



ANALYZING OF PRODUCT AS A SERVICE METHOD IN CONTROLLING PRODUCTION COST BASED ON COMPANIES IN UNITED KINGDOM

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ABSTRACT

This thesis explains most of the concepts of Product as a Service (PaaS), which is a potential change in buying and selling patterns of goods to consumers and producers. In this case, explaining the consumer as a point involved in the ownership-based model, buying products directly with the responsibility for maintenance. The Product as a service method aims to offer products through a service-oriented model, where consumers pay for the results obtained from the product rather than owning it directly. This thesis examines aspects of Product as a service by explaining some of the basic principles and business models as well as their potential for the financial stability of a company as a producer. By analyzing companies that use the Product as a Service method, the author aims to analyze whether this method can impact their production costs in order to get a stable financial level. With this, it is necessary to review the comprehensive literature and analyze a company's annual report. The findings of this thesis will contribute to existing knowledge by providing an understanding and the impact that will occur if a company implements the Product as a Service concept as their business strategy. In the end, Product as a service has the potential to make the company's financial stability and policies for customer satisfaction, and it can be implemented in other companies in various countries in a more sustainable future.

Keywords: Controlling, Product as a Service, Production Cost

BACKGROUND

In today's fast-paced business, most companies are turning to the Product as a service or PaaS model in meeting the changing needs of customers. Product as a Service is a business that offers access to a product rather than ownership. This can give customers a huge advantage in being able to use a product with flexibility and cost-effectiveness. Companies that use this procedure can build long-term relationships with their clients by using the product without having to buy it.

The United States of America was the first nation to become a 'service economy' coined the term to reflect the relative state of employment within it. While this worldwide 'servicisation' of advanced economies has been partly driven by increases in the supply of traditional services such as financial and legal, research shows that several firms have used the service type of transaction to develop a range of new service orientated products (Cook et al., 2006). It seems more likely than ever that futures will feature a dominant service economy. In most OECD nations, the service sector grew quickly in the final decades of the 20th century to the point where it now makes up between 50% and 75% of jobs and added value (Cook et al., 2006).

Products as a service can address several management issues. In product development, designing and validating existing components can be costly and benefit from any product design improvements. The need for environmentally friendly product designs is urgently needed so that these tools can be used in an environmentally friendly manner to minimize operational costs in their use for consumers. This is one of the big advantages for users of a product because they can carry out company goals without having to think about further operational costs. because products that are large-scale or financially very crucial require very high costs, therefore one of the



advantages of manufacturers by implementing products as services they can increase profits and for customers, they can reduce their operational costs by using these services. In the use of product as a service, the producers can also benefit from long-term relationships with customers, by increasing number of customers and customer retention in product as a service offering.

In this research, it aims to carry out an analysis of the product as a service method that is suitable for companies in the United Kingdom, whether they are very efficient at using this method or not. This research also wants to find out by using the product as a service method whether it can increase in terms of profits for the company and whether it is efficient and long-term in using this method based on 5 list company that based in United Kingdom. The problem this also that company may setting the price model for product that made are very crucial on customer side to make a long-term relationship because if the pricing is too low it may affect to the company that may not able to cover its cost or generate sufficient revenue.

The problem as this time is how companies can implement Product as a Service, from this, many companies specifically sell their products, for example, heavy equipment that costs a lot to buy, this makes manufacturers experience difficulties in selling their own products. Companies must also look at product development as a service method to what extent experience in using the system must be provided by the product department and to what extent system services are part of the product and service. coherent or consistent to what extent users evaluate it.

Therefore, this analysis is carried out whether the company needs outside assistance such as investors to continue selling products with a service system and can help increase the level of sales of the company.

THEORITICAL FRAMEWORK

Product as a services

A Product Service System are products and services that can be marketed and are able to meet user needs simultaneously. This system is provided by one company and can be attached to only one product plus additional services. This can include additional services plus products. The needs and objectives of the researcher determine the hierarchical levels, system boundaries and system element relationships.

Product service system is a concept where products and services become an activity carried out without the need for tangible goods or without the need for a system in the relationship between Producers and Consumers. Most authors consider PSS only as a competitive proposal intended to satisfy consumer demands. However, certain authors assert that PSS goes beyond this view and, instead, aims for sustainability by seeking a balance between environmental, economic, and social concerns. This system is a competitive opportunity which is intended to change consumption standards. This aims to improve competitiveness among social, economic, and environmental issues. Product Services as system is a design that aims to integrate product, service and communication systems based on the new form of an organization.

Product Services system is defined as a commercially viable collection of goods and services that can collectively address a user's need. The Depending on the economic value or how well a function is fulfilled, the product/service ratio might change. The PSS concept has generally been discussed in terms of the manufacturing industry which shifted its business focus from designing and selling physical products only, to designing and selling systems. products and services (Gemser et al., 2012).

Vandermewe and Rada (1988) Introduced the term 'servitization' to refer to the increased market offering of more complete packages in combination of customer-focused goods made by a firm. One route to servitization is the PSS business in the model but service providers can fit into the system by adding service products to existing products. For manufacturers, bundling of products and services is advantageous because services tend to lock the user into a long-term relationship (Lockett et al., 2011).

From a business point of view, it is only profitable to invest in a Product as a service system indeed a product service system at least in the client's perception, adding more value to



goods and services that are sold separately in the market. Usually, companies that combine products with services in such a way follow the Product as a service system and thus must ensure experience in using this added value to personalize experience in one of the fields where this can be achieved by both parties.

At this time where the service provision is provided by manufacturers by combining their existing offerings with either new or existing products and services being implemented by companies that normally use the system. For a Product as service system to be successful, it also seems crucial that the products and services are linked in a logical way and offer a "synergetic" user experience, enhancing one another.

Aspect of Total Care Product

Total Care Product and the value that could be given to consumers, manufacturers, and suppliers. While some authors centre their research on the design process of Total Care Products, others have broadened their work to include the product support strategy and life cycle simulations. As an alternative to marketing and providing support for conventional items, functional products were established. In these cases, the manufacturer offers the software and functionality of the product rather than the hardware.

The architecture aspect includes the hardware, services and software that may be considered as integrated parts of the hardware and service support system (Alonso-Rasgado & Thompson, 2006). In the hardware section, high-value "core" components that can be utilized to remanufacture products while maintaining their value must be identified. In order to provide cutting edge performance, the hardware system's driving software can be regularly upgraded as technology develops. The required interface, which contains external inputs and outputs, as well as a set of internally compatible subfunctions make up the service components of the architecture element.

By applying the concept of total care product, there are several benefits that can impact suppliers, including: The first has an impact on the smooth flow of cash that can be generated by providing the functions needed throughout the product life cycle. Secondly, the Total Care Product agreement will build long-term relationships with customers and suppliers that can ensure a constant stream of income in the long term. Thirdly as suppliers learn from the valuable feedback they regularly receive from customers.

Here are some of the benefits of implementing a total care product from a customer perspective including, On the customer side, it has many and important benefits, one of which is the impact on eliminating high capital investment requirements with Total Care Products. The agreement is based on the provision of equipment to the customer if necessary.

In addition, it also has a bad impact on risk management where the customer pays for the function only when it is used. This can create incentives for suppliers to engage in high availability. As the conclusion that this Total Care product on the customer side they do not need to allocate high investment funds to buy equipment. Due to the existence of an agreement based on the provision of equipment to customers if they are needed, while the ownership remains with the supplier. With this the customer can estimate costs based on the estimated usage of the equipment over a specified period.

Product Costing

The role of cost in the aerospace field is seen as an approach that can help finance knowledge and information through products and services. Costs are expenses that must be paid regardless of the number of companies that make a loss, this can have an impact on the influence in determining the form of service of a product. At the cost of this product there is an abbreviated PCE technique, namely Product cost estimation, this has been categorized using specifications by many people.



Niazi and his colleagues have categorised the Product cost Estimation techniques into two method there are qualitative and quantitative, there are many ways to classify PCE approach on the classification of the estimation techniques (Niazi et al., 2006).

The basic idea of this technique is to identify whether a product has something in common with previous products. Applying this type of method can generate costs that are normally estimated or take parameters of a product that differ throughout the product's life cycle into production calculations. This method can approximate the general approach by obtaining more accurate costing results and helps to obtain quick and rough estimates at the initial conceptual design stage of a product.

Service Costing

Since the turn of the 20th century, the idea of providing services has been studied and is now widely used in a variety of industries, including aerospace, health care, banking, civil construction, and defence. (Huang et al., 2012)

In this Theory the estimate for maintenance costs is with one of the few areas in the Service Cost Estimation that is owned by the aerospace industry. This method is usually used in forecasting aircraft maintenance costs. In the service costing method, there are contracts with sides for spare parts or preventive maintenance, repairs, component management and others related to aircraft engine maintenance costs.

Life Cycle Cost

In addressing machine life-cycle costs in current services and related products, effectiveness is usually limited by cost and scale at the time of changes in testing activities, design, etc. On the life cycle the cost impacts of design changes are often less effective or direct than from optimizing maintenance and control practices. In the life cycle cost, there are various costs which include: Product Acquisition, Operation and Support on the product, and Product disposal.

Based on existing data, this theory has shown that in general public design underestimates the operating and maintenance costs of mechanical products in relation to shipping costs. This component is very dominant in the initial selling costs and with spare parts consisting of 30% to 50% of repair invoices and very focused on acquisition cost reduction components. This explains also that focusing only on component costs is left at 50% of the total cost. Therefore, this theory aims to balance the acquisition costs, disposal operations related to the profit margins of producers and the impact on operating costs for consumers (Harrison, 2006).

Measuring Customer Satisfaction

Customer service index is one of the methods to measure consumer satisfaction index in products in the form of services. It is introduced for the first time in marketing to provide a quantitative number of customers or the percentage of total customers who report on their experience with the product they use or service for the purpose of satisfaction as determined by the consumer. In this measurement, for example, with calculates by looking at the overall level of customer satisfaction and compared with the level of quality of the product itself.

Ratio Analysis

Analysis if a firm financial statement is of interest to shareholders, creditor, and the firm's own management. To analyze financial statements, we need relative measures that in effect normalize size difference. Effective analysis of financial statement is thus based on the use of ratios or relative values. Ratio analysis involves calculating and interpreting financial ratios to assess the firm performance and status.

Different constituents will focus on different types of financial ratios. The firm's creditors are primarily interested in ratio that measure the firm's short-term liquidity and its ability to make interest and principal payments. A secondary concern of creditors is profitability when they want assurance that the business is healthy and will continue to be successful. The firm managers use



ratios to generate an overall picture of the company financial health and to monitor its performance from period to period.

Liquidity ratio measures a firm’s ability to satisfy its short-term obligation as they come due. Because a common precursor to financial distress or bankruptcy is low or declining liquidity, liquidity ratios are food leading indicator of cash flow problems. The two basic measures of liquidity are the current ratio and the quick (acid-test) ratio.

The current ratio, one of the most commonly cited financial ratios, measures the firms ability to meet its short- term obligation. It is defined as current assets divided by current liabilities. The formula: *Current Ratio = Current assets/Current liabilities*

How to predict the answer of the current ratio depends on the answer, for example a current ratio of 1.0 would be acceptable for a utility but might be unacceptable for a manufacturer. The more predictable a firm cash flow, the lower the acceptable current ratio.

Firms finance their assets from two broad sources, equity, and debt. Equity comes from stockholders; debt comes in many forms and from many different leaders. Debt ratio measures the extent to which a firms uses money from creditors rather than stockholders to finance its operations. The more indebted the firms, the higher the probability that it will be unable to satisfy the claims of all its creditors.

The Debt ratio measures the proportion of total assets financed by the firms’ creditors. The higher this ratio, the greater is the firm’s reliance on borrowed money to finance its activities. The ratio equals total liabilities divided by total assets. The formula: *Debt Ratio = Total liabilities/Total assets*

A solvency ratio is a key metric used to measure an enterprise’s ability to meet its long-term debt obligations and is used often by prospective business lenders. A solvency ratio indicates whether a company’s cash flow is sufficient to meet its long-term liabilities and thus is a measure of its financial health. Here is the formula: *Debt to equity ratio = Total Debt/Total Equity*

RESEARCH METHODOLOGY

At this writing the author wants to conduct an in-depth analysis of 5 companies from the United Kingdom using Product as a Service, by looking at the effects on the financial side and whether the products used as services are effective or not. Here are some techniques for analysing this writing, namely: Observation, Document Review, and Financial statements. In collecting data on companies of Rolls Royce using sustainability financial reports from 2018 until 2022 as the main data for calculating on their Production Cost. The author is using their annual report to analyse the financial aspect of the company..

RESULTS AND DISCUSSION

**Table 1
Total Production Cost**

Pound/Million	2022	2021	2020	2019	2018
Underlying Revenue	5.686	4.536	5.089	8.107	7.378
Underlying OE Revenue	1.982	1.612	2.298	3.246	3.119
Underlying Services Revenue	3.704	2.924	2.791	4.861	4.259

Table 2
Production cost (Cost of Good Sold) details between EO Revenue and Services Revenue in Each year

Production Cost Calculate			
Year 2022	OE Revenue	Service Revenue	Total
Underlying Revenue	1.982	3.704	5.686
Cost of Good sold	1.685	3.148	4.833
Underlying Profit/loss	297	556	853
Year 2021			
Underlying Revenue	1.612	2.924	4.536
Cost of Good sold	1.444	2.618	4.062
Underlying Profit/loss	168	306	474
Year 2020			
Underlying Revenue	2.298	2.791	5.089
Cost of Good sold	3.203	3.891	7.094
Underlying Profit/loss	- 905	- 1.100	- 2.005
Year 2019			
Underlying Revenue	3.246	4.861	8.107
Cost of Good sold	2.997	4.488	7.485
Underlying Profit/loss	249	373	622
Year 2018			
Underlying Revenue	3.119	4.259	7.378
Cost of Good sold	2.911	3.974	6.885
Underlying Profit/loss	208	285	493

Table 3
Summary of Revenue and its Production Costs (COGS) of Service only

Pound/Million	2022	2021	2020	2019	2018
Underlying Revenue	3.704	2.924	2.791	4.861	4.259
Cost of Good sold	3.148	2.618	3.891	4.488	3.974
Underlying Profit/loss	556	306	- 1.100	373	285

The data above shows the revenue and its production cost in details for last 5 years, it is shown that the table are revenue and its production cost data consecutively for comparison purposes. Revenue at the Rolls Royce company is divided into two parts, the first is original equipment which is income generated from the sale of original equipment, such as engines and other components to the customer. The second is income from services or services resulting from providing various services related to the products sold. Both calculation from Table 1 and 2 refers to the Product as a service method where Rolls Royce provides services on the use of their goods (engine) plus support for its maintenance, including the spare parts.

In Table 2 there is an explanation of the calculations to find out how much the cost of goods sold they spend during the year and what is the implication to the bottom line (profit margin) percentage is increasing since they had used Product as a service method on their operations as part of the management strategy of company.

The cost of good sold was calculated manually because the COGS data was not provided in their annual report. There are only data on revenue and operating profit/loss. Below is the way

author calculate for the cost of good sold of service segment only as an objective of this thesis. Information was provided are revenue and its gross profit margin segmental in yearly (see table 1 above); Refer to table 1 above for an example year 2022, the revenue of service is 3,704 (pound/million); Refer to table 1 above for year 2022, the gross profit margin is 853 (pound/million); Formula is $COGS = Revenue - Gross Profit Margin$; COGS is allocated in percentage of revenue for both OE & Service and multiply; Below are the way COGS is calculated with a sample for year 2022

Table 4
Sample Calculation for year 2022

Year 2022	OE Revenue	Service Revenue	Total	Remark
Underlying Revenue	1,982	3,704	5,686	
Cost of Good Sold (no data provided)	35%	65%	4,833	COGS = Revenue - GPM 4,833 = 5,686 - 853
Underlying Gross Profit/Loss Margin	297	556	853	
Year 2022	OE Revenue	Service Revenue	Total	
Underlying Revenue	1,982	3,704	5,686	
Cost of Good Sold	1,685	3,148	4,833	Being allocated based on percentage of revenue
Underlying Gross Profit/Loss Margin	297	556	853	

In table 3 it is shown how much COGS and total gross profit/loss for each year specifically for the Service revenue segment. It is shown that the profit obtained is highest in 2022 because the previous two years in 2021 and 2020 were the lowest points of all industrial sectors by the Covid 19 outbreak. The impact that occurred on the Rolls Royce company which provided aircraft engines, therefore in 2022 they improve their business strategy. In 2022 as well the margin on the Revenue and COGS is increasing high compare with previous years that's make the percentage profit is up to 70%-80% within a year.

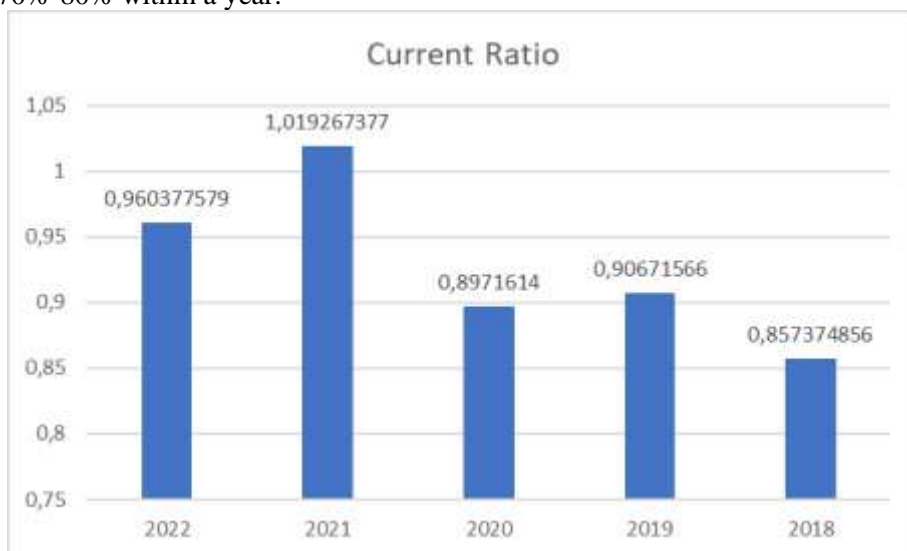


Figure 1
Liquidity Growth

the current ratio owned by Rolls Royce from 2018-2022 has not increased too much. Even though in 2020 it has a very small ratio figure compared to others due to the covid outbreak, which has resulted in the level of current assets being higher than the level of liabilities. Overall, this indicates that the company may experience difficulties in meeting its short-term obligations using

only its current assets. This also shows a liquidity problem and implies that current liabilities in the civil aerospace segment imply that the company's current liabilities exceed its current assets. This also shows that the company currently has a higher proportion of short-term liabilities relative to current assets based on data from the annual report each year.

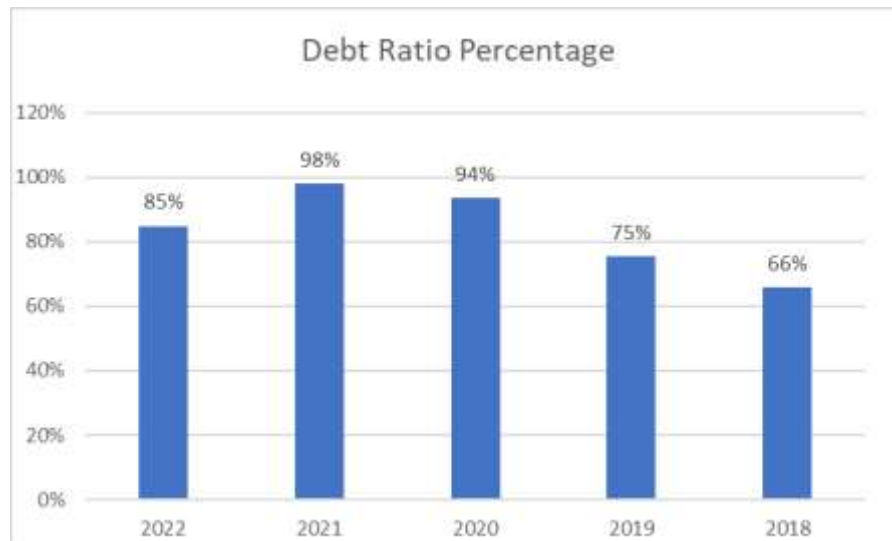


Figure 6
Debt Ratio Growth

To calculate the ratio level on the debt ratio, namely if the higher the ratio level, the higher the rate of borrowing money to carry out their financial activities. Based on the calculation of the debt ratio, there are in 2020 to 2022 a very high percentage of the ratio. This is due to the same reason that the Covid Pandemic has threatened their production and they have to cover the amount of income to continue carrying out operational activities such as machine maintenance and others. Therefore, because of the pandemic segment, Civil aerospace is very threatened. Unlike in the year before the pandemic, the ratio level was 60-70, this shows that it is still below normal. To carry out aircraft engine operations does require a very large cost.

4.3.1 Revenue growth

In the 1990s, Rolls-Royce made strides by responding to consumer needs and developing a new model that matched these incentives. This model served as the foundation for Total Care, commonly known as the Product as a Service (PaaS) concept. Rolls-Royce's response to clients like Cathay Pacific and American Airlines led to the creation of the forerunner of what would later become Total Care the combination of engine sale and aftermarket services into a lifetime contract.

By incorporating engine overhauls and maintenance into a service package that was charged at an agreed-upon price per engine flight hour or EFH, the Total Care model addressed the uncertain scheduling and expense of engine overhauls and maintenance encountered by airlines. In accordance with this revenue model, which is also known as "Power By the Hour" (PBH), Rolls-Royce is compensated at a set rate for each hour that the engine is used to propel an aircraft. The airline does not pay Rolls-Royce when the engine cannot be used.

If the engine is not being utilised or cannot power the aircraft when needed, the airline does not incur the PBH cost and Rolls-Royce isn't paid. It is Rolls-Royce's responsibility to deliver and optimise all the MRO processes and costs enabling engines to be utilised as much as possible.

This Production as a service innovation later developed into the more comprehensive of Total Care services, which continues to use the PBH revenue model for aligning incentives. Customers have successfully adopted the Total Care aftermarket servicing model since it was first introduced in the mid-1990s, and currently almost all Rolls-Royce Trent engines are covered by this plan. This demonstrates how the business evolved from focusing primarily on manufacturing

(OEM-focus) to offering services on a time-and-materials basis, to inventing the PBH-based service, and ultimately the suite of Total Care services it now provides.

From its beginnings to the present, the essential tenet of Total Care has been the creation of value through the transfer of this risk from the airlines to Rolls-Royce within a revenue model that charges per the engine flight hour. Following are the benefits that this model brings to airline operators: A straightforward and well-understood billing method that makes MRO-related costs predictable over the course of an engine's lifetime; Improved operational effectiveness, considering fuel costs; Reduced expenses and disruptions while enhancing service quality; Increased value of the engine asset, facilitating sales and transfers; Concentration of internal resources on core business

Rolls-Royce can take on this risk due to its intimate knowledge of the engine technology and performance in-use. Rolls-Royce has developed a business model that effectively manages these risks and delivers the Total Care value proposition service in a reliable and efficient way. In return, Rolls-Royce has been able to create an attractive source of predictable, recurring revenues for delivering Total Care and, importantly, to reinvest in new generations of better-performing engines as well as continuous service innovations.

The Total Care model enables effective deployment and reuse of parts based on intelligent tracking and management of parts. To ensure quality of service Rolls-Royce forecasts, plans, and monitors what servicing is needed at the required time and location, how many spares need to be manufactured, and where they are stocked.

Furthermore, as described above, Rolls-Royce utilized Used Serviceable Materials for engines where it can do so (usually for mature engines). Today, around 95% of a spent aero engine can be recycled, and about 50% of the recovered material is of such good quality that it may be safely utilized again to create a new engine. Because of this, there is less demand for virgin resources, whose extraction is costly and has a negative effect on the environment. By preserving vital raw materials at the high grades required for use in the Rolls-Royce supply chain, revert also protects the supply chain. This material efficiency will lead to reducing over-production cost by implementing the Total Care concept, which is the same as the Product as a Service model.

In the mid-1990s they had just changed their business and service strategy in order to get a sufficient level of revenue. After using the PSS method, Revenue from Civil aerospace increased quite a lot by 25% (Windekilde, 2017). The Rolls Royce company has just developed their Product as service method in the mid-1990s, it can be seen from 1991 to 2001 they were able to develop their business strategy with a 20% increase in service revenue. produced by the civil aerospace segment. The product as a service method has a very large impact on increasing both the revenue and production cost sides. It can also be seen that after they have used the Product as a service method for more than 20 years, they have received a stable revenue side of more than 50% for each year.

CONCLUSION

Total Cost model or known as Product as a service could make some impact not on the revenue side but also on the value proposition that could enable on the risk transfer. This might make the customer based on simple and transparent charging mechanism to share the power by the hour that Rolls Royce made. The value proposition may also change the customer requirement over the lifetime of their asset as well. This could make the strong partnership to support the risk transfer such as Revenue sharing and Risk as well as providing the scale and capabilities to serve customers integrated.

In the production cost analysis, the author compares the last 5 years recorded from 2018 to the latest in 2022. It is noted that in 2018 to 2019 they had a revenue rate of up to 9.8%, almost 10% in 1 year. This is arguably so big on the impact of the Product as a service method in terms of revenue. This also affects the profit/loss side of the annual report data. It was noted that from 2018 they earned a profit of 493 million pounds and in 2019 it increased by 200-300 million pounds. Not only in terms of revenue but profit also increases each year.



Before the covid pandemic, their income and profits were stable and every year, they used to increase 2-3 times their turnover. Starting from 2020 to 2021, this company has experienced a very significant decline which is extraordinary. Based on their analysis, the standard cost of good sold is 3,900-4,000 million pounds, which has decreased significantly to 2,618 million pounds in 2021. This is due to a pandemic, and consumers, as commercial airlines, are not carrying out flights as usual. Due to this impact, the company has experienced a decline in revenue as well as in terms of their profits, even in 2020, when a worldwide pandemic occurred, the company suffered a loss of 2,000 million pounds. This can be explained by the huge impact of flying hours or the company calls it Engine flying hours in terms of their profits. With low income, in terms of production, it is also reduced, Low demand, Low supply, which makes the company experience very small profits, up to losses. Based on this analysis, service revenue in the Aerospace segment is very dependent on the consumer's use of their aircraft engines, and they will not be able to generate stable income and profits. From the results of the production cost analysis, the authors can estimate how much their net profit will be each year and the impact on the Product as a services method

The ratio value in 2018-2019 was still within reasonable limits, almost close to 1.0, even though in 2018 it was 0.85, that in the civil aerospace segment, the service revenue side barely fulfilled the obligation not too short. It is different in 2020, which went down a lot due to the damaging impact of Covid from all aspects of a company's finances, even though Rolls Royce in 2021-2022 has fixed this problem according to the calculation of the ratio value at 0.9-1.0.

The ratio is high in 2020 and 2021 where the ratio is 90%, this is due to the impact of the pandemic where their consumers, namely commercial airlines, cannot carry out normal flying hours and Rolls Royce is experiencing an impact in terms of paying their very high debts. Based on data analysis conducted annually, Rolls Royce is still at a safe limit for making long-term payments. Based on data where the company initially applied the product as a service method where revenue turnover was 17% to 20% in the 1990s to 2000. This shows how big the impact of product as a service is in terms of revenue. After using the application of the Product as a service method, the income from the company has increased, although not too significantly, at least per year the turnover of the company's income reaches 10% for each year. This stated that even though it did not occur significantly, it provided a stable and increasing impact on their revenue side.

Based on the data, it is very clear that service revenue dominates the range of 50% to 60% per year, compared to sales of original equipment, which ranges from 30% -40% per year. It is very clear that the impact on the product as a service method dominates in terms of revenue and profits for a company and has a very high stable level so that annual income will not experience a significant decrease and likewise the increase will not be too significant.

REFERENCES

- Alonso-Rasgado, T., & Thompson, G. (2006). A rapid design process for total care product creation. *Journal of Engineering Design*, 17(6), 509–531. <https://doi.org/10.1080/09544820600750579>
- Cook, M. B., Bhamra, T. A., & Lemon, M. (2006). The transfer and application of Product Service Systems: from academia to UK manufacturing firms. *Journal of Cleaner Production*, 14(17), 1455–1465. <https://doi.org/10.1016/j.jclepro.2006.01.018>
- Gemser, G., Kuijken, B., Wijnberg, N. M., & van Erp, J. (2012). *THE EXPERIENCE OF PRODUCT SERVICE SYSTEMS*. www.crispplatform.nl
- Goedkoop, M. J., van Halen, C. J. G., te Riele, H. R. M., & Rommens, P. J. M. (1999). *Product Service systems, Ecological and Economic Basics*.
- Harrison, A. (2006). *Design for Service: Harmonising Product Design With a Services Strategy*. Power for Land. <http://www.asme.org/about-asme/terms-of-use>
- Huang, X. X., Newnes, L. B., & Parry, G. C. (2012). The adaptation of product cost estimation techniques to estimate the cost of service. In *International Journal of Computer Integrated*



- Manufacturing* (Vol. 25, Issues 4–5, pp. 417–431). Taylor and Francis Ltd. <https://doi.org/10.1080/0951192X.2011.596281>
- Lockett, H., Johnson, M., Evans, S., & Bastl, M. (2011). Product Service Systems and supply network relationships: An exploratory case study. *Journal of Manufacturing Technology Management*, 22(3), 293–313. <https://doi.org/10.1108/17410381111112684>
- Niazi, A., Dai, J. S., Balabani, S., & Seneviratne, L. (2006). Product cost estimation: Technique classification and methodology review. In *Journal of Manufacturing Science and Engineering* (Vol. 128, Issue 2, pp. 563–575). American Society of Mechanical Engineers(ASME). <https://doi.org/10.1115/1.2137750>
- Rolls Royce. (2018). *2018 ANNUAL REPORT Rolls-Royce Holdings*.
- Rolls Royce Holding PLC. (2008). *Annual Report 2008*.
- Rolls Royce Holding PLC. (2012). *Annual Report 2012*.
- Rolls Royce Holding PLC. (2014). *Annual Report 2014*.
- Rolls Royce Holding PLC. (2015). *Annual Report 2015*.
- Rolls Royce Holding PLC. (2016). *Annual Report 2016*.
- Rolls Royce Holding PLC. (2017). *Annual Report 2017*.
- Rolls Royce Holding PLC. (2019). *Annual Report 2019*.
- Rolls Royce Holding PLC. (2020). *Annual Report 2020*.
- Rolls Royce Holding PLC. (2021). *Annual Report 2021*.
- Rolls Royce Holding PLC. (2022). *Annual Report 2022*.
- Smith-Gillespie Aelyn, Munoz Ana, Morwood, D., & Aries Tiphaine. (2020). *RollsRoyce : A Circular Economy Business Model Case*.
- Windekilde, I. (2017). *From Reactive to Predictive Services the Internet of Things (IoT) Enabled Product Service Systems (PSS) of Innovative and Sustainable Business Model*. 117–127. <https://doi.org/10.18276/pzfm.2017.50-07>