Proactively triggering timely contact (touch points) and conversations with customers, enabling account managers to build a better understanding of the customer and longer-lasting relationships.
- The platform also uses information from sales and customer transactions to provide insights that Philips uses to develop and refine product roadmaps.

3.8.2 Role of software and digitisation in MRI

Software plays an increasingly important role in creating value for customers using MRI equipment. It can improve the operation of the machine and imaging outputs; the processing and management of image data; as well as providing diagnostic applications.

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As discussed above, software is a core part of the SmartPath value proposition. With the overall trend in digitisation of radiology and diagnostics, the importance of providing software solutions and applications to customers will become increasingly important. It will also enable the upgradeability of hardware so that it can stay relevant and provide better value to customers for longer periods (extending lifetime).

3.9 SWOT analysis

This section contains an analysis of the Strengths, Weaknesses, Opportunities and Threats (SWOT) associated with the circular business model. It is important to note that this is primarily an assessment of the attributes of the business model itself and only secondarily of the specific attributes of the individual company. As is customary in SWOT analyses, the Strengths and Weaknesses are internal to the case organisation's business model. Whereas the Opportunities and Threats are external to the case organisation's business model, coming from the context in which they operate (illustrated in Figure 14).

The strengths, weaknesses, opportunities and threats covered in this section have been discussed in detail within the business model assessment sections above. The purpose is to distil and highlight those key areas that result in enablers or barriers for the development of circular business models. Chapter 4 discusses these barriers and enablers, drawing lessons and conclusions.

FIGURE 14 SWOT ANALYSIS FRAMEWORK

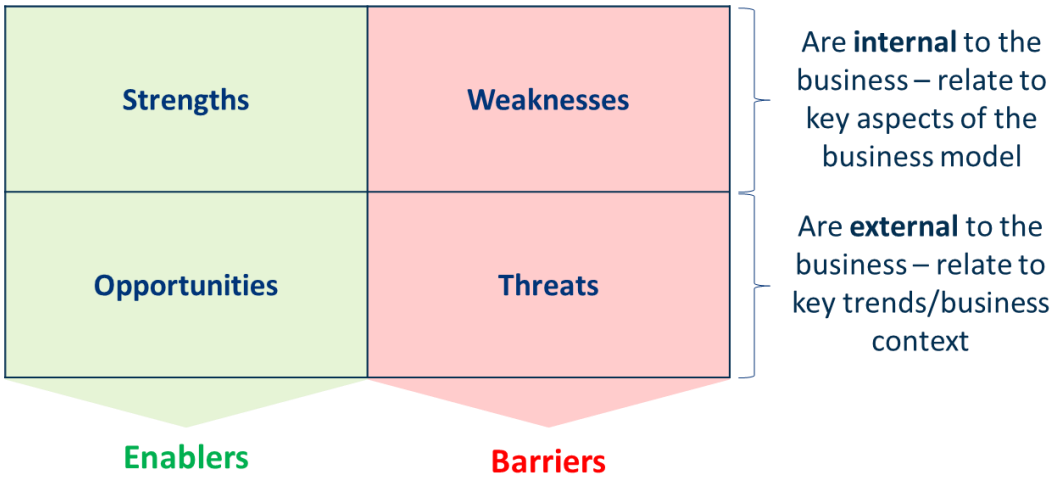

Figure 15 below summarises the key SWOT areas assessed for Philips' SmartPath upgrade portfolio, which are discussed below.

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FIGURE 15 SWOT ANALYSIS

Strengths	Weaknesses / Improvement opportunities
• Lifecycle roadmap of updates and upgrades • Strong refurbished product proposition • Trade-in value & enhanced trade-in value • Long-term service based contracts • Decision-support platform • Design for upgradeability • Design for backward compatibility	• Creating an integrated and seamless proposition • Integrated lifecycle contracting • Financial and contractual processes • Sales team incentives
Opportunities	**Threats**
• Digitisation • Technical/technological developments • Demand for cost efficiency and productivity • Demand for cost predictability and focus on value • Customer drive towards standardisation of MR processes	• Regulations – Environmental health and safety • Policy – disincentives for older equipment upgrade • Policy & Regulations – Public sector procurement practices • Customers – slow uptake of servitised propositions • Customers – traditional procurement mindset • Competition from new entrants

Source: R2Pi Project analysis

3.9.1 Strengths

Value proposition

Lifecycle roadmap of updates and upgrades

A key strength of the SmartPath upgrade portfolio is a set of value propositions that provide a roadmap of value-enhancing updates and upgrades over the course of the MR equipment's lifecycle. This is complemented and made feasible through product design (see below).

Strong refurbished product proposition

The "Diamond Select" proposition, applied across all Philips refurbished systems, is strongly recognised by the market for its quality. This also enables sales teams to understand and communicate the proposition more effectively. Diamond Select refurbished machines are officially part of the Philips product-line up and catalogue.

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Trade-in value and enhanced trade-in value

Philips has a customer loyalty programme offering a trade-in value. A central expert team provides advice and support to account managers having customer conversations on incentivised trade-in.

Internal visibility of end-of-life dates of MR equipment across the installed base enables proactive discussions regarding trade-in at the right time to maximise value.

Channels

Long-term service-based partnerships

Philips has been establishing broad multi-year partnerships (e.g. over periods of 15 years) with a number of hospitals. This process enables the company to gain deep insights into current and future customer needs.

These partnerships, and the services provided by Philips such as 'PerformanceBridge' and other managed services, are an important foundation for exploring and developing service-based models for MR. This is because they expand the focus from hardware specifications to delivery of value and outcomes for the customer and for patients.

Key Resources for sales

Decision-support platform

In the past, determining the right offering of options and upgrades for a customer was relatively complex. Now, account managers can rapidly define an opportunity using the decision-support platform developed. There is therefore an opportunity to align incentives to match the tools and opportunities provided to sales teams.

Key Activities – New Product R&D

Design for upgradeability

When developing a new product, Philips designs the whole lifecycle roadmap of upgrades and enhancements. This enables 'future-proofing' and enhances the customer value proposition.

Digitisation is a key component of upgradeability, where capabilities can be improved in the future through software updates and additional clinical software applications.

Design for backward compatibility

When developing new features, technology, and applications for MR systems, Philips also considers how these can be applied to the existing installed base. This is done by having a stage-gate decision in the product development process to assess if and how these can be made backward-compatible with older hardware in the installed base.

Insights from installed base characteristics and customer needs are used as part of the design process to identify and prioritise upgrades that have most relevance and impact to existing installed base customers.

For example, SmartPath to dStream upgrades that bring MR systems up to the latest digital capabilities also enable customers to benefit from further software updates and clinical applications.

Philips has therefore developed a balance in capabilities and investment in both new product development as well as existing product upgradeability.

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3.9.2 Weaknesses / Opportunities for Improvement

Value proposition

Creating an integrated and seamless proposition (and the processes to deliver it)

Philips has developed a suite of offerings within the overall SmartPath Value Proposition (Optimise, Enhance, Upgrade, Trade-in), which can be offered as solutions. The opportunity is now to further implement and develop a seamless experience for customers across the SmartPath offering. This will be enabled through training and awareness raising within sales teams, continued change management, and effectively applying the decision-support platform.

Integrated lifecycle contracting

As part of having a set of propositions that apply over the product lifecycle, it is important to communicate these up-front with the customer during the procurement and contracting process.

Sales teams often encounter the situation where a customer would like to purchase an update or upgrade, however they do not have the budget to do so. This occurs when discussions regarding the lifecycle roadmap and future customer needs are not part of the initial contracting. A barrier to this type of discussion may be that customers' decision-making and budgeting cycles make it difficult to earmark budget in the future, and they are more focused on the initial procurement contract.

A further opportunity lies in integrating the trade-in option into contracting from the beginning, and to explicitly highlight the mutual benefits of equipment trade-in and take-back. This would enable Philips to maximise both the retention of customers, as well as the retention of valuable assets that can be refurbished or recycled.

Key Activities

Financial and contractual processes

Service-based contracts require a very different set up in terms of financial systems and practices (contracting, billing, accounting etc.) compared with product-focused sales and traditional services (e.g. maintenance).

Philips has the opportunity to learn from its experience with multi-year, large-scale service contracts and develop the systems and processes needed to apply service-based propositions for smaller scale contracts (e.g. focused on MR as a service).

Channels – Sales team

Sales team incentives

Philips' sales teams are a key part of the transition towards providing customers with relevant lifecycle-based solutions and building long-term relationships. This requires ongoing change management as well as developing appropriate sales targets and incentives such as commission structures. In addition to the use of decision support tools, this will be important in aligning sales with the desired lifecycle and solutions-focused model.

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"It is vital to shift our mind-set and culture towards focusing on our installed base, not just selling new. This is a winning formula when combined with customers wanting to get more out of their equipment."

- STATEMENT

3.9.3 Opportunities

Digitisation and technological developments

Digitisation

The increasing and overarching importance of software and ICT within healthcare creates a number of opportunities:

- Driving demand for add-on or bundling of software updates that enhance the value of MR systems over their lifetime by adding functionality and improving diagnostic capabilities (as well as integration into hospital data systems).
- Driving demand for system upgrades/conversions that can cost-effectively bring older equipment up to the latest standards for digital imaging (e.g. the SmartPath to dStream conversion upgrade).
- Enabling potential performance and value-based business models such as 'pay-per-scan'.
- Creating opportunities for leadership in new and disruptive applications (e.g. Big Data analytics and AI) that can transform the role of radiologists and the use of patient data.

Technical / technological developments

Technological developments drive customer demand for updating MR equipment. In addition to digitisation, the introduction of larger bore sizes enabling a larger diameter of the tunnel through which patients are scanned has driven demand for new MR equipment. This is an opportunity for offering attractive trade-in terms in order to take back older equipment and either harvest them for parts or refurbish and re-sell them.

Customer requirements and demand

Demand for cost efficiency and productivity

Hospitals are very focused on 'doing more with less', requiring greater productivity and value from their investments in MR systems. These customers see upgrades as a way of enabling increased functionality and lifespan of their equipment. Key segments include:

- Emerging private radiology providers that are more business and cost/efficiency focused.
- Hospitals that don't require advanced or niche applications.

Demand for cost predictability and focus on value

In general, the hospital C-Suite is positive towards service-based business models and value proposition concepts (including new ones such as pay-per-scan). They recognise the need to move towards value-based healthcare and are open to explore propositions and partnerships enabling

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this. Furthermore, hospital finance departments favourably perceive services that enable greater predictability and certainty over costs.

Customer drive towards standardisation of MR processes

Standardisation of MR imaging protocols is being driven by consolidation and hyperscaling of private hospital networks. These organisations see this as an opportunity to increase efficiency and consistency of healthcare.

When implementing a managed service model for a customer, Philips works to get consensus across multiple stakeholders (including radiologists, operators, etc.) in order to define standard processes and timeframes for running MRI procedures and workflows. The drive towards standardisation within the industry will therefore help facilitate this process, so that Philips can concentrate on developing and delivering value-added services. This will also enable servitised models (such as pay-per-scan) as these can be more efficiently scaled and be replicated.

3.9.4 Threats and uncertainties

Threats to the Refurbishment proposition

Regulations – Environmental, Health and safety

Regulations such as RoHS and REACH do not yet make allowance for 'second use' / refurbished systems which may no longer comply when they come back into the market due to long lifecycles. Philips therefore potentially runs the risk of setting up models for product take-back which it will not be able to re-sell in the European market. Retroactively removing parts/components that no longer comply with latest regulations can be unaffordable, putting the refurbishment business model at risk.

Policy – Disincentives for older equipment

Historically, in some countries hospitals cannot receive reimbursements for procedures conducted on equipment that is greater than a certain age. This is a disincentive to procuring service models that extend the lifetime of equipment.

Threats to the servitisation model

Policy & Regulations – Public sector procurement practices

Public sector procurement and tendering does not generally allow purchasing of bundled equipment and service contracts. Tendering needs to specifically be done based on equipment specifications and pricing. This is a challenge for product/service propositions which are bundled and benefit-focused, as opposed to focusing on specifications and cost.

Furthermore, in some markets (e.g. France), public hospitals receive government funding that has to be earmarked for capital expenditure (capex), making it difficult to use this to procure service-based propositions (an operating expenditure – or opex) such as subscription-based 'MR-as-a-service' models.

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Customers – Slow uptake of servitised propositions

Practitioners within Radiology departments traditionally use a diversity of protocols for conducting imaging procedures. However new pay-per-scan services work best if these processes are standardised. Adoption of new propositions therefore requires change management and building acceptance of new ways of working.

Customers – Traditional procurement mind-set

Customers traditionally purchase MR systems together with a service agreement. Procurement discussions tend to focus on costs to the customer of owning the machine over a 10-year period (up-front investment, cost of service agreements, etc.) – i.e. total cost of ownership – rather than total value. There is often resistance to considering performance or outcome-based models such as pay-per-use due to lack of understanding of how to assess benefits.

Competition from new entrants

Philips operates in a competitive market for MRI equipment together with other vendors such as GE Healthcare and Siemens Healthcare. As discussed in the Business Context, digitisation and software applications are an increasing area of value for customers in the imaging and diagnostics industry. This is observed in the importance of software within Philips' own SmartPath Value Proposition.

Non-traditional players coming from the tech and software industry – such as Apple, Google and Microsoft – are entering the 'digital medicine' space. In the future, Philips may therefore need to navigate a different competitive landscape which will include a wider spectrum of competitors beyond the traditional hardware-based vendors. As observed in a number of technology-based industries, value tends to shift from hardware towards software applications and solution.

"In many industries technology eventually matures and becomes commoditised. You can see this trend will happen for us, so we need to think about new ways of creating value for our customers."

- STATEMENT

"The way companies are valued is starting to shift. Investors are changing their focus from the short term to looking at long-term sustainable value."

- STATEMENT

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4 Discussion & Conclusions

Philips is on a journey from being a product-focused to a service-focused organisation. This process is beginning to generate new, emerging value propositions and business models.

The benefits of moving to a more servitised model are that it will focus value creation and customer attention on outcomes (rather than the product itself). This will require innovation in services and software applications, creating new opportunities. It will also require Philips to manage MR equipment and related assets in the most effective way possible, which will align with resource efficiency and circular economy principles. Key enablers and barriers for this transition are described below.

4.1 Key enablers

4.1.1 Enabling the changing role of radiology departments

As Radiology departments start to embrace the opportunities offered by digitisation and the potential to become owners of patient data and intelligence, they are likely to increasingly accept service-based models.

their mind-set is likely to become increasingly aligned with that of hospital management. Philips can play a key partnership role in helping this transition. This will in turn increase acceptance of servitised value propositions.

"Customers are asking us why our equipment needs to have an end-of-life. Why can't it last twenty-five years?"

- STATEMENT

"If Philips were able to move the discussion from equipment specifications to focus instead on quality of service and outcomes, then we could take the decisions on equipment management off the customer's mind. This would give us the control and flexibility over what and how we deploy our equipment."

- STATEMENT

"The more we can simplify our product portfolio while still covering different customer needs and price points, the less complexity we will have in how we serve our installed base. This will have subsequent benefits for embedding circular economy."

- STATEMENT

4.1.2 Working with 'leader' customers

Private sector customers (e.g. imaging centres) tend to be more progressive and commercially focused, and are not subject to capex investment requirements in the way public hospitals are. Therefore they are more likely to be early and more rapid adopters of service-based models. They could be the pioneers that prove the model, enabling public hospitals to follow.

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Private sector healthcare providers are much more open to exploring new value propositions, including approaches to sharing risks and benefits as a way to unlock innovation.

4.1.3 Targeting customers seeking scale

As discussed above, a number of healthcare providers are merging and consolidating, and seeking to standardise MRI protocols and processes in order to better scale their operations and gain cost efficiencies. These will be potential candidates for servitised propositions which require standardisation and provide economies of scale.

4.1.4 Lifecycle contracting processes

In order to move towards a more servitised value proposition and business model, Philips will need to better integrate the multiple options and add-ons it currently offers within an overall contracting process.

These are currently offered as distinct options, triggered by the decision-support platform or customer enquiries. Providing greater customer awareness of the roadmap of updates and upgrades could enable these to be contracted from the beginning, and seamlessly combined into an integrated lifecycle service.

"It is much easier to have a conversation up-front with a customer and map out the upgrades and lifecycle interventions into a long-term contract, rather than having separate discussions on upgrades several years later."

- STATEMENT

"SmartPath has been a huge step forward in addressing installed base opportunities."

- STATEMENT

"Having customer insights is key. It allows us to propose the right product or service at the right time."

- STATEMENT

4.1.5 Product design

The design of hardware and software architecture will be important in transitioning towards a more servitised business model. SmartPath has demonstrated the benefits of designing for upgradeability and backward-compatibility. As value and competitive advantage shifts from hardware towards software and services, MR equipment will need to be re-deployable and re-configurable as efficiently as possible. One opportunity, therefore, is to develop an MR hardware and software platform that is continuously upgradable and configurable as needed.

"We now need to start thinking about the hardware architecture and platform design. For example, modularisation, re-using components across hardware models and generations. This will be key to driving efficiency, serviceability, and upgradeability.

- STATEMENT

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4.1.6 Identifying new market opportunities for refurbishment

Refurbished MR equipment is already included within Philips' product line-up and catalogue, and has a recognised brand (Diamond Select). Demand for refurbished MR has already been proven within developed markets with cost-sensitive customers in the so-called 'value segment'. Customer communications and campaigns could build on this success to make it attractive to other segments.

For example, the veterinary market has been identified as being significantly more open to purchasing refurbished MR systems. This could provide additional baseload of demand to further drive the refurbished MR machine business.

4.2 The role of leadership, management and culture

While the enablers above focus on driving Philips' future transition towards a more servitised business model, it is also important to acknowledge the key enabler of leadership, management and culture. These aren't specific to the business model, however they have been supportive and will be key to future success.

4.2.1 C-Suite leadership

Philips's CEO Frans van Houten has been leading the development and communication of the company's circular economy vision and ambition. Stakeholders have noted the CEO's internal and external communications on the subject, and also commented on how he took a personal interest and followed up on specific circular economy initiatives he would hear about within the company.

Philips' Executive Committee (ExCo) is also strongly involved and supportive of the company's circular economy ambition. The fact that circular economy principles are seen to fit well within Philips' business strategy and transition towards becoming service-focused is an important factor. This creates a willingness to engage internally in exploring innovative business models.

4.2.2 Management oversight and KPIs

Management tracking of KPIs relating to replacement and lifecycle sales (not just new sales) has raised the visibility of SmartPath, and focused management attention on driving revenue from these propositions.

4.2.3 Local market team leadership

Senior management within local market teams have played a key role in encouraging risk-taking and exploration of innovative business models. For example, several stakeholders identified the UK as being relatively advanced in developing and offering service-based models to customers (such as managed services).

4.2.4 Business-centric positioning of circular economy

Circular economy has been positioned within Philips as a core aspect of how the company does business. Several stakeholders also recognise that circular economy is "just good business" and see that the principles of circular business models align well with what the company should be doing to better create and deliver value to customers as well as to Philips.

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Stakeholders have also commented that circular economy fits well within Philips' overall strategy to transition from being a product-centric to a service-centric company, and that this would in fact be a strong enabler for circularity.

"Circular economy is just good business."

- STATEMENT

"We originally took a top-down approach to circular economy: developing a strategy, targets, and KPIs. Now the challenge is to make circular economy meaningful, tangible and actionable for all our staff."

- STATEMENT

"You need to adjust the message to the audience so that they recognise what's in it for them."

- STATEMENT

"We need to transition from 'business-to-business' to 'business-for-business'."

- STATEMENT

"Moving towards service-based models will be a key enabler for transitioning towards circular business models."

- STATEMENT

4.2.5 Change management

Initially, the focus for driving circular economy within Philips was on developing a strong narrative linked to Philips' own mission, as well as a top-down strategy with targets and high-level KPIs.

Now the focus is on making circular economy meaningful and tangible for all staff. Everyone needs to understand what it means for them, how they can benefit, and how to contribute to this transition.

Philips recognises the need to drive circular economy programmatically across the business. This includes:

- Embedding within processes and ways of working
- Targets and KPIs that are relevant to specific functions and individuals in the business, and that enable management to measure progress and provide actionable insights.

It is important to clearly communicate the benefits of circular economy in a manner that is relevant to different stakeholders (both internally and externally), adjusting the message to the audience. Key arguments used to communicate the benefits of circular economy are that it:

- Creates strategic and financial advantages
- Drives customer satisfaction and more intimate relationships

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- Helps to better manage and get value from the installed base globally
- Helps to de-couple growth from increasing pollution and resource use

"Circular economy requires the development of totally new paradigms as well as requiring people to work together in different ways."

- STATEMENT

"Circular economy is such a disruptive concept that it is very hard to know exactly where to intervene within an inherently linear model."

- STATEMENT

"We try to leverage the energy that is within the company to transform ourselves and make circular economy relevant to different stakeholders."

- STATEMENT

"When you start to think about the business model needed for MR as a service, you realise this will have big implications for how the product portfolio needs to be designed and served."

- STATEMENT

"Transitioning from our current model to a future model is one of our biggest challenges."

- STATEMENT

"As a manufacturer, the more you move towards a service-based model, the more you are deferring revenue to the future. We need to do this in a balanced way and at the right pace, otherwise we could get a short-term hit to our revenues."

- STATEMENT

4.3 Key barriers

As seen above, Philips has multiple factors that can enable it to further transition towards a service-based model for the MR business. However a number of key barriers also exist, outlined below.

4.3.1 Customer acceptance of new business models

Radiology departments may feel concerned about changes to processes and protocols when adopting service-based models. It will therefore be important to win over 'hearts and minds' and clearly demonstrate benefits from better diagnostic outcomes, patient care quality and return on investment.

4.3.2 Internal Philips competencies

Moving towards a more servitised proposition will require gaining new skills and competencies and further developing these within Philips. Otherwise this will become an important constraint. This

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includes areas such as asset management; advanced software application development; service operations and large-scale contract management.

4.3.3 Public sector procurement and tendering

Given the importance of public healthcare, especially in Europe, the traditional procurement processes and mindset of public sector tendering are important barriers for selling 'MR as a service'. Current procurement is designed to ensure technical and price comparability around technical specifications and requirements, typically requiring hardware and services to be evaluated separately.

Philips will need to either find ways to work around and fit within these constraints, or identify opportunities with 'pioneer customers' and develop case studies demonstrating benefits. A potential strategy is to work with private sector customers who don't have these constraints, using this as a platform to launch into the public sector.

4.4 Replicability in other sectors

Philips' SmartPath Upgrade portfolio business model shows the success of adopting a whole lifecycle approach to serving customers. In doing so, it is able to generate significant opportunities for circular economy because these are aligned with, and enhance, the creation and delivery of value to customers. This requires a coherent business model that takes into account key aspects such as product design, customer relationship management, decision support tools, and attractive value propositions.

MRI systems are high-value, long-lifetime assets, which customers highly depend on for delivering quality and reliability of medical outcomes. As such, MR equipment lends itself to this type of lifecycle approach. Other sectors that share similar characteristics (e.g. large capital assets) could be candidates for exploring similar business models.

4.5 Insights for business guidelines

The core focus of this case study is on business model patterns that enable product value and utility to be enhanced over its lifetime, as well as enabling life-extension and take-back for refurbishment and re-sale. The business model assessment and SWOT analysis in Chapter 3, and the assessment above of key enablers and barriers for the circular business model, provide a real-world example that organisations in similar sectors or in a similar context can draw insights and lessons from.

In particular, the following key insights are important to note:

- Significant value can be created by taking a lifecycle and service-centric approach to serving customers. This requires re-balancing priorities from focusing on new product sales towards maximising the value for customers from systems already installed (the installed base). With this new focus, the installed base becomes a key resource to be 'cultivated' over its entire lifecycle. This creates the foundation for developing solutions and services that are consistent with the principles of circular economy:
    - Enhancing the utility and value of products at different stages of their lifecycle
    - Enabling the upgrade and life-extension of products

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    - Establishing mechanisms to incentivise the take-back of products at end-of-cycle so that their value can be re-captured – for example through refurbishment and re-sale

- Product development and design needs to be consistent with a lifecycle approach, for example ensuring that future solutions are backward-compatible with systems already installed, and that these are equally upgradeable when new hardware or applications become available. This requires additional investment, however creates significant benefits including:

    - Ensuring systems in the installed base can maintain or enhance their value over the lifecycle

    - Improving customer experience and satisfaction

    - Creating opportunities for new and recurring revenue streams

- Transitioning from a product focus to a service/solutions focus (a form of 'servitisation') is a key enabler for circular business models. Offering products as a service creates a focus on value generation and customer satisfaction based on delivering overall performance and outcomes, rather than on the specifics of a product. This allows manufacturers the opportunity, for example, to offer and deploy refurbished assets as part of an equipment fleet.

- Transitioning toward a lifecycle, service-focused model requires a shift in mindset, processes and behaviour with respect to sales and customer relationship management. Customer relationships need to become long-term partnerships, and sales teams need to be supported and incentivised to sell solutions at the right time within the product lifecycle (this may include refurbished products, or incentives to trade-in equipment for refurbishment and re-sale). In addition to change management, decision support tools and incentive systems are key resources that may be required to enable this shift.

4.6 Insights for policy recommendations

Key issues arising from this case study which have direct policy implications are those that relate to EHS regulations; public sector procurement practices; and sector-specific funding policies that aren't aligned with circular economy.

- **Compatibility of Environmental, Health and safety (EHS) regulations with long-lifecycle assets sold back into the market**. Regulation such as RoHS and REACH do not yet make allowance for 'second use' / refurbished products which may no longer comply when they come back into the market. This is particularly the case for products with very long lifecycles, such as MR equipment in this case study. Manufacturers potentially run the risk of setting up models for product take-back which they may find challenging to re-sell in the European market. EHS rules and regulations may therefore need to consider new models for addressing the refurbishment or remanufacturing and re-sale of long lifecycle equipment.

- **Public sector procurement practices**. Current procurement is designed to ensure technical and price comparability around technical specifications and requirements, and typically requires hardware and services to be evaluated separately. This can create a challenge for product/service propositions which are bundled and benefit-focused, as opposed to focusing

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on specifications and cost. Public procurement processes may therefore need to find new metrics and approaches to assessing the value of vendor bids if governments wish to promote circular economy. This requires changes to rules and guidelines, as well as improving awareness and education of procurement managers.

- **Public funding practices that prioritise new over 'circular' equipment**. Public sector funding rules and practices may not be keeping pace with the development of circular products and solutions. In an example from the MR equipment market, public hospitals in some countries receive government funding specifically earmarked for capital expenditure on new products. In other cases funding rules consider a life-extended machine as 'old' and at a disadvantage to new equipment (not taking into account services that can bring equipment up to the latest state-of-the art functionality). Public funding rules and guidelines therefore need to be examined to ensure they do not put circular products at a disadvantage.

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