Space Management - A Better Institutional and Academic Research Management and Reporting Tool

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ABSTRACT

In December 2014, the “Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards,” commonly called "Uniform Guidance," was released and it superseded the previous White House Office of Management and Budget - OMB “Circulars A–21” (and other Circulars as well).

For colleges and universities, the Uniform Guidance determines how Institutions of Higher Education participating in federally funded research activities, and how to report about funds/grants used for the research activities.

For these institutions, the ability to report accurately and consistently about research activities are of crucial importance, as the accuracy and defensibility of research data will ultimately determine the amount of reimbursement that the institution will be able to recover from the Federal Government.

The adoption of a space management system, dedicated to the listing and the cataloguing of space inclusive of space ownership (Department, PI), can greatly simplify and improve the process of reporting research activities to Federal agencies, support the Institution during the reporting process for the Uniform Guidance (the “old” A-21 Indirect Cost Recovery) and may greatly improve the quality of the reporting.

Furthermore, a space management system has the unique capability to create strategic metrics aimed at research planning efforts, aiding the negotiation process for indirect cost rates for your institution.

In this paper, we will look at some of the current reporting practices and investigate an alternate methodology aimed at creating a statistical and mathematical algorithm to allow Institutions to track their research space, and to establish processes and reporting “C-level focused” capabilities to optimize the Uniform Guidance reporting, maximize charge-backs, and improve institutional research management.

WHAT ARE RESEARCH COSTS?

To perform grant-funded research activities by and on behalf of funding agencies, Institutions will incur a variety of costs.

The facilities and administration costs at colleges and universities is used to cover costs for staff salaries, costs related to the acquisition and maintenance of major research instrumentation, build and maintain cooling and heating systems, and provide telecommunication and computing infrastructure to support research activities, all of which are crucial in modern research. Additionally, buildings will need to be staffed by facilities support personnel, cleaned and maintained.

The Uniform Guidance describes what expenses/costs are allowable and not allowable to report.

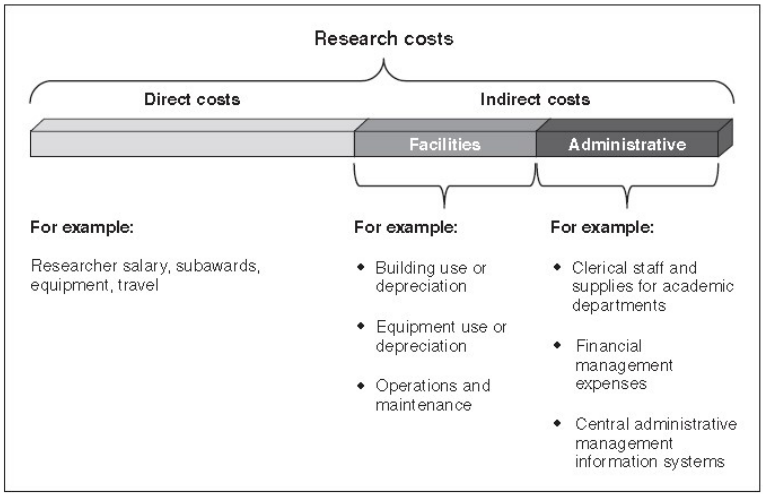
Costs are divided in two broad categories: direct and indirect. The following graphic from the US Government Accountability Office (GAO) is an excellent representation of the elements that are part of the costs of research. It clearly identifies costs captured in the sponsored research activity.

Direct costs are associated with the expenses that are directly interrelated with research activities and clearly identifiable: personnel salaries and equipment used for research activities are part of direct costs.

Indirect costs are those associated with the all other activities that are essential in support of research activities such as facilities/operations costs, and any allowable administrative costs that can be directly linked to research activities. Indirect costs are also referred as F&A Costs (aka overhead).

“Direct Costs” plus “Indirect Costs” are referred as “Total Research Costs.” This is an equation that drives all related activities focused on “recouping” research costs.

Figure 2: Types of Research Costs



Source: GAO analysis of OMB Circular A-21.

Definitions

Direct Costs (NIH Grants Policy Statement 2017)

> *Costs that can be identified specifically with a particular sponsored project, an instructional activity, or any other institutional activity, or that can be directly assigned to such activities relatively easily with a high degree of accuracy.*

Facilities and Administrative (F&A) Costs (GPO – CFR 2014) "Indirect Costs"

> *§ 200.56 Indirect (facilities & administrative (F&A)) costs. Indirect (F&A) costs means those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved. To facilitate equitable distribution of indirect expenses to the cost objectives served, it may be necessary to establish a number of pools of indirect (F&A) costs. Indirect (F&A) cost pools should be distributed to benefitted cost objectives on bases that will produce an equitable result in consideration of relative benefits derived.*

The following excerpt from Stanford University's "Costs of Conducting Research" is a good example of the items that can be included as part of the "Indirect costs."

"Full research costs include those often referred to as "facilities and administrative costs" or "indirect costs," such as portions of:

- research facilities
- health and safety compliance and management
- utilities such as electricity, heat, lighting
- information technology infrastructure and services, libraries and library collections
- operating and maintaining the physical plant, e.g., building upkeep, campus security, ground care and custodial services
- departmental administration of grant / contract preparation and expenditure tracking
- central administrative granting / contracting costs (Stanford's sponsored research administrative units that endorse sponsored project proposals, negotiate and accept awards, issue subawards, and establish financial accounts to meet sponsors' reporting requirements)
- allowance for technical obsolescence of research facilities and equipment (>$5,000)
- disposal of hazardous waste"

THE INSTITUTIONAL COST OF HIGHER EDUCATION

There are over 7,000 Higher Educations Institutions[1] in the US providing a diversity of degrees. Of these 7,000 institutions, over 1,000 have access to government grants and have been awarded (and posted expenditures in 2015) over $72B for research activities[2] .

Among those 1,000, the top 200 ranked Research Universities account for over $67B of federally funded research, with John Hopkins at #1 with $2.4B and University of Puerto Rico, Medical Sciences Campus at #200 with $46M (2015 data).

Research activities in Higher Ed are complex and extremely competitive. In order to perform at the top echelon of the research institutions, and to be able to attract "top researchers," Institutions are pressed to make significant financial commitments in new facilities, equipment and personnel.

In the past 10-15 years, the way in which research is supported and the underlying technologies dedicated to research activities (i.e. cloud, data centers) have also changed dramatically and has led to a national trend toward construction of new, high-end research buildings.

New construction cost for a research building now can range from $350 to $500 per gross square foot for a research building, depending on program, as opposed to $150 to $250 for a typical academic building[3] and with an advanced physical science research facility the cost could reach as much as $750 per gross square foot.

In addition to the construction costs of new research buildings, overall cost of facilities and administrative functions has also steadily increased and can reach up to 75% of the operating budget of a typical Institution.

Globally, as result of these factors, institutions seeking alternative ways to increase efficiency and to mitigate high operating costs. In the case of research activities, to maximize the sharing of expenses, and to maximize the amount of research funds that can be recuperated from grant sponsoring agencies.

NCES - National Center for Education Statistics https://nces.ed.gov/fastfacts/display.asp?id=84
NCES – National Center for Education Statistics https://ncsesdata.nsf.gov/fedfunds/2015/
Lab construction outlook (2015) https://www.labdesignnews.com/article/2015/08/2015-lab-construction-outlook

IDENTIFYING AND REPORTING THE COST OF RESEARCH - METHODOLOGY

While the Uniform Guidance provides in-depth guidance for the understanding and definition of the components of research costs, the Uniform Guidance does not dictate how these costs should be internally tracked by the institution.

The responsibility of identification, tracking, management and reporting of the internal institutional costs is trusted to the Institution receiving awards from sponsoring agencies. This effort is generally supported by recovered F&A (overhead) funds.

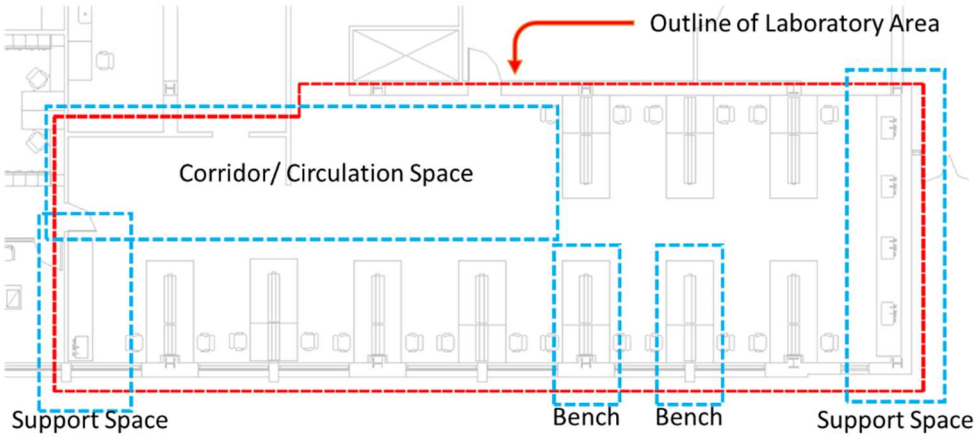
Each institution has the prerogative to structure their reporting in the best way matching financial/grant systems and more importantly, the financial systems and internal reporting processes. Several examples of the way in which Institutions structure themselves to meet the Uniform Guidance are publicly available on many of the research Institutions web sites. We suggest visiting the websites of any of the many research institutions to acquire some insights.

At an institutional level, research activities are often managed by offices focused on providing support for the acquisition, management and reporting of federally funded grants.

As the cost of research is spread across a wide range of activities such as salaries, equipment cost, maintenance, usually the tracking of these costs is done by a variety of institutional systems, such as ERP (Enterprise Resource Planning) Systems. These systems are sophisticated and expensive, and can collect an extensive variety of data combining financial expenses and personnel information as it relates to the project timelines.

These systems are tailored to respond to tracking historical financial information about sponsored projects. In order to achieve the desired in-depth reporting, they are heavily structured, employing a variety of mathematical, statistical, and visualization tools.

To replicate how a statistical/financial model-based system may capture and store information, the diagram below, the dashed red outline defines the overall lab area; research benches and shared support areas and circulation/corridor area are defined by the blue dashed lines.



The (10) benches are divided among (3) PIs (Principal Investigators): PI#1 has (3) benches, PI#2 has (2) benches and PI#3 has the remaining (5) benches. From a statistical point of view, this information will be sufficient to determine the space allocation of the entire lab: PI#1 has an allocation of 30%, PI#2 has an allocation of 20% and PI#3 has an allocation of 50%.

Additionally, the PI's are part of (2) different departments, let's say Chemistry and Biology; PI#1 and PI#3 are part of the Chemistry Department while PI#2 is Biology. This allocates the Departmental space as Chemistry=80%, Biology=20%.

These calculations are accounting just for the bench areas allocations and could be used to calculate the percentage of support space used as corridor and support. Additionally, because they are linked to each individual PI, grants as well as costs could be associated to space.

This process is complex, although not extremely complicated, if we just look at a single lab.

Increasingly complicated as we extrapolate this to a five floor research building, inclusive of shared spaces, cold rooms, equipment rooms, glass washing rooms and potentially dedicated research space assigned to PIs but located in other buildings. Exponentially sophisticated as we cross reference all of the above components in a research campus inclusive of several buildings.

Additionally, research is rarely in a steady state, therefore, a single change in bench/grant/cost allocation will require these events to establish an historical methodology retention process for all research activities.

Such methodology should require to:

1- establish an annual review process and the related data retention data structure to properly capture and verify all research assignments (analyze percentage calculation and assignment for each PI)
2- establish methodology to verify all costs that are to be charged to space (revision of all percentage calculations)
3- reporting procedures, which will need to be linked to #1 above

At a first glance, a complex process, Institutions have been managing research activities for decades, therefore they are equipped to do this, but is there a better, more dependable, systematic way to capture and manage this information?

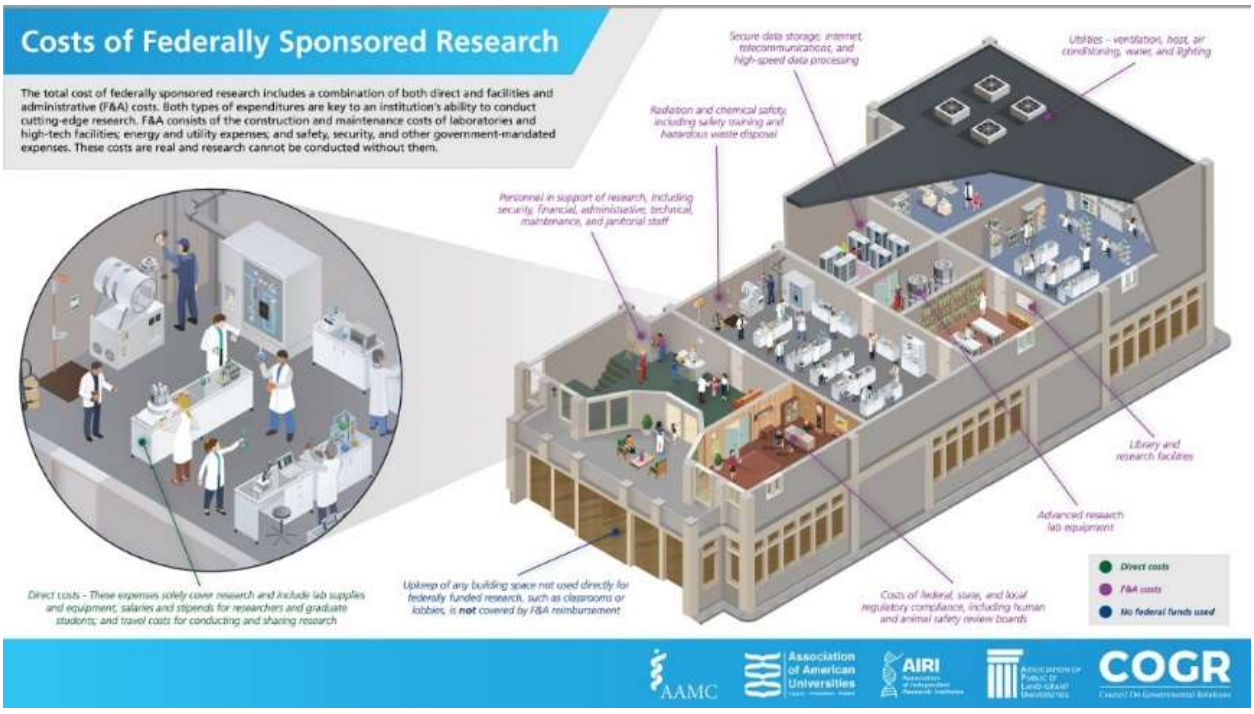
SPACE BASED RESEARCH DYNAMIC REPORTING

If we take a step back and look at what any institution or organization (or any business) is comprised of, we can see that there are three main components: People, Space and Resources. Here are the definitions:

- People: those who are either part of the Institution, serviced or at the service of the Institution.
- Space: the physical space that is occupied by anybody and anything that is part of the Institution.
- Resources: all that is needed to support the business of the Institution (what make it run/function). Money, equipment, computer systems, or furniture are all examples of resources.

A state-of-the-art space management system will have the ability to track, interconnect and manage these three components and to produce metrics that will relate/measure each one of the components against the others, either as a single metric or as an integrated system of interrelated metrics. Additionally, the space management system will have the ability to track these data on a time-based scale, allowing to capture and to produce historical information.

The diagram by the Council on Government Relations (COGR) is a good visual representation of all activities taking place in a typical research building.



Note: A link to enhanced graphics is provided in the Reference Section.

Space Management: Advantages

By definition, the first distinguishing characteristic of a space management system is the ability to track dedicated space with extreme accuracy.

By "cataloguing" space information created by either a Computer Aided Design – CAD system or by a Building Information Modeling – BIM system into the Space Management System. The accuracy of the information that can be captured is estimated in the 99.99% accuracy range for both CAD and BIM systems.

A Space Management System improves data integrity over other systems where the space information is based on approximation or those cases in which data is passed from one system to another in a tabulated format and in many cases, in a basic numerical format from an Excel file to another.

Change is inevitable, and institutions adapt to meet the evolving needs of their research enterprise. As Institutions routinely renovate or build new research facilities to keep up with the competition from their peers a Space Management System has the that ability to historically track space, people and activities across different space configurations and they can quickly and accurately integrate new facilities' information within their existing space portfolio.

Space Management: Integrating Information

A state-of-the-art space management system should connect and interface with Enterprise Resource Planning - ERP systems that are used to track financial, HR, accounting, scheduling or purchasing information across the Institution.

This capability allows to relate Research Direct Cost and Indirect Cost of space use, hence creating a completely new set of data, that once properly calibrated, can create a unique data set.

By adhering to industry standards and ensuring that the ability to connect systems by "back-end" utilities, holistic integration of information strengthens reporting related to the cost benefits of the research enterprise.

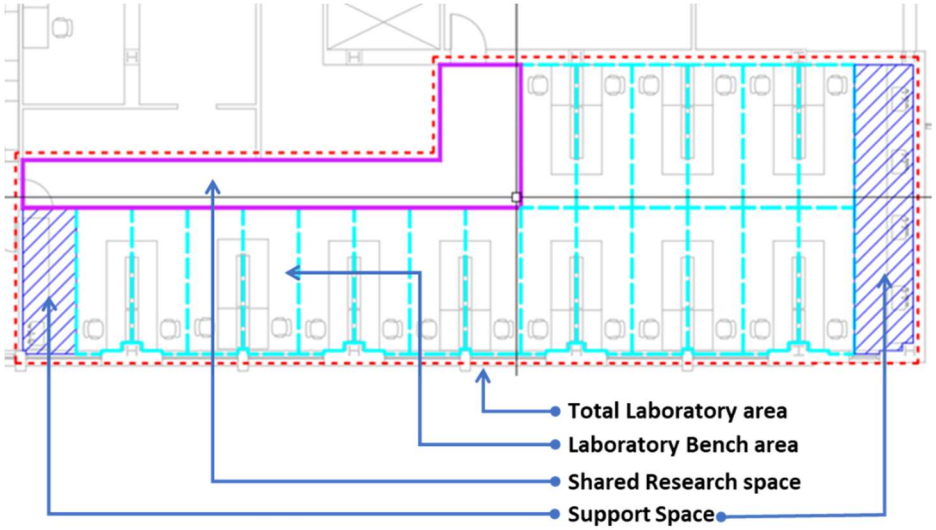
An example of such connectivity would be to integrate the PI (Principal Investigator) space allocation with related salaries/effort and equipment expense generated/supported by sponsored research plus operational expenses of facilities.

Space Management: Increasing Accuracy and Streamlining Information

We previously reviewed how a statistical and mathematical based model may track research space.

Let's review how a space management system would do this and the related improvements. This illustration demonstrates lab space tracked in a Space Management System:

- **Total Laboratory area** (identified by red dashed line):
  (*Total Laboratory area*) = *(Sum of Laboratory Benches) + (Shared Research Space) + (Support Space)*
- **Common or shared research space** will be identified by the following calculation:
  (*Shared Research Space*) = (*Total Laboratory area) – [(Sum of Benches) + (Support Space)]*
- **Bench Area**: each bench is catalogued to allow for the allocation of bench space to each PI:
  (*Sum of Benches*) = (*Bench#1 + Bench#2 + Bench#N)*



Inherently, the Space System will capture each research bench and will calculate how much of the total laboratory space is used as bench area and how much of the remaining floor area is shared among the research benches.

Each PI will be associated with each bench therefore, all calculations about the allocation of space will be simplified. If a PI releases a bench or acquires a bench, all that is needed, is to change the "ownership" of the bench.

However, if needed, the Space Management system will still be able to capture "percent values" per room, if needed.

Shared research space will be allocated to each PI based on the total amount of research bench space they occupy. Changing any bench ownership will automatically recalculate the allocated amount of shared research space.

These calculations will be extrapolated at a building floor level by using the bench ownership to allocate any Floor Research Shared areas. The same logic will be used to allocate Building Shared Research spaces. The result is a simple, manageable, and defendable system.

Another type of information that a Space Management System will be able to track is "Space Ownership -vs- Space Occupancy."

In the event of collaboration between PIs or of Departmental collaboration on grants, research space belonging to a Department may be used or leased to a PI from another Department.

With this occurrence that the Space Management System is uniquely equipped to manage and report by separately tracking the PI's Department and the research space ownership.

Space Management: Tracking Research by "Time and Effort" Activities

When observing use of research space, it is necessary to evaluate, for each space, the "time and effort" data points:

1- Who was occupying the research space
2- What research activity was taking place
3- For how long the activity was taking place.

These are additional data points that will help to further evaluate how research space is used. As the Space Management System does track space to the more detailed value, it will provide another level of accuracy.

CONCLUSION

A state-of-the-art Space Management System will be able to provide unique reporting capabilities to the Institution and it will support the Institution in the Uniform Guidance process.

In brief:

- The ability of the Space Management System to record and manage relationship/data between People/Space/Resources – historically, will allow for the creation of a unique set of strategic metrics for the Institution.
- The higher ability to produce more accurate and defendable reports will allow the Institution to increase the recovery of costs that the Institution incurred during federally funded research activities. In many cases, a 1% increase in the cost recovery could amount in several hundreds of thousands of dollars.
- The Space Management System is also capable to identify and to catalogue all the areas that are devoted top "Dry Research" or "Wet Research", therefore giving another "layer" of strategic and planning information.
- The information created by the Space Management System will become of unique value to the Institution's ERP system by adding another layer of data to their datasets.
- The Space Management System could be included as part of the cost recovery efforts.

REFERENCES

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https://www.grants.gov/web/grants/search-grants.html

A Brief History of Circular A-21
https://www.rand.org/content/dam/rand/pubs/monograph_reports/MR1135-1/MR1135-1-appa.pdf
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Definitions of NACUBO and OMB Circular A-21 Functional Categories
Crosswalk between the functional categories identified by the National Association of College and University Business Officers (NACUBO) and the U.S. Office of Management and Budget (OMB)
https://nces.ed.gov/pubs2006/ficm/content.asp?ContentType=Appendix&appendix=B

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A more detailed graphic descriptive of cost of research
https://www.aau.edu/key-issues/costs-research-infographic
https://www.aau.edu/sites/default/files/Costs-of-Research-Infographic.pdf

NACUBO and OMB Circular A-21 Functional Categories
Functional categories were developed for cost financial accounting purposes but are identified in the FICM as optional data elements that can be used to link space allocations to financial data or to institutional missions
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An overview with references to other top US Research Universities
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ABOUT THE AUTHOR

Fred Mechini is an experienced Facilities Technology and Management Systems expert in the Corporate and Higher Education sectors, with over twenty-five years' experience in Architecture, Strategic Planning, Facilities Management and implementation of Infrastructure Technologies-IWMS and GIS.

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