Closed-Loop Servicing of Sony PlayStation®

During the 2nd quarter of 2006 Mike Nabarro, Vice President of Technical Services for Sony Computer Entertainment Europe (SCEE), needed to make an important decision and a plan. He had reviewed information on the existing operation of SCEE’s warranty service for PlayStation®One and PlayStation®2. With PlayStation®3 scheduled to launch in Europe during March 2007 he had to decide which operation to use and anticipate what differences should be accommodated for servicing PlayStation®3.

Figure 1: Mike Nabarro’s Situation in 2nd Quarter 2006
Sony Computer Entertainment Europe
SCEE, based in London, is currently responsible for the distribution, marketing and sales of PlayStation®2, PlayStation®Portable and PlayStation®3 hardware and software in over 108 territories across Europe, the Middle East, Africa and Oceania.

In January 1988 Sony bought CBS Records Inc. to form Sony Music Entertainment, and in 1989 Sony purchased Columbia Pictures, to form Sony Pictures Entertainment. In 1993 Sony formed Sony Computer Entertainment Inc (SCEI) with the launch of PlayStation® with a long-term plan to take a lead in the burgeoning videogames market.

Sony Computer Entertainment Europe (SCEE) was established with the launch of the original PlayStation® throughout Europe and other PAL (Phase Alternate Line) regions such as Australia and New Zealand in 1995. Sony also established sales companies in major territories, such as SCE United Kingdom and SCE Ireland. Figure 2 shows the relationship between these different Sony companies.

![Figure 2: Sony Company Relationships](image)

Mike Nabarro, VP Technical Services
When any company launches a new product it also must establish a customer after sales service to deal with the inevitable warranty claims. When SCEE recruited Mike Nabarro in September 1995, to organise and develop their new support service from the ground up, his gathered expertise from IBM and then Compaq stood him in good stead.

Nabarro came to SCEE with decades of experience. As a trained field service engineer and a customer service manager he understood the challenge of maintaining parts availability for repairing products reliably and on-time. Prior to SCEE he setup and managed Compaq’s BDG (Business Development Group). This provided a service operation for emerging eastern European and African countries and involved customer helplines and a series of Compaq ASDs (Authorised Service Dealerships). ASDs are independent companies who are authorised to carry out service repairs for an Original Equipment Manufacturer (OEM).

At Compaq he learned that administration and component costs could exceed repair labour costs, particularly when hard disk based products had to be securely returned to the original customers to comply with data protection requirements.

Starting with little more than a telephone and a desk Nabarro relished that challenge of building a service operation for SCEE from scratch. Yet, right from the start, Nabarro made the brave decision to establish an “exchange” model rather than the industry standard “return” model.

The industry standard “return” model begins when a customer ‘phones to report a faulty product. Following verbal assessment and diagnosis to confirm their products are actually likely to be faulty, either directly by the customer or via courier the product is delivered to a Service Centre. Here the product is logged and tracked through fault detection and replacement operations. When the product has had any
faulty components replaced, it is then packed for shipping and returned by courier or other method to the same customer. This is illustrated in figure 3.

An “exchange” model begins the same way with a customer call and verbal diagnostics to confirm a fault. However, when the courier is sent, the old product is collected and a replacement product is immediately given to the customer. The faulty product is then returned to a Service Centre and all faulty or damaged components are replaced to bring the product back to an “as new” condition. This product then forms part of a “buffer” stock to be sent to the next customer requiring a replacement. This is illustrated in figure 4.

As the trickle of inevitable warranty claims began to come in for PlayStation® Nabarro utilised space at an existing Sony Repair Facility in Londerzeel, Belgium. Rather than operate a network of Authorised Service Centres across the different territories, he wanted to leverage the benefits of operating one large central facility. Yet having just one facility does have a significant disadvantage: the lack of competition. Having more than one facility adds competition which helps drive innovation and efficiency improvements. Table 1 shows the approximate average cost breakdown per typical €300 retailed consumer product for the three main operating models used in the consumer electronics sector.

<table>
<thead>
<tr>
<th>€/product</th>
<th>Same Product Returned</th>
<th>Exchange Product Returned Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Franchised Dealer Network</td>
<td>Central Hub Network</td>
<td>Remanufacturing Hub Network</td>
</tr>
<tr>
<td>Call Centre</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Courier</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Repair (Labour)</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Repair (Parts)</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Central Overheads</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>163</td>
</tr>
</tbody>
</table>

Table 1: Typical Costs for Consumer Electronics Service Models
The Historical “Problem” of Success

Sony spent more than £300 million in developing PlayStation®. By the time of the European (and PAL countries) launch of PlayStation®2 in November 2000 worldwide sales of the original PlayStation® had already exceeded 74 million consoles.

Nabarro quickly became aware of a far bigger short-term problem (than introducing competition) needing urgent attention. Consumer demand for PlayStation® quickly outgrew even the most optimistic forecasts. After proving the production process in Japan SCEI added production capacity in China and placed large orders with all the suppliers to meet demand.

As a knock-on effect this created a shortage of available spare parts for Nabarro’s PlayStation® Service Centres. With run-away sales across Europe it was only a matter of time before a respective increase was expected in warranty claims. Nabarro faced the huge challenge of honouring all service commitments to existing PlayStation® customers.

From Replacing to Remanufacturing

It was at this point that Nabarro made the telephone call that would begin a quiet service revolution. He called Tony Rogers, a service entrepreneur who had left the mainstream Personal Computer OEM industry to establish his own service repair company called Infoteam International Services. It provided a service with the distinction that it actually repaired components (even down to the circuit board level) rather than merely replacing them with new.

The request was for Infoteam to take faulty PlayStation® consoles and fully repair certain components and return them to an “as new” condition. This activity, known as remanufacturing, although well established in automotive and heavy equipment sectors was then little heard of within the consumer electronics sector.

A pilot study was agreed for 250 PlayStation® consoles to be remanufactured each month. The pilot was a success: Careful monitoring of later product returns showed no increase in second-failure events. No longer would SCEE need to rely wholly on new spare parts manufactured in the Far East. This change allowed for immediate customer satisfaction. From this point on, certain carefully selected sub modules within the console were remanufactured back to an as-new condition in a matter of days.

Figure 5 shows the final structure of the European Service operation for PlayStation®. Different territories had their own local call centre and courier partners, yet just one of three Central Service Centres were used for the Servicing work. A core team of staff based at SCEE’s London Head Office maintained clear management control over the whole operation.
PlayStation®2

Much more than just a console, PlayStation®2 was designed to be an entertainment hub allowing users to play games, watch movies and listen to music. In addition to PlayStation®2 software, the PlayStation®2 was designed to read both CDs and DVDs and be backward compatible with PlayStation® games. It also supports PlayStation® memory cards and controllers and also features USB expansion ports. Some games on the PlayStation®2 also support online multiplayer gaming through the use of a broadband internet connection and a PlayStation®2 Network Adapter.

PlayStation®2 was designed on a single chassis and the design variant launched in 2006 weighed approximately 900 grams and has 230 mm (W) × 28 mm (H) × 152 mm (D) dimensions. By May 2006, worldwide sales of PlayStation®2 had exceeded 100 million consoles. Table 2 shows worldwide sales data for PlayStation®2 during 2005.

<table>
<thead>
<tr>
<th>Country</th>
<th>2005 PlayStation®2 Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria/Switzerland</td>
<td>200,000</td>
</tr>
<tr>
<td>Benelux</td>
<td>350,000</td>
</tr>
<tr>
<td>France</td>
<td>750,000</td>
</tr>
<tr>
<td>Germany</td>
<td>860,000</td>
</tr>
<tr>
<td>Ireland</td>
<td>90,000</td>
</tr>
<tr>
<td>Italy</td>
<td>820,000</td>
</tr>
<tr>
<td>Nordic</td>
<td>350,000</td>
</tr>
<tr>
<td>Spain/Portugal</td>
<td>930,000</td>
</tr>
<tr>
<td>UK</td>
<td>1,340,000</td>
</tr>
<tr>
<td>Western Europe (PAL) Total</td>
<td>5,690,000</td>
</tr>
<tr>
<td>Australia/ New Zealand (PAL)</td>
<td>490,000</td>
</tr>
<tr>
<td>Other PAL Countries</td>
<td>1,400,000</td>
</tr>
<tr>
<td>All PAL Countries Total</td>
<td>7,580,000</td>
</tr>
<tr>
<td>USA</td>
<td>5,530,000</td>
</tr>
<tr>
<td>Japan</td>
<td>2,140,000</td>
</tr>
<tr>
<td>Rest of World</td>
<td>610,000</td>
</tr>
<tr>
<td>World Total</td>
<td>15,860,000</td>
</tr>
</tbody>
</table>

Table 2: 2005 Sales volume for PlayStation®2 (Source – Screen Digest)
The UK PlayStation®2 Service Operation

Whilst the operation was designed to accommodate specific requirements for each territory, the largest operation, servicing markets in UK, provided a 24hr customer exchange service. In other territories (such as France) a replacement arrangement was established through local retailers within a period of one week. The UK operation is shown in figure 7.

If a customer returned a faulty console (usually to a retailer) within 30 days of purchase a brand new boxed console would be exchanged. Although the cost of this exchange was still charged to SCEE, the remaining faulty console is surplus to requirement, and was therefore returned for remanufacture and added to SCEE’s buffer stock. If a customer called the UK Service helpline a specialist call centre company would answer the call (Mon-Fri 8 am to 10 pm, and Sat-Sun 10 am to 6 pm). Staff would collect customer details and serial numbers (to prevent fraud) and would run through a series of technical diagnostic questions to confirm a genuine fault was likely to be present and minimise No-Fault-Found (NFF) returns.

If a replacement was needed an automated request would be sent immediately to the second key player in SCEE’s operation: an outsourced courier company. They would then deliver, from their warehouse, an equivalent product within 24hrs (provided that the faulty console was handed over by the customer). The courier would then bulk up returned consoles and deliver them to the third key player: the central remanufacturing company. The remanufacturing company would receive and fully remanufacture the vast majority of consoles for later collection by the courier for future delivery. Any consoles determined to be beyond economic repair would be dismantled with working sub modules kept from future use. Then remaining defective and unusable materials and then sent for recycling.

SCEE’s London staff co-ordinated the overall operation and undertook all strategic decisions. One important function of the London staff was the collection of call and repair data from across Europe to help forecast future demand and allocate and plan and co-ordinate work-flows accordingly.
Infoteam, Cornwall

Partly due to the newer PlayStation®2 sheer volume of sales, and partly also due to Nabarro’s leverage on price, Infoteam relocated to a business park in St Colomb Major, Cornwall. Based just off the A30, and only five minutes from Newquay Airport, their new facilities include 23,500 square feet of factory space and Class 1000 clean room facilities.

Two overriding aspects have governed the way Infoteam operate: flexibility and information management.

Flexibility is vital given the need to respond rapidly to changes in demand. From one month to another Infoteam may receive more of one type of model than another. Many workers are, therefore, trained to be able to cover multiple tasks, and the factory track layout can be reconfigured in a single weekend to allow different operations to be established the following Monday morning.

Before the faulty consoles arrive at St Colomb Major their details have already been loaded onto Infoteam’s Generis Information System. Each activity around the factory is logged in and out by barcode scans. Every worker is identifiable by a unique login and is presented with customised instructions to suit the immediate task needed. In this way information can be immediately gathered to track trends, ensure quality, and relay ordering data direct to overseas suppliers. In this manner, information management is shown to be key to Infoteam’s success.

On arrival a faulty console may be stored for a number of weeks until it is needed. After unpacking and removing any accessories a controlled airstream to blow out any accumulated dust or dirt before allows the console to move to a cleaner environment. The console is then placed in “Service Mode” both to allow diagnostic tests and to prevent illegal use of spare parts. Following this a number of diagnostic checks are made to determine where faults are and determine the appropriate disassembly needed. Then, through a carefully organised process, various components are removed for rework. Using buffer stocks of new, reclaimed and remanufactured parts the consoles are reassembled and placed through rigorous tests (including a two hour heat ageing test) before being approved and packed ready for dispatch.

Rather than scrap faulty components Infoteam deploy the skills of a team of electrical technicians to diagnose faults and repair circuit board components. These operations are illustrated in Plates 1 & 2.
Service & Logistics
Replacement component parts for PlayStation®2 were ordered and paid for by SCEE and then shipped direct to Infoteam. SCEE placed any orders for new parts with SCEI, who then leveraged demand both for the new manufacture of PlayStation®2 in China, and the demand for replacement parts from SCEE and other regional Sony companies.

Whilst this practice ensured the lowest cost it also meant that the lead time for parts from primary suppliers was typically 5 months. As parts were bundled and shipped together this lead time applied to all replacement PlayStation®2 components.

With all electrical products that read data from a CD or DVD disc the Optical Block (OB) is a common component to fail because it is in use for the majority of the device “on time”. The Optical Block is an optical-mechanical device with moving parts which includes that the laser that reads the data from the disc.

One significant factor with the PlayStation®2 operation was the buffer stock generated by 30-day returns. As retailers replaced customers’ faulty PlayStation®2 consoles with new products, the remaining faulty consoles were added to SCEE’s stock once they had been remanufactured. This allowed SCEE to build up a buffer stock of consoles to alleviate changes in demand for Service throughout the calendar year. After a peak of sales (such as during the Christmas period in the UK), the number of returns rose in the spring months. The additional buffer stock of 30-day returns, therefore, allowed SCEE to meet service demands without interruption.
As with PlayStation®, PlayStation®2 went through a series of model upgrades (termed A through to G models), each having energy efficiency improvements and tweaks to improve product performance. When SCEE built up a stock of older remanufactured models which became greater than the service demand required the excess quantities were made available for sale through SCEE’s Sales & Marketing department.

**Customer Relations Management**

By deciding to operate an “exchange model” each PlayStation®2 customer only experienced one interaction activity before receiving their replacement product. This 24-hour exchange has minimised customer disruption and reduced the need for a second courier journey. Of equal significance: the single interaction has reduced the amount of data tracking and customer call handling required as customers do not make repeat calls inquiring about their product.

One side benefit of the fully remanufactured exchange model has been the ability to offer a replacement service to out-of-warranty customers. As every product is remanufactured back to the same quality standard, older products are also received (albeit after paying an out of warranty fee), and then returned back to other customers. Remanufacturing has helped reduce customers buying brand new products unnecessarily; this both extends product life and helps maintain new sales to new customers.

Due to the low cost and ease of repair SCEE is able to offer an out of warranty service for a nominal charge to customers, meaning they can continue to enjoy using their console without buying a new. As much as a half of exchanges are for out of warranty consoles.

**Knowledge Management**

Whilst outsourcing different parts of the Service operation brought competition to both PlayStation® and PlayStation®2 servicing - it also brought the real risk of losing control of operations. To prevent this SCEE put two important steps in place:

Firstly, SCEE ensured that it developed and retained ownership of all the call centre, logistics and remanufacturing training and procedure documentation. SCEE also remained involved in all staff training exercises and, where highly technical information was needed, ensured proper Non Disclosure Agreements (NDA) were in place. Retaining control over operational decisions and training manuals allowed SCEE to consider competitive bids from other service providers. During the time of PlayStation® and PlayStation®2 a number of different call centre and courier companies were used.

Secondly, SCEE bought all the repair jigs & software directly from SCEI in Japan and retained ownership even when placed with sub-contracted remanufacturers. Each of these jigs had a microchip requiring regular communication with SCEI computer servers Japan. The exact location of this equipment, therefore, was tracked via company Internet Protocol (IP) addresses. Furthermore, all computer software used for diagnostics had to operate on PCs that had their MAC (Media Access Control) network cards and IP addresses authenticated by servers in Japan. SCEE conducted regular audits on all jigs/tools/manuals.

Infoteam set up an information system to log all events within their factory. Every PlayStation®2 was “logged in” on arrival, and each disassembly and reassembly stage logged. This data was sent to SCEE each night and allowed both Infoteam and SCEE to monitor production rates and scan for trends.

SCEE’s Knowledge Management system would allow them to change their operational model in totality or even their outsourced partners over a period of just 9 months.
Environment & Compliance
SCEE’s use of a small number of central service centres has made both the collection and reporting of recycling easier. Typical annual recycling rates have been 36,000 kg of plastic from plastic covers and 14,000 kg of remaining “electronic” waste from unusable circuit boards.

By remanufacturing the “spare” 30-day returned PlayStation®2 consoles, SCEE has been able to sell around 50,000 PlayStation®2 products into developing markets each year. This has directly avoided the need for new PlayStation®2 consoles to be manufactured to meet this demand.

PlayStation®3
Incorporating the latest advancements in computing technology, PlayStation®3 was designed to put High Definition entertainment at the centre of each household. It would include High Definition Blu-ray movies, motion-sensitive Wireless Controllers, Wireless Internet and HDMI connectivity, all powered by the Cell Broadband Engine. In addition, each PlayStation®3 would have built-in hard disk space to allow users to store movies, music, games, photographs and downloads.

PlayStation®3 was developed with a modular design - with different components assembled on to a common architecture platform. At launch the PlayStation®3 was to weigh around 4kg, with dimensions of 325 mm (W) x 96 mm (H) x 275 mm (D).

Figure 9: A PlayStation®3 Console

Acknowledgements
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