Optimizing Institutional Approaches to Enable Research

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Abstract: *Challenges that face the academic research enterprise are numerous. These concerns include, but are not limited to: declines in extramural funding for investigator-initiated research, an aging faculty workforce (the average age of securing a faculty's first R01 is over 42), insufficient funds to support faculty laboratories, and limited access to cutting-edge, next generation infrastructure and methods to support research. This manuscript describes an institutional approach to providing leading-edge core facilities and enhancing the effectiveness of their operations by implementing process improvements, managing the lifecycle of core facilities, and monitoring key core facilities' metrics. This approach has created a number of standardized, transparent processes to effectively manage central infrastructure that enables enterprise-wide research, including a process for capital equipment planning, a procedure to evaluate new cores, a method for reviewing and managing the lifecycle of existing cores (invest, maintain, or sun-down), an investment in the administration and operational efficiencies of the cores, and support for the development and implementation of new methodologies for our investigators. The execution of these processes has provided faculty with forward-looking technologies to facilitate innovative research and provide a competitive edge for extramural support.*

Keywords: *core facilities, infrastructure, strategy, governance*

Introduction

Within the past two decades, the complexity of biomedical science has provided the impetus to design increasingly sophisticated and innovative instrumentation and services, thus enabling faculty to dramatically advance research along the entire spectrum of basic and clinical investigations. While the infrastructure for and enablers of research continue to provide the basis for these cutting-edge investigations, they come with a price to individual investigators regarding both instrumentation expense and technical expertise. As acknowledged by Angeletti, Bonewald, Jongh, Niece, Rush, and Stults (1999) over fifteen years ago, the model of an individual investigator possessing a self-sufficient single laboratory, including all the necessary modern equipment to conduct competitive science, is a distant memory. The historic high-end, self-sufficient laboratories have been mostly replaced by laboratories that rely on institutionally supported infrastructure (i.e. core facilities). These core facilities enable scientific discovery by providing the latest technology, instrumentation, and technical expertise. However, those institutions that invest in enabling infrastructure are often faced with additional conundrums. These include the cost associated with maintaining/replacing existing services (Haley, 2011), developing new technologies (Slaughter, 2009), identifying highly trained faculty/staff to serve as core directors (Rey, 2007), and integrating a system to effectively monitor services that need to either grow, be maintained, or be dismantled (Haley, 2009). This manuscript addresses the enterprise-level challenge of keeping pace with and effectively managing cutting-edge, next generation infrastructure that supports the needs of scientists, allowing them to remain competitive in securing extramural funding and publishing novel discoveries. An institutional approach for enhancing the effectiveness of core infrastructure operations by implementing process improvements, managing the lifecycle of core facilities, and monitoring key core facilities' metrics is described.

In 2010, the Office of Research at the University of Michigan Medical School conducted a thorough business review of its centrally managed biomedical research core facilities. As a result, the Office of Research has implemented an institutional approach to effectively manage the supporting infrastructure of our central core facilities. This includes: 1) a process for core facility capital equipment planning and acquisition, 2) a method for reviewing and managing the lifecycle of existing core facilities (invest, maintain, or sun-down), 3) a process to evaluate whether department-based core facilities should transition into the central, school-wide core facilities, 4) an investment in the administration and operational efficiencies of the core facilities, and 5) support for the development and implementation of new methodologies to make the latest techniques available to our investigators. The optimization of this approach to infrastructure management has allowed the Medical School to replace obsolete equipment, introduce new technologies and platforms, increase scientific capability and capacity, reduce turnaround times, create standardized and sustainable oversight, create core evaluation processes and metrics, and pilot an outsourcing model (to eliminate capital investments when appropriate). While this business strategy was developed as a platform to specifically manage the functional units of the core facilities, it also is structured to provide a broad governing system that guides key "lifecycle" decisions of the core facilities.

A Business Review

The University of Michigan is home to 92 core facilities or shared resources that facilitate the pace of both broad and specialty research for our scientists. Due to a decentralized environment, most of these core facilities or shared resources are created and maintained at a department or programmatic center level, often characterized by serving a limited, targeted population of investigators. Eleven institution-wide core facilities are housed under the Office of Research in the Medical School and are collectively administered as the Biomedical Research Core Facilities (BRCF) with an operating budget funded by the Dean of the Medical School. The BRCF is managed by a single administrative director and provides central support for "in demand" technologies. The BRCF services are available to all university faculty based on a cost recovery model (i.e., university approved recharge rates). The core facilities comprising the BRCF include: DNA sequencing, flow cytometry, bioinformatics analysis, biosafety containment, proteomics and peptide synthesis, metabolomics, transgenic animal models, viral vector creation, microscopy and imaging analysis, the biomedical research store, and a sample preservation freezer facility.

The Office of Research launched a business review of the BRCF in order to identify ways to improve the ability of the core facilities to meet our researchers' needs. This review also resulted in the identification of areas of strengths, including reliable, high-quality services, national recognition associated with specific core facilities, and competitive recharge rates within the university and across the nation compared to peer institutions. The BRCF is a significant operation with annual expenditures in excess of $17 million, with most of the cost of operations recouped through recharges to investigators.

An important aspect of the business review was the identification of the challenges that threaten the timely acquisition of new, state-of-the-art technologies for the core facilities. For example, the review identified that both the general fund allocation and the level of administrative support for the BRCF had been stationary for decades. The static funding for the core facilities curtailed progress in the development of new methodologies and prevented the acquisition of new equipment. These issues were further compounded by a core facility financial system that was not keeping pace with the growth and increasing complexity of the BRCF, with its myriad recharge accounts and billing across a broad customer base of internal and external clients. The system did not readily generate automated reports with the type of information needed to track the granular performance of the BRCF business portfolio. Finally, the absence of key performance indicators for each core facility as well as the lack of a standard process for evaluating where cores are in their business lifecycle hindered the strategic and operational management of these costly assets.

Overall, the lack of predictable and strategic funding allocations that kept pace with inflation and researchers' demands for services along with a deficient prioritization process for procuring new equipment and technology were arguably the most serious threats to the viability of the BRCF's activities and the scientific competitiveness of our faculty. The review found that without a financial and operational strategy supported by executive leadership 1) investments became static and insufficient; 2) equipment was increasingly becoming obsolete or the number of instruments available was no longer meeting the demand of faculty, resulting in long wait times for investigators; 3) the budget neither accounted for state-of-the-art methods development

required by many core facilities nor provided financial aid to investigators recovering from large-scale instrument failures, leaving faculty with the entire liability; 4) governance and decision making regarding the fate of a core facility when business either waned or boomed was opaque; and 5) the absence of standard, key performance indicators that are routinely monitored clouded the oversight and management of the core facilities.

Business Strategy

Armed with the information generated during the business review, the Office of Research developed a multipronged business strategy that has served to facilitate informed decision-making around investing, sustaining, monitoring, and managing the lifecycle of these key core facility assets. The Office of Research's approach to the business assessment consisted of benchmarking peer institutions; surveying our faculty for their most pressing core facility needs; assessing short- and long-term solutions to meet those needs; establishing metrics to chart service utilization, faculty satisfaction and financial feasibility; and building a standard, transparent decision tree to guide consistent decisions making on our core facility portfolio. This latter tool aids the Office of Research in determining whether to invest in established or new core infrastructure, maintain existing core infrastructure, or sun down core infrastructure that has become commoditized or is less scientifically relevant. The goal of this process was to facilitate more, better, and faster scientific investigations by our research community and to increase awareness and oversight of current infrastructure. To execute this business strategy, specific tactics were used that included: 1) creating a process for core facility capital equipment planning; 2) implementing a process for reviewing and managing the lifecycle of existing core facilities (invest, maintain, or sun-down); 3) developing a process to evaluate whether department-based core facilities should transition into the central BRCF operations; 4) stabilizing the financial investment in core administration; and 5) providing funds for the development of the next generation of research enhancing, cutting-edge methods as well as a central pool of "insurance" funds for emergencies, such as large-scale instrumentation or technical failures.

Planning and Acquisition of Core Facility Capital Equipment

Robust state-of-the-art infrastructure, including leading-edge equipment offered by a centralized core facility, is vital to the success of research faculty. Previously, each core director was responsible for securing capital investments by seeking financial contributions from individual department chairs, which, if successful, significantly delayed the timely acquisition of the latest technologies or upgrades to existing instrumentation. Due to the lack of strategic, central investment, much of the BRCF instrumentation was obsolete, lagging by several generations in technology, and largely oversubscribed with demand well beyond capacity. As a result of the business review, the Office of Research secured a three-year investment from the Dean of the Medical School to replace obsolete equipment and to increase capacity in cores with long wait times. Moreover, in an effort to better plan for capital acquisitions in the future, a central inventory of BRCF equipment with a useful life depreciation schedule was developed to calculate the timing of ongoing equipment replacement needs, to identify impending obsolescence, and to formalize multi-year forecasting for capital funding.

A Capital Investment Committee was also established and is comprised of research faculty, who are customers of the BRCF. The committee is advisory to the Medical School Senior Associate Dean for Research. This committee is charged with reviewing and making recommendations on acquiring equipment for either replacement or bringing new technologies/methodologies on line. The Capital Investment Committee has overlapping membership with the BRCF Advisory Committee, which is a faculty committee responsible for providing counsel and guidance related to the scientific direction of the cores. The overlap in membership ensures continuity between technology acquisition and the scientific objectives of the core facilities. The Capital Investment Committee meets twice a year to review capital request applications submitted by the BRCF core unit directors. A Capital Equipment Request Form is used to outline the need, the purchase cost, the return on investment, and a proposed recharge rate to defray operating costs. In addition to submitting the Capital Equipment Request Form, the individual core directors deliver a short presentation to the committee justifying the importance and impact of specific equipment purchases to our research community. The committee weighs the information, strategically prioritizes requests taking into consideration the financial, operational and scientific benefits of the potential investment, and makes their recommendations for specific technology acquisition to the Senior Associate Dean for Research.

Since its inception in 2010, the Capital Investment Committee has recommended approval of $10.5 million in equipment purchases. These investments have allowed the BRCF cores to more effectively fulfill demand (e.g., the DNA Sequencing Core has increased the number of bases sequenced per month by a factor of five) and reduce turnaround time (e.g., the Flow Cytometry Core reduced its wait time from 4 weeks to 2-4 days). The Capital Investment Committee has declined $5.4 million in equipment requests due to a low impact (either in number of faculty served or the level of anticipated utilization of the equipment), a lower strategic research priority in comparison with other requests, or significant uncertainties associated with the emerging technology.

Managing the Lifecycle of the BRCF Portfolio

In order to maintain optimum services and provide the capacity to deliver the next generation of emerging technologies, the BRCF has developed a core lifecycle management process that is used to conduct an annual evaluation of the scientific and financial health of its core facilities (Figure 1).

A decision tree was developed and implemented to aid in making transparent, consistent decisions regarding the management of the BRCF's portfolio of core facilities. This process provides insight into investing in core facilities that are experiencing high demand for existing service offerings or new, emerging technologies; maintaining a core facility that has reached a steady state in its business, neither experiencing growth nor a decline in service utilization; or phase out a core facility that provides a service or technology that is available as a commodity, readily offered by vendors, or the underlying science has evolved beyond the technology/method offered. The decision tree is informed by four introductory questions:

1) Is the core facility financially self-sustaining?

2) Would additional investments make the core facility self-sustaining?

3) Does the core facility enable better science by being housed within the Medical School?

4) Is the core facility a regulatory requirement?

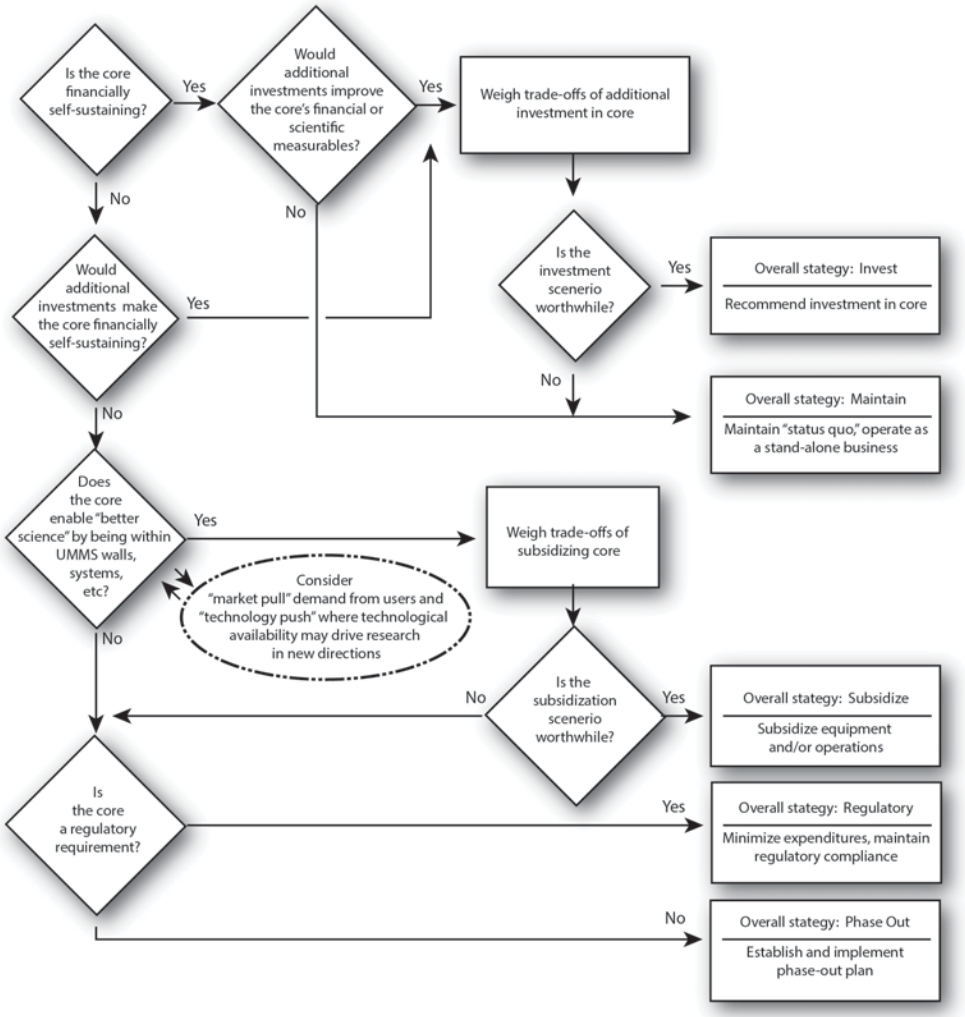

Figure 1. A "roadmap" to guide decisions on managing the core facility portfolio. This decision tree provides insight into whether to invest in an established BRCF core facility or transition a department-based core into the central BRCF envelope of operations; to maintain the status quo of the core facility under consideration as it currently is; or to sun down underutilized or scientifically less relevant core facilities.

Affirmative answers to either of the first two questions lead to the consideration as to whether the investment scenario is worthwhile when weighed against competing priorities. A further positive response signals that specific investment in the core facility is strategically important and support is recommended. However, if at this point on the decision tree it is deemed that other competing activities take precedence, the financial support is denied, and the core facility maintains current

operations "as is." Two main considerations become drivers for answering the third question on the decision tree: does the core facility enable better science by being within the Medical School? The first consideration is aimed at addressing whether the demand or "market pull" from our faculty and staff consumers is significant, thus fulfilling the economic paradigm of supply and demand. The second consideration is whether the core has the potential to provide a "technology push," thus driving research at the Medical School to a new level or in a new direction by offering the service or technology. An affirmative answer to either consideration directs the final investment decision into the trade off against competing priorities category. The decision tree further considers the issue of compliance, as research-intensive institutions are increasingly asked to deal with unfunded regulatory mandates. Therefore, if a core facility fulfills a regulatory requirement or enables compliance for our researchers, the decision tree takes that into consideration and supports maintaining compliance while minimizing expenditures as long as the characteristics of an enterprise-wide core facility described in the next section continue to be generally met. Lastly, the decision tree indicates when a core facility should be placed under a phased-out plan and shuttered in a timeframe that takes into account alternative options for investigators. This latter action is implemented when each of the four fundamental queries in the decision tree is answered in the negative. This model was originally established to evaluate entire BRCF core units but has more recently been leveraged to also assess the individual service offerings, or business segments, within each core unit.

The annual BRCF assessment provides information to categorize the individual core facilities into specific lifecycle management stages as shown in Figure 2.

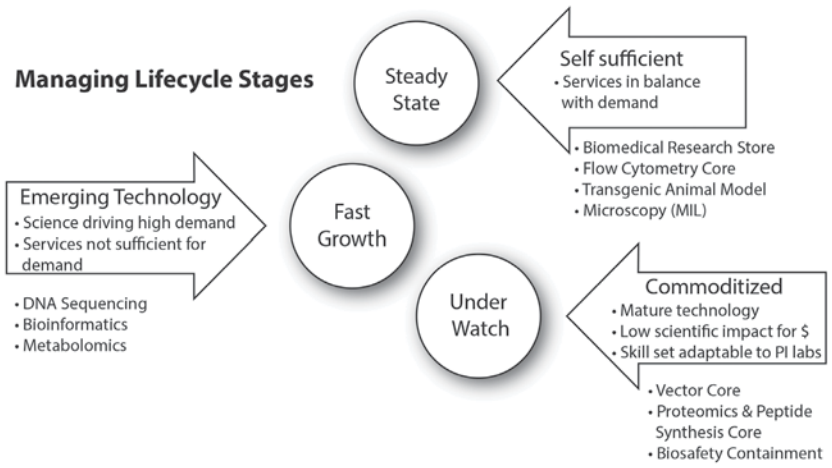

Figure 2. Core facility lifecycle management. In order to manage the return on investment of the core facilities, they are monitored and assigned to stages of their lifecycle. This includes a steady-state stage, where the core facility is nearly self sufficient with services in balance with demand; a fast growth stage, where emerging technology drives high demand that is not met by present services; and an under watch stage, where the mature technology is now a commodity and the core facility provides low scientific impact for the investment.

Those core facilities that provide science-driving services and emerging technologies that cannot keep pace with demand are designated as "Fast Growth" and are strategically considered for new investments. Core facilities categorized as "Steady State" indicate that the services are in balance with the demand. These units are, or are nearly, self-sufficient and need little to no subsidization. An "Under Watch" designation indicates that the core facility is providing mature technologies with low scientific impact for the financial investment required to maintain the service. In addition, the technology may have matured to a point where it either can be conducted routinely in an individual investigator's laboratory or is readily available as a commercialized service. As such, there likely are diminishing returns with further investments and an exit strategy is contemplated.

A specific example of a BRCF fast growth core facility is the DNA Sequencing Core Facility, which is characterized by the high scientific demand and rapidly changing technology of next generation sequencing (Shendure & Ji, 2008). The demand is driven by a number of factors, including that genomics research has penetrated many scientific disciplines, RNA and DNA sequencing technology is expected to continue to evolve for the foreseeable future (technology 'generations' only lasting 2-3 years), and investment in genomics technology and methodologies brings services at the frontier of science to our faculty. The demand for this technology is shown in Figure 3, where the number of bases sequenced rose dramatically with the acquisition of each additional high sequencing instrument. As a consequence, fast growth core facilities are typically poised for strategic investment.

"Steady State" or maintenance core facilities are characterized by providing critically needed services that are financially backed by near self-sustaining recharge rates. The BRCF Flow Cytometry Core Facility, which provides both analytic and cell sorting activities, is a good example of this type of core facility. Interestingly, the ability of this core facility to enter the

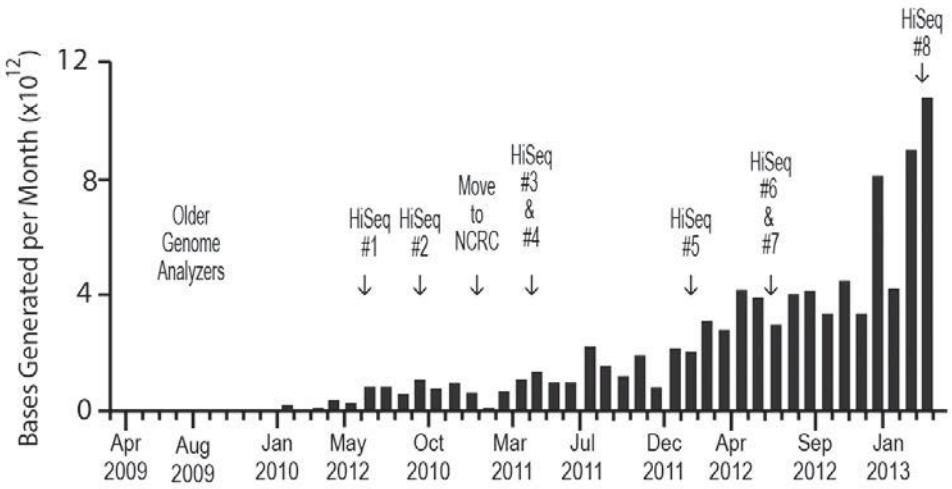

Figure 3. DNA sequencing is an example of a fast growth core where there is high demand for emerging technology. Each time a high capacity sequencer was added to the core facility the use of the service, as determined by bases of DNA sequenced, exponentially rose.

steady-state category was facilitated through the capital planning process, with new investments into an oversubscribed facility that had been operating with both dated equipment and too few instruments to meet the research community's demands. The Flow Cytometry Core Facility had been operating with lead times approaching 4 weeks. Replacement of old cytometers with multiple new higher-capacity cytometers reduced turnaround times to 2-4 days and has continued the path to self-sustainability.

"Under Watch" status has been assigned, for example, to the Proteomics and Peptide Synthesis Core. Historically, the book of business for this core facility was cannibalized by multiple, stand-alone proteomic facilities in various medical school departments. The low utilization and high carrying cost of this core led to the decision to pilot outsourcing the technical services to commercial vendors and other academic institutions, while maintaining an in-house consultation service using the core facility's existing scientific expertise. This paradigm has actually resulted in increased usage, while decreasing annual costs. An overall savings resulted from both capital equipment avoidance and a reduction in annual recurring operating expenses.

Transitioning Department-based Core Facilities into the Central BRCF Operations

Due to the decentralized structure at the University of Michigan, many core facilities initially emerge within departments or programmatic centers in direct response to the specific needs of a subset of investigators within a discipline or field of study. However, over time the scale and scope of department-based core facilities may change. Demand for a given technology/method may grow and utilization of a department-based core facility may far exceed the original targeted investigator base. Under such circumstances, the faculty member responsible for the nascent development of the core may no longer want to divert the required time and effort away from their individual research to manage a high-quality core facility. Transitions in key technical personnel, the complexity of the business operations, and significant ongoing costs of service contracts, replacing capital equipment, and space are additional reasons why, on occasion, department-based core facilities may request consideration to transition from a department-based operations to the centralized operations of the BRCF.

In order to determine whether an existing, department-based core facility outside the central authority of the BRCF should be acquired and integrated into the BRCF structure, a consistent and transparent evaluation process was established. The assessment is based on what the Office of Research has defined as the fundamental characteristics of an enterprise-wide core facility. These features include 1) the ability of the core facility to serve a broad range of faculty from multiple departments, 2) the identification of a faculty or staff leader with expertise in the technical domain to provide scientific vision and translate that vision into business operations, 3) the ability to enable science by operationally being in the university as opposed to outsourcing, 4) the capability of the core facility to meet a regulatory requirement for the university, and 5) the likelihood of the core facility becoming financially self-sustaining. Using these characteristics of a medical school core facility as a framework for decision-making, a Core Facility Consideration Request Form and business plan template were developed. The business plan template captures the history of the core facility, leadership capabilities, space requirements, impact of the service

on facilitating research, and historical and forward looking financials, including recharge rates, expenditures captured through cost recovery, and the level of department subsidization.

The BRCF Advisory Committee reviews the information and makes a recommendation to the Senior Associate Dean for Research to either incorporate the department-based core facility into the central BRCF or decline the request. The Senior Associate Dean for Research has the final decision making authority. To date, the BRCF Advisory Committee approved integrating the Microscopy and Image-Analysis Lab, Bioinformatics Core, Metabolomics Core, and the Vector Core, while declining four other requests. Those requests that have been declined were due to low demand and narrow range of investigators served (i.e., serve few faculty largely from a single, or very few, departments), limited application of the technology provided, or lack of alignment with strategic research priorities.

Investment in Core Facility Administration for Operational Efficiencies

The business strategy not only addressed scientific and operational issues within individual core facilities but also focused on the central administration of the BRCF. Opportunities to increase operational efficiencies and strengthen the administrative arm were identified that will aid in ensuring the continued success and longevity of the BRCF. One of the first priorities of the Office of Research following the business review was to develop a financial plan that reflected the growth and increased complexity of the BRCF business that had occurred over the past decade. Previously, the BRCF had a merged financial structure, where all the core facilities finances were rolled together into a single financial view, requiring manual segregation of funds to develop a financial picture of individual core facility finances and obscuring individual core performance. The increase in the number and scale of core facilities within this financial structure created an opaque and unwieldy environment to effectively manage individual core operations. The granularity, adaptability, and responsiveness demanded by the core facility life cycle management outlined above required modernizing the approach to managing the BRCF finances. To align the finances to the oversight model, individual core facilities were separated into units with a consistent financial structure that allows for effective reporting and consistent evaluation at an individual core level or as a roll-up for a total BRCF financial picture.

The new financial structure has enabled greater transparency of large, complex cores within the BRCF. By aligning revenues and expenses by service lines within an individual core, the evaluation and lifecycle management concept developed for management at the core-level of the BRCF can be applied to managing an individual core facility's service portfolio. Within a given core facility, each service offering can be evaluated and characterized as a fast growth, steady state, or under watch. This approach has allowed the BRCF to begin discussions, for example, as to whether a low demand service line within the DNA Sequencing Core should be terminated to free up technical and financial resources to invest in higher demand next generation sequencing offerings.

In addition to altering the overall financial structure of the BRCF, the Office of Research worked in partnership with the Dean of the Medical School to establish a new annual budget that reflected the significant growth in the BRCF portfolio. Furthermore, two critical deficiencies in the prior budget model were addressed by including specific line item allocations within the new budget.

These allocations included providing dedicated funds for cutting-edge methods development as well as provisioning a small amount of funds that would operate like an insurance fund for operational/technical failures. The latter funds are used when a BRCF core facility experiences a failure or error that would be catastrophic to an investigator's research program. The funds are used to help mitigate, if possible, the impact to the investigator by providing resources to repeat an experiment. These dedicated line items as well as a funding line item for capital equipment that is informed by the multi-year forecast undergo rigorous evaluation, justification, and adjustment as part of the Dean's Office annual budget review.

Methods development is essential for shepherding new technologies into reliable scientific services (Chalmers, Bracken, Djulbegovic, Garattini, Grant, Howells, and Ioannidis, 2014) and is a cost not recoverable by standard recharge mechanisms. Dollars for this activity allow the core directors time and resources to develop new techniques or optimize methods for newly acquired instrumentation. Recognition of methods development as a deliberate investment supports the timely introduction of new technologies to the research community, fueling the pipeline of new core services, and can significantly influence a core facility's position within the lifecycle model. These resources also afford a core facility to take strategic and calculated scientific risks, which are essential to achieving innovative, game changing services. The Bioinformatics Core is an example of leveraging the methods development budget to systematically evaluate and validate continually evolving software that, ultimately, leads to the development of novel methods for analyses of data from new DNA Sequencing platforms.

Additional areas of focused attention included developing standardized operational metrics to provide insight into the number and diversity of investigators served, both internal and external to the university; demand for provided services; turnaround times; financial sustainability via recharge collections; and customer satisfaction. The above metrics are routinely tracked, which allow strength and weakness trends to be identified for each of the individual cores. Another focal point was succession planning for key personnel to ensure sustainable core facility leadership and continuity of scientific and operational expertise. Furthermore, to raise awareness of available services and to improve responsiveness to the research community, acquisition of a dedicated marketing specialist was defined as another key priority. The marketing specialist has improved communications and increased core facility recognition through initiatives such as redesigned websites, core facility newsletters, core facility showcases, and real-time customer satisfaction surveys.

Conclusion

Optimizing institutional approaches to enable research is a necessary strategy that should be embedded into all research-intensive universities. Developing and implementing a robust managerial and stewardship strategy is particularly necessary for core facility services, as the current institutional environment of competing priorities and constrained financial resources place many services at risk of being scaled back or dismantled. Core facility and infrastructure-intensive activities may especially be in jeopardy, as the costs associated with maintaining existing services, starting up new technologies, and hiring highly trained faculty/staff to serve as methodology consultants and instrumentation managers are substantial. However, investments in

both core facility-associated personnel and equipment are an absolute necessity if an institution's scientists are going to remain competitive and scientifically current. Clearly, the sophistication of biomedical research has created the demand for more complex and innovative technology and services, thus enabling faculty to dramatically advance research along the entire spectrum of basic and clinical investigations.

The BRCF at the University of Michigan Medical School has implemented processes, business practices, and governance models that have allowed more robust management of the core facilities while better meeting the needs of our research community and improving faculty satisfaction with the core facilities' performance (Table 1). With this systematic strategic approach, the BRCF has

Table 1. Realized Benefits of a Core Facility Business Strategy

1. Replaced obsolete equipment
2. Introduced new technologies
3. Increased scientific capability and capacity
4. Reduced turnaround times
5. Created standardized and sustainable oversight
6. Created core evaluation processes and metrics
7. Piloted a model to outsource services
8. Gained efficiencies with a web-based core facility management system
9. Improved faculty satisfaction

been able to demonstrate rigor in making challenging trade off decisions and making compelling, data-driven arguments for investments that have resulted in stronger core performance. Customer satisfaction surveys for individual BRCF core facilities indicate increasing satisfaction with the improved quality and timeliness of core facility services, along with new services created through methods development. Engaging faculty, who are end users of the services to actively participate in the acquisition of new technology and provide scientific guidance to the BRCF director, has empowered the research community to influence and shape the service offerings available to them. Interestingly, we have found the faculty committees to apply a high standard of rigor in their deliberations and recommendations.

Medical School leadership has embraced the transparent core facility evaluation framework, as it enhances communication, provides accountability for investments made, and creates a path forward to not only efficiently sustain core facilities but also allow them to thrive based on the scientific demands of the research community. The transparency and consistent application of the process has provided a solid rationale for making tough trade off decisions that can be effectively communicated to faculty and departmental leadership. Moreover, it demonstrates sound stewardship of limited resources. Some of the principles developed for managing the BRCF are now being applied to other areas of the Medical School. One such example is the implementation of the central capital equipment inventory with useful life depreciation schedules and a capital

line item budget allocation for the Unit for Laboratory Animal Medicine, which is also a capital-intensive, recharge unit in the Medical School.

A number of key lessons have been learned from this comprehensive approach to core management. (1) Business planning supported by ongoing financial analyses and key performance indicators should become part of a core facility's culture. (2) Capital equipment planning and methodology development must become fully integrated into the budget process. (3) Faculty who are consumers of the core facility's services should be involved in providing guidance and counsel on key aspects of the core facility's operations, such as introduction of new technologies and lifecycle management. (4) Succession planning for scientific and administrative core facility leadership is imperative for continuity and sustained performance. (5) A process integrated into routine business practice needs to be set in place to annually monitor services that need to be expanded, maintained, or dismantled. (6) Within a financially constrained environment of research-intensive institutions, trade-off investment decisions are better informed with well-established performance metrics, and when difficult decisions are required, having a transparent, consistent process assists with making those decisions and effectively communicating them to your constituency. In total, a core facility specific strategy with defined and actionable tactics is key to providing robust and pertinent services to support our research faculty and staff with the goal to facilitate more, better, faster, cutting-edge research.

Author Note

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