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A perspective into full cost recovery within a core facility/shared resource lab

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Abstract

Here we outline a vignette of the Bioscience Technology Facility (BTF) at the University of York as a singular exemplar of the Full Cost Recovery model. It is fully appreciated that every facility operates slightly differently, and each are subject to various rules at the institutional, regional and national level. Understanding the regulations that need to be followed for your cost recovery model may require discussion with your administrators to ensure compliance regulations for your Institution and governing bodies are followed. The below is almost a pick and mix of ways of working. It is, however, one of the few examples that is able to fully recover its operating costs within an academic environment and has sought and obtained full institutional and funders support. This model is now being much more widely adopted across the United Kingdom although again always with slightly different interpretations.

KEYWORDS
charging, core facilities, finance, funding, TRAC

1 | THE YORK BIOSCIENCE TECHNOLOGY FACILITY

The BTF was set up in 2002 and very quickly become firmly integrated within the Department of Biology. At its inception, there were 14 core staff, in 6 specialist laboratories and this has grown over the last 20 years to 27 staff as shown in Figure 1. The core staff do not have research portfolios, although they are involved in technology development, but support the research of users across Biology and other STEM departments.

Ever since the inception of the BTF academics in the Department of Biology at the University of York were made aware that there would be a charge to access the high-end equipment housed in the BTF—a scenario which was new to them.

This charging model is now increasingly common but a Facility cannot go from no-fee to full cost recovery overnight so it was made clear from the start that the charges would be introduced gradually. The University initially underwrote 100% of the costs and this percentage was decreased as the Facility ramped up the costs to cover the full economic costs of the instruments and staff over a period of 5 years. This was directly agreed with the major funding bodies at the time (BBSRC, MRC, NERC, Wellcome Trust) with signed letters from the Chief Executives and Directors. The BTF was originally funded by a BBSRC Joint Infrastructure bid with an additional Wellcome Trust contribution and comprises of six adjacent labs: Data Sciences, Genomics, Imaging & Cytometry, Metabolomics & Proteomics, Molecular Interactions & Biophysics and Protein Production. The colocation of the labs with each other,

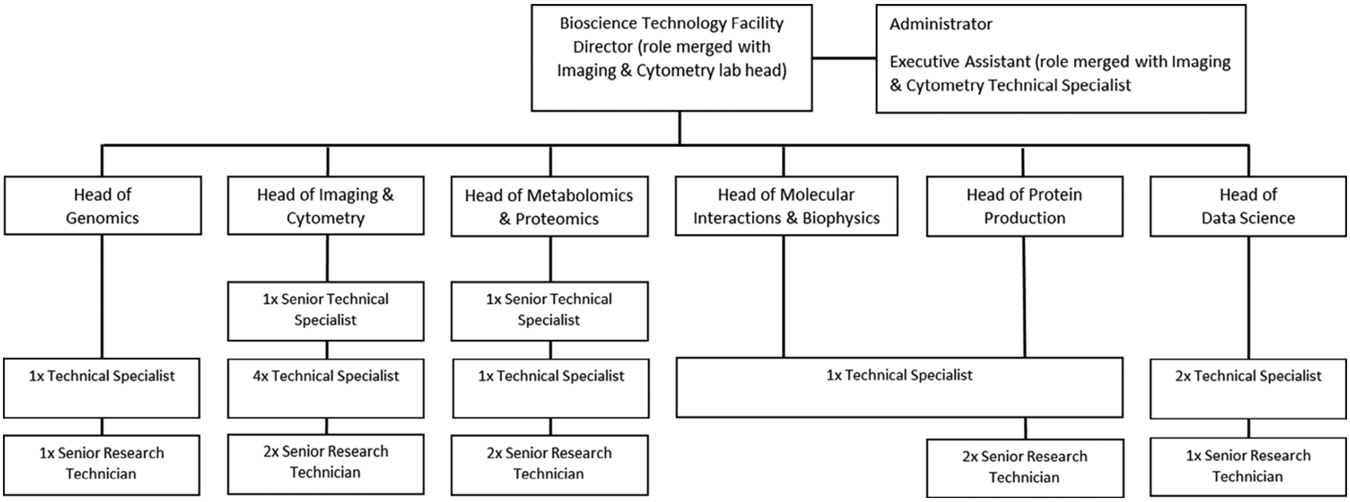

FIGURE 1 Organogram of the current BTF staff within each technical specialism.

spanning three floors in a brand-new purpose-built building was unique at the time, and is still very unusual, with each lab having a lab head and technical specialists. The labs work across each other, and whilst each have individual budgets, they work closely together for final financial reporting.

2 | FINANCIAL STRUCTURE

The BTF has more than 80 high-end specialist instruments with an annual expenditure of over £2million and recovers 80–90% year-on-year. The facility underpins more than £40million in active research funding over 70 different York research groups across Departments with over 400 internal users annually. Work is also ongoing with external clients, typically around 35 industrial and 25 external academic groups every year (generating around £400k per year); this varies from year to year and depends on where the internal demand is. Imaging, flow cytometry and data science courses are run several times a year attracting over 100 delegates per year. These are run without profit, but they still contribute a significant income to the facility and enable it to sustain a higher instrument and staff load than would otherwise be possible (Figure 2).

Both courses and external work are often for short very intensive efficient bursts with minimal impact on internal users who are always the priority. However, it is vital to communicate as to when these will limit support and access time and stress the longer-term benefits to the user base themselves.

All the labs operate on this mixed economy comprising of internal users alongside external academic and external commercial users. This portfolio as well as a range of low-, medium- and high-level users helps minimise disruption should one group, one funder or one research strand suddenly decrease. If the internal income was heavily dependent on just a few very highly active labs without the mid- and lower-level users, the lab would be very vulnerable should one of these leave or lose funding. Having a mix of all types of users helps to reduce these risks (Figure 3).

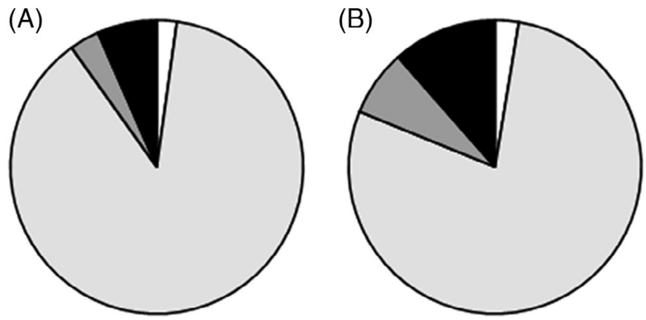

FIGURE 2 The relative frequency of the different user categories (A) and the relative income derived from these categories (B). Internal users (light grey), external academic (dark grey), external commercial (black), courses (white).

Furthermore, in the case of the Imaging & Cytometry lab, the unit houses light microscopy, electron microscopy and flow cytometry making it very robust with overlapping staff expertise enabling resources to shift from one technology to another as demand requires, giving much better efficiency of staff time and resource. This also enables work to flow through the pipelines more easily (as well as through the rest of the BTF), which also increases income and impact. This model has been developed and successfully delivered over the last 20 years and has enabled the facility to grow and sustain the staff expertise throughout the facility. The BTF runs a full economic

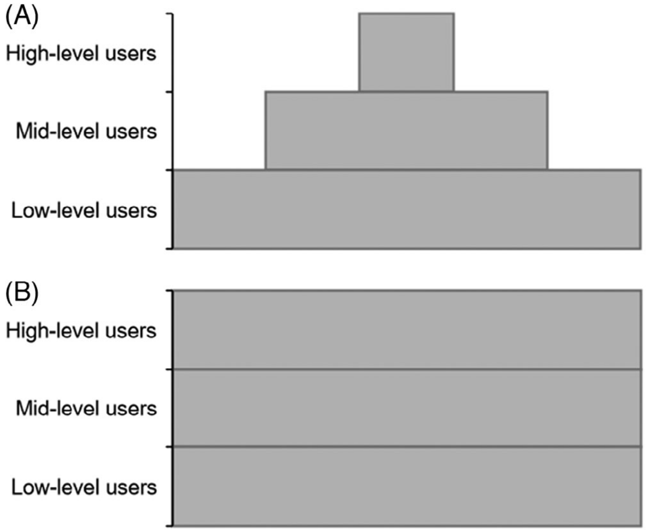

FIGURE 3 The relative frequency of use by high-, mid- and low-level users (A) and the ideal relative income derived from these categories (B).

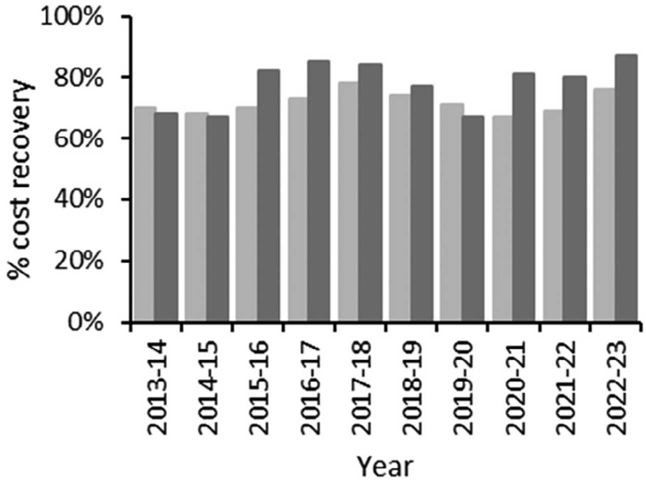

FIGURE 4 BTF percentage cost recovery over the last 10 years showing forecasted percentage recovery (light grey), actual percentage recovery (dark grey).

(fEC) recovery model and routinely recovers 80%–90% of its annual operating cost (salaries, service, maintenance, training/travel and consumables). The actual percentage has always been more than the forecasted percentage since 2015–2016 except for 2019–2020 which was impacted by Covid-19 as shown in Figure 4.

Each of the six labs holds its own budget and has a preagreed end of year income, expenditure and percentage recovery forecast. Figure 5 shows the cost recovery for each lab over the last 10 years, 2013–2023. This illustrates that although some labs routinely recover 80% or more (e.g., Imaging & Cytometry) others recover less and there are also yearly fluctuations. At the end of the financial year, the BTF reports as a whole unit to the Department/Faculty so any fluctuations in any one individual labs budget are offset against each other allowing for yearly individual variation whilst encouraging the labs to work more closely as a collective team and not stand-a-lone labs in isolation.

3 | TRANSPARENT APPROACH TO COSTING (TRAC)

The principle of charging users to access the BTF equipment was agreed with the UK Research and Innovation funding agency (UKRI) in 2003–2004 and is at full economic cost (fEC). Charging rates are determined and reassessed annually for each instrument in a robust way using the higher education sector Transparent Approach to Costing (TRAC) model (see https://www.trac.ac.uk/wp-content/uploads/2018/07/TRAC-A-guide-for-Senior-Managers-and-Governing-Body-members.pdf) and funders now request that all eligible institutions employ TRAC in order to apply for funding. The fEC TRAC rates are based on a number of variables (Figure 6).

First, the direct costs for each piece of equipment. These include the following:

- Associated facility staff Full-Time Equivalents (FTE) including institutional tax and pension contributions for background time associated with the instrument (e.g., installation, training, troubleshooting, liaising with engineers, fixing, aiding users directly on their protocols and optimisation)
- Spare parts and consumables
- Equipment service contracts

A further component of the fEC costs are the indirect costs. These are as follows:

- Utilities and space allocation charges for the equipment (overheads)
- Annual depreciation costs of the instrument (replacement cost divided by the estimate of the useful life)
- Facility staff general support that is not directly attributable to any one instrument (e.g., staff training, running user group meetings, discussing projects, updating TRAC costs)
- Administrative and steering group academic members support

For charity funders the costs relating to utilities, space and equipment depreciation are removed as these elements cannot be recovered. Once the above have been established and total cost per instrument calculated, the charge rate is determined by dividing each instrument's

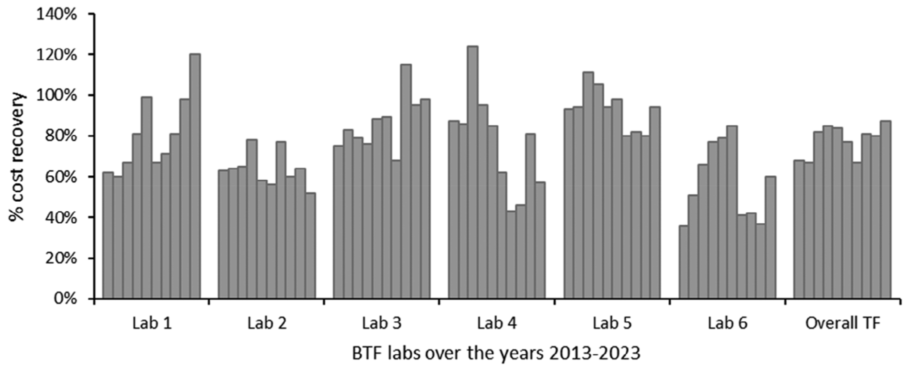

FIGURE 5 Percentage recovery in the 6 BTF labs and BTF as a whole over the last 10 years (2013–2023).

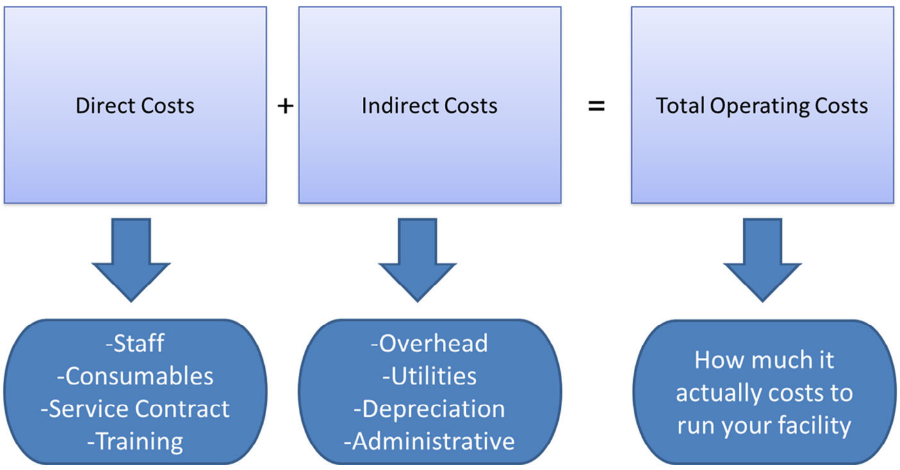

FIGURE 6 The elements included in the calculation of fEC rates using TRAC.

total by the estimated efficient usage hours in the previous year, an example is shown in Table 1.

Staff costs are calculated based on the effort of each lab employee on each piece of equipment associated with the individual in their specific lab. Several of the other costs identified above may not be attributable directly to one piece of equipment within a lab, for example, consumables such as ethanol, specialised tissues, pipettes and tips, fridges, and sonicators, and a mechanism is required to allocate these over all activities of each lab. This could be simply based on usage or weighted according to the relative complexity of each piece of TRAC costed equipment. All this data is crucial for the cost calculation and can have a significant impact on the final rates. It is extremely important that an estimate of efficient usage is used but one that is reasonable and justifiable for the facility. If the usage is set too high, the rates will be reduced and the facility will underrecover its costs; if set too low, it is likely to lead to a profit, which is usually not permitted for governmental or charity funded research and would result in a failure at audit. Where appropriate some equipment rates are charged per run or per sample rather than based on hourly units. Usage records must be auditable so it is imperative to have a robust booking system where usage can be tracked and used for auditing purposes when required. On first glance, it may appear that the charge rates are high, but they are calculated in a robust way according to the average usage over the previous few years and are transparent and equitable for all users in the Department and wider University. All internal users are charged either the fEC or charity rate depending on the funder of their award. Those members of the Department without external funding are charged at the charity rate as the University is already liable for overheads and a proportion of the depreciation. Over the last 10 years, 65% of grants using the BTF have originated from fEC funders with the remaining 35% from charity funders. At the time of writing, 59% of active grants originate from fEC funders with 41% charity funded. This could be due to a new cohort of academics whose research aligns more with the Charity sectors. If the majority of funding originates from Charity funders the total income will still cover operating costs, but

TABLE 1 A hypothetical example of the elements used to generate fEC and charity instrument rates.

Cost element	fEC rate	Charity rate
Direct costs		
Annual instrument service contract	£20,000	£20,000
Specific instrument consumables (flow cytometry tubes, reagents)	£10,000	£10,000
Specific instrument staff time (troubleshooting, QA, set up, ordering, training)	£10,000	£10,000
Indirect costs		
Instrument depreciation (typically over 10 years)	£15,000	NA
Facility & administrative staff time—general support	£10,000	£10,000
Overheads (utilities & space allocation)	£5,000	NA
Total costs	£70,000	£50,000
Estimate of efficient usage (hours/year)	1000	1000
Final rate per hour	£70	£50

the proportion of income towards depreciation would be lower.

Something to consider is whether a family of similar instruments can be grouped/bundled together as one instrument type. This would see the associated costs of all instruments collated and then divided by the aggregate annual used units. This has several benefits. First, when a new instrument arrives, it can be immediately assigned a charge rate, then upon the next annual rate setting, the new costs and potential increased used units can be added in. Second, this also ensures that the older 'less attractive' instruments remain at a competitive price and do not become more expensive compared to the latest new instrument. This helps maintain a more level amount of usage across the instruments themselves. Without this, the older less competent systems would cost more than the new improved systems, which would result in exacerbating the potential attractiveness of such instruments. If an instrument cannot readily be placed into a group, then expert estimated operating and usage figures need to be calculated in the first instance.

In some instances, rates for pieces of equipment that are routinely used for 24 h or more are capped at 8 h in any 24-h period, so the charge does not become prohibitive, for example, for time lapse imaging. Some facilities choose to run cheaper out of hours rates, whereas others charge for the whole 24 h but reduce the hourly rate. This can make it expensive for 24-h users who generally require less staff input per hour compared to the quicker, short experiments. Care should be taken when offering reduced rates at deemed unsociable hours as it could encourage a work/life imbalance and create pressure to work outside of classic working hours.

Academic users from outside the University are charged at the same rate plus an additional indirect cost and commercial users are charged with an additional standard commercial uplift.

Price comparison between facilities is always tempting, but prices will differ due to differences in the level of support, the local salaries, the number of units used, negotiated service contract prices, expected number of years for the instrument to depreciate, local indirect and estate charges, etc.

A top tip, although the prices can appear prohibitively expensive to a naïve user, talking new users through the costs and the comparing them to other external costs that they can relate to can be useful. For example, comparing the price of a day on a £1m microscope to the cost of a few hours for a car to be serviced, or the hourly rate of a microscope to the cost of a theatre ticket helps put things in perspective when they appreciate the level of expertise and cost of service contracts and purchase price of the instrumentation itself. Communication is critical.

4 | FUNDING STREAMS

Grant income comes into the BTF through two different routes: 'directly incurred' income or 'directly allocated' income. In the case of directly incurred income, the funds are awarded to the grantee and funds passed to the facility on a pay-as-you-go basis. This was how all core facility research income was received before a funder and University wide move to directly allocated costs. The directly incurred income model makes it easier for grantees to move funds in different directions if the research takes a different path as the income to individual core labs is not distributed automatically but it makes the core income more difficult to predict. However, once a lab is established, the trends in these income lines make predicting incomes over the coming years more robust.

Also, for high volume superusers of the facility, directly incurred income can also be taken as an upfront monthly or annual subscription this allows instrument usage to be worth more than the effective income, thus giving a better deal for 'superusers'. The second type of income, directly allocated, (as used by all UKRI funding streams) was introduced into the BTF in 2010 and the proportion of income received from directly allocated funds has gradually increased over the years from 26% to 63% as shown in Figure 7.

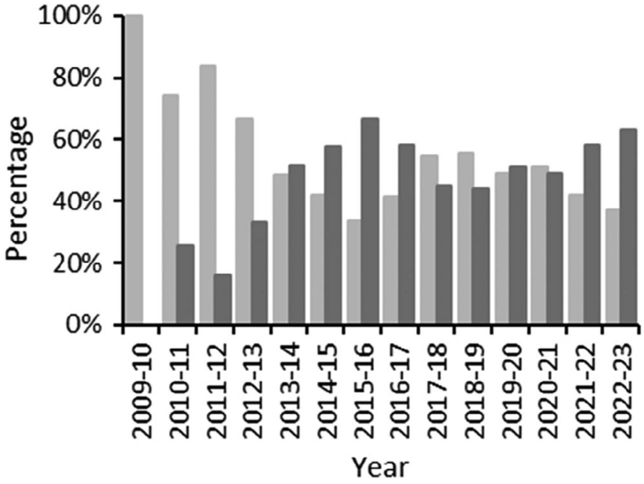

FIGURE 7 Percentage of directly incurred (light grey) and directly allocated (dark grey) BTF income since the inception of direct allocation in 2010.

Direct allocation requires good estimations of required costs in specific facilities before the grant submission as the awarded costs are then drip fed directly to the appropriate core facility lab monthly over the life of the award. This essentially makes this type of income a subscription model based on a reflection of the predicted grant usage from the offset. Applicants discuss with the appropriate BTF lab heads before submission to ensure appropriate provision is made for the duration of the project and the proposed charges are checked and authorised as part of the workflow. A Directly Allocated 'subscription' type model feels contrary to a TRAC based model, but with costs estimated, and units updated annually, this still works well. This type of model also results in a use it or lose it philosophy. However, a bit of leeway can be given in either direction over the lifetime of a grant and with sufficient grant diversity. A classic problem in the early days of establishing this model was if a user used all their credit in 1 year, but it was being drip fed over three years. This caused short-term issues, but once 3 years into the process these differences are evened out as some use a lot in 1 year whilst others do not use the facility at that time. But this can only work well if being averaged out over enough users. Also, as projects progress and sometimes change direction, funding which has been allocated and distributed, but unspent, in one BTF lab may be required in another lab. As long as the income has not been used for upfront consumable spend in anticipation of usage, the funds can often be internally moved after discussion so as not to hinder the progress of the science. As the BTF reports financially as a whole to the Department/Faculty, any diversion of usage can be tolerated to a certain extent if well documented. In the directly incurred model, usage charges are calculated from the number of equipment hours recorded in the booking software, whereas in the directly allocated model usage, charges are still calculated directly from the number of booked equipment hours but this usage is merely recorded against the preallocated budget and not charged as the income has already been received drip wise month on month. At the time of writing, 71% of all grants awarded to users (contributing 63% of the income) of the BTF have directly allocated funding the remainder being directly incurred. We have historically looked at the success rates of grants, which has proven that adding BTF costs to funding applications does not decrease the chance of funding despite increasing the financial commitment from funders. This was regardless of total cost of the grants and percentage attributed to BTF costs. Funders request true fEC costs to be applied, and it is good to see that this is not detrimental to proposals. This has allowed the BTF to provide and develop careers as well as properly maintain equipment to fully support the funded research user base. Furthermore, this model also ensures financial sustainability of the staff and instruments and avoids the loss of expertise at the end of a grant period.

Students are encouraged to access the equipment, with PhD students having their own budgets and usage charged directly to this budget. In some instances, 'superuser' PhD students negotiate an upfront yearly payment on a subscription 'use it or lose it' basis. This payment gives access to twice the amount of usage against the money paid and when spent also confers a reduction of future charges in that year allowing them to really benefit from the high-end equipment and expertise available. Third Year Project Students typically have some limited credit available, based on the requests for BTF support included in the project proposal. This does help ensure that the systems are not used excessively for poorly developed experiments, and that most experiments, even if very exploratory proof of concept at the early stage, are still thought out and designed well. This also ensures more successful and higher impact end results.

In many cases, the users operate the equipment themselves with the BTF staff providing routine maintenance, trouble shooting and basic support. Additional BTF staff time can be requested where extended training and support is required or to provide a full service, where BTF staff carry out the work on behalf of the user. The proportions of these different usage types vary across the BTF labs with Genomics, Metabolomics & Proteomics, Protein Production and Data Science labs providing more full service work whilst Molecular Interactions and Imaging & Cytometry have a higher proportion of user operated equipment. The fEC cost model is equally valid regardless of the proportion of time spent on instruments or offering full-service support. fEC allows the proportion of staff resources to be spread differently across instruments to full service available time. The standard 'Full Service' charge comprises the equipment hourly rate plus the staff hourly rate. When the work is non-routine, the charges are calculated on a case-by-case basis. The charges do not include costs for specific consumables associated with the proposed experiments; these are either added to the costs or charged separately in most cases. The costs for facility staff general support and project discussion time are accounted for in the background staff time attributed to each instrument.

5 | BENEFITS AND DRAWBACKS OF CHARGING

Charging ensures open, non-political, unbiased access to and resourcing of equipment and results in facilities the researchers actually need avoiding funding pet projects of the few or those who shout the loudest. Charging also prevents mass booking by over-zealous users. It gives control over the budget with clear and evidenced justification for staffing levels to the point of ensuring staff numbers can be increased if revenue shows it is viable, something which has happened on numerous occasions. It ensures the purchasing of service contracts to keep the equipment in good order as the costs for these are inbuilt into the charges. This also has added benefits for the users as service contracts can ensure priority visits from engineers when equipment develops issues and allows users to get back onto the equipment with minimal delay. All the above is safeguarded when the lab is recovering its full costs and makes these elements protected if wider institutional budgets are being cut.

However, there can be some drawbacks to the charging model as well. The overall focus of a fully costed facility can move towards the financial outcome rather than the scientific outcome, but this is something that a pragmatic lab head can overcome. Because the budget is scrutinised yearly if the facility's percentage recovery is less than expected, perhaps due to a dip in the amount research funding awarded, then this can lead to justifiable cuts to underutilised equipment or worst-case scenario cuts to facility staff numbers, but there can be opportunities to increase income from elsewhere such as the commercial sector to counteract a drop in research awards. It quickly highlights where technology or service is declining, making it possible to rectify the downturn, or simply appreciate the evolution and ensure that new technologies are being brought in to address the new needs. A further disadvantage to charging can lead to users rushing their experiments or a reduction in the number of ad hoc experiments due to costs, but again this can be overcome using the subscription models or the creation of pump prime funds. A further requirement for the charging model and the centralisation of high-end equipment in facilities must be a rule that individual academics cannot purchase high-end equipment and house them in their own labs unless they are going to use it 100% of the time and cover 100% of the costs, that is, service contracts. Any such 'out-of-facility' equipment could undermine the ethos and equitable nature of the facility and lead to the propagation of 'off the books' facilities that are not well supported and not financially sustainable in the longer term but could cause significant damage to the official facilities. In practice, we have found this rarely occurs, and in instances when the PI suspects they will use the equipment heavily, they will often choose to house it in the BTF ensuring continuity once their own staff have moved on and also be assured that the BTF specialist staff can give expert support as well as carry out the routine maintenance and troubleshooting.

The BTF does not run at a profit and so does not generate surplus income, which can be set aside for renewing ageing equipment. However, depreciation income is captured by the University, although it is not instrument specific. The University itself has routine calls for replacement equipment, which have proven to have contributed more finances towards replacement equipment than would have been possible by capturing the instrument specific depreciation alone. Nonetheless, arguing cases for lower cost, lower utilised but still essential equipment is much more challenging. High-end equipment can also be replaced through UKRI (BBSRC Alert and MRC Equip) bids. We have had success with this recently, and these bids have been led by the appropriate BTF lab heads and underpinned by multiple academics who can show the requirement for the equipment and the advantages to their research.

6 | CONCLUSION

The above example is close to the ideal scenario being encouraged by our funding bodies. This required a ramp up period and the buy-in from the internal user base to have the courage to apply true costs onto their grant applications. Whilst we have experienced varied problems over the past 20+ years, we have learnt at each stage, and now all labs are running more efficiently and with greater confidence. This in turn has enabled the facility to provide stable careers that in turn continues to provide expert support to the latest technologies to maximise the research impacts to the end users. The model has also enabled us to withstand times of wider financial problems and grow in line with user demand. Every element described above is important in the running and maintenance of a successful facility: a realistic 5-year plan; determining the usage rates; ensuring funding applications contain the appropriate number of usage hours; a robust booking/reporting system; efficient account management; local rules. A successful facility is not only an asset to the current users but also to Institution and as such is also a draw to potential employees.

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