

# OPTIMIZING RESOURCE ALLOCATION FOR TEACHING

An experiment in activity-based costing in higher education

# Executive Summary

How can a cutting-edge university continue to deliver a superior education to a growing student population, in an era of reduced state funding?

That is the question leaders of the University of California, Riverside (UCR) are actively seeking to answer with innovative new approaches today – and it is the reason that UCR's Provost and CFO joined forces to implement an Activity-Based Costing (ABC) pilot initiative. ABC has emerged as a promising tool that introduces the potential to inform decisions about where and how to invest in order to better serve the needs of students – a way to answer the critical question of how best to deploy resources (people and funding) to achieve the educational mission. ABC is already a widely used practice in the business world, but has so far been used sparingly in higher education – primarily in Australia. At the same time, many leading thinkers in higher education have begun to advocate its adoption in the U.S.

In the summer of 2015, UCR commenced a groundbreaking pilot of ABC to determine whether the approach could deliver improved cost data to assist in academic decision making. UCR has finished the technical implementation of ABC and is now working on reports and analytics that will serve as tools for faculty, department chairs and deans, the intended end users of the ABC system. UCR will spend the first half of 2017 engaging with academics to create the most relevant tools to support them in their resource allocation decision making. Ultimately, the goal is for ABC data to be coupled with student outcome data. Linking ABC cost data with outcome data will better inform discussions relating to the costs/quality relationship, allowing academic leaders to begin evaluating the relative trade-offs of different course design options.

It should be noted that ABC represents a decision support tool for a campus and that all inputs and outputs of the model are derived from management assumptions. Any campus that implements a similar system would need to make decisions on all revenue and expense allocation assumptions. These assumptions could differ significantly from campus to campus, resulting in very different outputs. Thus, ABC data is only useful as an intra-campus tool and not as a comparative data set with other campuses.

This document provides a detailed view of UCR's ABC pilot initiative.

**In Section 1: Activity-Based Costing at UCR: Introduction**, we describe the context surrounding this initiative, including a definition of ABC and a detailed examination of the reasons the university was motivated to embark on this journey. This section also includes a primer on beginning an ABC project.

**In Section 2: Making ABC a Successful Decision Making Tool for Managers**, we detail the specific benefits ABC was expected to introduce for a range of leadership roles at the university, from presidents and chancellors to provosts, deans, department chairs, and more. In this section we also present a number of university scenarios in which ABC could be expected to perform an important role. Finally, this section identifies the keys to success in the initiative, and shows how they were pursued.

**Section 3: Understanding and Using ABC Data** is about the data provided by ABC – what it means and how to use it. We share examples of the types of data provided by ABC, as well as specific information on how exactly it could be used, using blinded examples from our own data. We also provide examples of the assumptions made by UCR's specific implementation of ABC, both on the level of specificity, to include direct and indirect expenses, and on the general revenue allocation rules we utilized. UCR's data and underlying model assumptions are provided as examples only.

**Section 4: Implementing the ABC Pilot**, is a guide to implementing ABC, drawn from our own experience. We start with setting the strategy and roadmap, moving on to vendor selection, establishing models and methodologies, roll-out, adoption, and much more. Once again, we use specific data from our own experience to illustrate many of the insights in this section.

**In Section 5: Conclusion**, we review key findings, takeaways, and next steps.

We have written this document as a practical, detailed guide to understanding and implementing ABC, including both benefits and potential drawbacks, through the lens of one of the first and most comprehensive ABC implementations in the US university system.



# Section 1: Activity-Based Costing at UCR: Introduction

Among the most difficult challenges that academic leaders – particularly department chairs and deans – face is how best to provide curriculum with very limited resources.

This problem has intensified in the current environment of decreased funding and rising enrollment. Chairs, faculty members, and deans increasingly find themselves faced with questions such as “What is the best way to deploy resources (people, funding, classrooms, etc.) to provide a desired curriculum?”, “Could an alternative allocation of resources achieve better results with the same investment of time and money?”, “Where can existing resources be better optimized?”

In an effort to better address questions such as these, the University of California, Riverside launched a pilot Activity-Based Costing initiative that is detailed in this document.

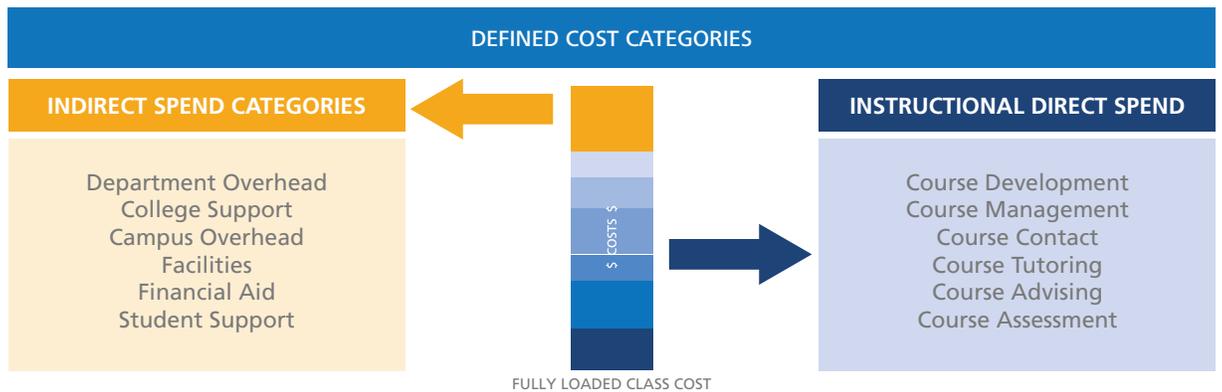


## What is ABC?

Activity-Based Costing (ABC) is a multi-stage cost allocation methodology that measures cost from the bottom up. While traditional “top down” costing methodologies estimate costs on a per-unit basis by dividing total costs by the number of units produced, ABC measures both the direct and indirect costs of each activity associated with the production of a single unit and sums them up to arrive at a per-unit cost. The result is costing data that is more accurate, more detailed and specific, and better suited to helping leaders determine the effects of changes to organizational practices.

Widely used in private industry, ABC has been used in higher education primarily in Australia, but leading educational thinkers have begun advocating for its use in US institutions. When ABC is implemented in higher education, the individual course section is the basic unit of instruction for which costs are calculated.

ABC captures all relevant institutional expenses and allocates them to courses, including the portion of support functions of the institution (such as facilities costs), that can be attributed to each individual course. Once the cost of an individual course is calculated, it can be rolled up into higher-level cost categories, such as total departmental costs or the cost of producing a major. Institutions can apply activity-based costing principles to any other functions, such as administration, well beyond instruction alone.



It is critical to note that ABC is meant to be a management tool, not a policy or accountability report. Unlike financial statements (which are based on Generally Accepted Accounting Principles and are audited for accuracy) and data submitted to IPEDS<sup>1</sup> (which has specific national standards), ABC calculations involve a significant amount of discretion regarding how cost and revenue allocations are made, as well as the specificity of data required. For example, in Section 4 of this white paper, we describe 3 different ways of collecting faculty





## Why did UCR embark on this project?

### **A commitment to student success**

The University of California at Riverside (UCR) is one of the ten campuses in the University of California (UC) system, inland Southern California's only research university, and a federally designated Hispanic Serving Institution<sup>3</sup>. With a current enrollment of approximately 22,000 students, including roughly 18,000 undergraduates, UCR is a recognized leader in diversity among the nation's universities<sup>4</sup>. Approximately 69% of its student population is comprised of students of color and 56% of its undergraduates are first-generation college students<sup>5</sup>. UCR's diversity extends beyond race and ethnicity to include diversity of economic opportunity and status, welcoming students for whom a low household income would have likely been a barrier to higher education. Enrolling one of the highest percentages of Pell Grant recipients for top research universities (56%, compared to the 38% average for public 4-year institutions), UCR has continuously demonstrated a strong commitment to provide a quality education to groups with traditionally low access<sup>6</sup>.

UCR considers this diversity a defining characteristic of the institution – one which strengthens its core identity, contributes to the vibrancy of the campus, stimulates intellectual exchange and ultimately increases its capacity to make substantive impacts in the region and beyond<sup>7</sup>. Diversity drives UCR's mission across all levels of the campus as leaders, faculty and staff realize UCR's unique opportunity as a national exemplar for diversity to demonstrate the strong link between diversity and excellence. Diversity of ethnicity, socio-economic status, ideas, perspective, programs and opportunities not only enables excellence, but in many way defines it, positioning UCR, its faculty, alumni and students to have a national as well as global impact.

To this end, UCR focuses not only on student access, but also on overall student success, guiding students from the entry gates of the university system all the way through the graduation stage. For UCR, it is not enough to simply provide access to these groups; it must also empower each student towards the successful completion of a degree. In fact, UCR has essentially eliminated the "achievement gap" in graduation rates between racial/ethnic/economic groups that have proven difficult to close elsewhere. UCR has one of the most diverse and economically disadvantaged student populations in the UC system, yet the six-year graduation rates for white, African-American, and Latino/a are 71%, 73%, and 69% respectively<sup>8</sup>. Similarly, six-year graduation rates are at 72% for Pell-eligible and 73% for non-Pell eligible students – virtually identical<sup>9</sup>.

### Limited revenue opportunities, rising costs

While UCR continues to grow its student population, diversity and national prominence, the university has limited revenue opportunities with which to continue pursuing its current growth trajectory. Historically, support from the State of California has been a primary revenue source for the university. But the level of state funding has not increased in step with enrollment growth over the past several decades. Years of budget cuts have dramatically reduced state funding per student, from approximately \$18,000 in 1990-91 to an estimated \$7,700 in 2015-16<sup>10</sup>. The State of California cut the UC budget by over a billion dollars during the 2008 recession, and even in nominal dollars, State funding to UC is still below its 2007-2008 level, despite enrollment increases. From 2008-2013 the student headcount at UCR increased by 22% while State funds grew by only 4% over the same period<sup>11</sup>. This trend has continued in recent years and according to virtually every indicator, will likely be the normal operating state for the near future. Meanwhile, the effects of financial constraints on key academic metrics are predictable. For example, UCR's faculty- to-student ratios are above the average of the University of California overall, which has led to larger class sizes and impacted courses.

Given that UCR is not among the elite of public or private institutions in terms of its endowment, the university has fewer options in addressing the budgetary challenges that have confronted public education in recent years. Non-resident enrollment, which brings enormous additional revenue to better-known schools, is quite low at UCR. Similarly, the relative newness of the university, and youthful demographic of its alumni base (roughly 60% of UCR's 100,000 living alumni graduated within the last 16 years), means that fundraising has yet to mature as a significant funding source.

*To ensure that UCR can optimize the use of limited resources on its top strategic priorities, university leaders will require high-quality data in order to better determine how money is currently being spent and what outcomes are being achieved.*

### The need for innovation

Given UCR's institutional commitment to improving student success and attainment in the face of current financial challenges, innovation and experimentation will play a central role in its continued success. Since its inception as the Riverside Citrus Experiment Station, research has been embedded into the mission of UCR. Its heritage as a land grant institution highlights this focus on research and agriculture as well as UCR's commitment to developing practical knowledge that inspires solutions to real-world problems. Its commitment to access, diversity, and student success has fostered a culture of innovation that can ensure that the values of a research university education are available to students from all backgrounds.

UCR's pilot implementation of Activity-Based Costing promises to be a crucial part of this innovation effort. In many ways, UC Riverside is a perfect test case for ABC – as a growing, diverse, public university that is committed to both accessibility and research excellence, but with limited revenue opportunities, UCR is dealing with many of the challenges that typify today's higher education landscape. If ABC can work at UCR, its success can be used as a template nationally for other institutions similarly in need of operational innovation.





# Section 2: Making ABC a Successful Decision-Making Tool for Managers



## The value proposition for academic leaders

### **The ethic of efficiency**

When public universities face severe funding shortfalls, there is an ethical imperative to ensure that every dollar spent is allocated in such a way as to best serve their institutional missions. Harry Brighouse at the University of Wisconsin refers to this imperative as the ethic of efficiency<sup>12</sup>. Rather than serving to undercut a university's values and mission (a widely held view of efficiency in a university context), the ethic of efficiency maintains that if leadership is able to free up even one dollar to invest in a high-priority mission, there is an ethical obligation to do so<sup>13</sup>. The rationale for being cost-conscious and for exploring opportunities to increase revenue is that the dollars saved or raised can contribute crucially to the underfunded parts of the mission.

There is a frequently cited concern that narrowly focusing on cost will inevitably lead to a decreasing number of small, high-interaction courses or to a reduction in the number of courses taught by tenure-track faculty members in preference of cost savings. In fact, the opposite is likely true. By revealing the costs of such classes, and by showing options for achieving savings or increasing revenue elsewhere, ABC ultimately affords decision makers the necessary context, data and understanding of what it will take to achieve this goal. In an era when hoping for more state support or raising tuition again are unreliable strategies for funding new initiatives or maintaining the most valued parts of an instructional model, there is an ethical obligation to understand the options.

### **Making informed decisions**

Academic leaders must continually assess their available and finite resources in order to determine the most effective combination of courses and class sizes. What courses will be offered and in what formats? Who will teach these courses? If short-term revenues for a department or school are fixed, leaders will likely face a tradeoff between varying class sizes and instructional models. If revenues are not fixed (that is, if it is possible to earn additional revenue by teaching more students), then the range of options expands. Ultimately, the greater question is not which courses to teach or who should instruct, but rather whether the academic leaders have the necessary data to adequately consider the optimization of limited resources in achieving desired educational outcomes.

When leaders begin to consider their options, there is typically relatively little data available to help determine the costs and benefits of these options. As a result, leaders are most likely to rely on intuition in making these decisions. This lack of data often leads to outcomes which are obviously "efficient" in narrow terms, but may not actually achieve optimal results. There may be the temptation to increase the number of students in classes while hiring cheaper instructors (such as replacing retiring faculty with adjuncts). Alternatively, leaders will maintain the quality and integrity of their courses by capping enrollments, resulting in majors that are deemed "impacted." Students will then be unable to enroll in the courses needed to graduate on time and graduation and retention rates will experience a corresponding decline.

Activity-Based Costing can strengthen leaders' ability to answer optimization-related questions. By clarifying the relative costs of different teaching models, the tool should allow chairs and departments to better allocate scarce resources. One possible result is that more seats in "bottleneck" courses can be offered because the tool helps the department identify areas where the costs of instruction can be optimized without negatively impacting student outcomes, thereby releasing valuable resources towards more effective pursuits. Another possible result is that high-quality, high-cost instruction models can be protected by identifying which lower-cost models elsewhere can create overall balance. The university can be viewed as a web of cross-subsidies. By clarifying the directions and magnitudes of these subsidies, ABC can help leaders to maximize the funding available to subsidize those activities deemed essential, but which do not cover their own costs. These activities might include individual curricula, such as engineering or the arts, or certain modes of instruction, such as small seminars, studios, and labs. Cost savings resulting from this type of analysis could also be passed on to students in the form of reduced fees or increased aid.

Academic leaders may readily identify several instances where the type of data provided by ABC will significantly aid the decision-making process. Such scenarios could include:

#### *Scenario 1*

The university decides to accept more students. Other things being equal, class sizes will increase. Some parts of teaching (such as feedback and grading of essays) will require increased time proportional to the increase in enrollment. If the time spent on teaching is not to increase, some other aspect of the course must receive lower investment of time. By quantifying the time spent on different teaching activities, ABC can quantify how much of a time-shift is needed, helping faculty and chairs estimate when it is reasonable to add more students without changing the teaching model, and when the teaching model will break down because there is no longer sufficient time to give minimal attention to all the tasks. The alternative is to guess, which can lead to a) faculty being overworked; b) time being unintentionally shifted from other activities to teaching; or c) resources being allocated inefficiently.

#### *Scenario 2*

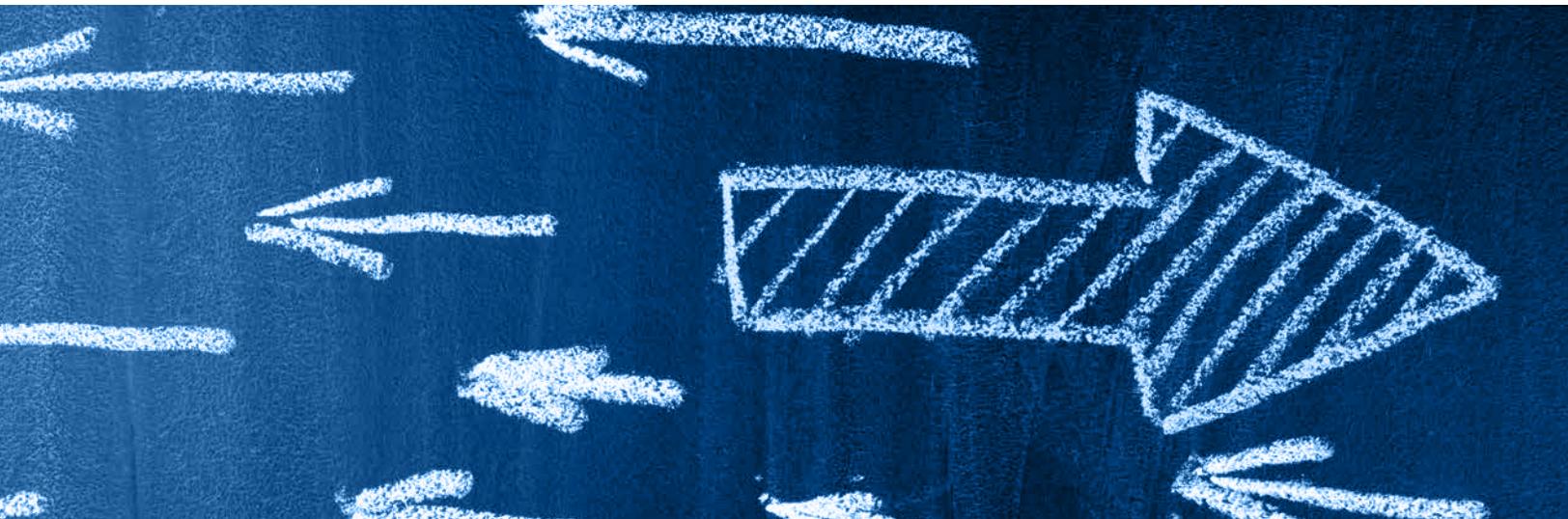
The math department believes that teaching pre-calculus in small sections and offering a lot of tutoring leads to better results than relying primarily on large lectures – but this approach is costlier than alternative teaching methods. How should the department (and dean) weigh the tradeoff? Applying ABC may lead to more precise estimates of how much the two different teaching models cost, improving decision-making. Coupled with data on outcomes (such as how students in subsequent courses perform in subsequent math classes), the data from ABC can help determine whether the more expensive way of teaching pre-calculus in smaller sections actually saves money in the long term, contributing to a decision that still must be made on academic grounds.

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### *Scenario 3*

UC charges the same tuition for very different curricula. Given that the courses offered by a university will have variable costs, some courses and curricula generate surpluses, while others require subsidy. As long as the campus generates sufficient surplus on some curricula, it can afford to subsidize more of others. But while the direction of such subsidies/ surpluses is known, the magnitudes are not. Suppose that UCR decides to add students in a more expensive major. How many more students are needed in the surplus-generating fields to pay for the added cost? ABC can help answer this question more accurately than other methods. This will be essential in achieving strategic academic goals while maintaining budget balance.

Notice that the scenarios focus on teaching activities as well as costs. Considering what is done, in what configuration, provides more information than cost summaries by themselves. For example, the mix of class types and sizes, as well as teacher types, can provide at least rough insights about educational quality. Riverside's ABC model reports a rich array of activity information, which, when juxtaposed with its cost data, support decision makers to make the tradeoffs they need to make.

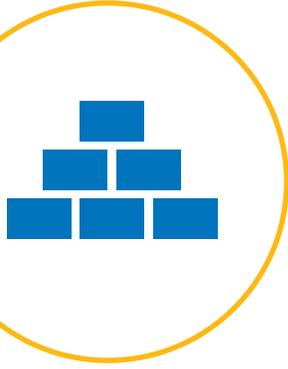


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In the end, outcomes are still of primary importance, and ABC will be most powerful when paired with good data regarding the student outcomes themselves. When both cost and outcomes are considered together, the benefits gained from a particular investment (or what is lost by a cost-savings measure) will be quantified, allowing for resources to be allocated so as to maximize the outcomes at any given level of spending. Ultimately, it is the quality/cost payoff that is most important. This is true even for, or especially for, research universities like UCR, where the focus on research-based learning complicates efforts to understand and control costs.

*“To summarize, and this is an essential point, the goal of ABC is not simply to reduce costs, which we already know how to do. Rather, acknowledging that all of our decisions are made under cost constraint, the goal is to gather and use information about costs that allows us to maximize the quality we get for any level of spending.”*

*(Massy 2016).*



## Laying the foundation for success

### **Campus leadership cross-collaboration**

A strong, collaborative partnership between the university Provost and Chief Financial Officer (CFO) is the foundation of a successful ABC implementation. Traditionally, the Provost and CFO of a university work closely together – but on parallel paths. The CFO will know how much money is available to spend at any point in time, and the Provost then makes decisions regarding how and where to spend those resources. On rare occasions a Provost may be involved in some sort of cost analysis, but in most cases would leave this to the financial experts. In other words, a CFO would speak primarily in terms of cost while a Provost would focus on quality, thus perpetuating the disconnect between cost and quality that is prevalent within higher education<sup>14</sup>.

UCR has taken a significantly different, forward-looking approach to this relationship – one that necessitates collaboration between these senior leaders rather than isolation. The Provost and CFO of UCR work as partners in an integrated workflow – in fact, they have foregone individual offices in favor of a shared workspace. The co-location of the Provost and CFO is a physical representation of the strategy that undergirds an integrated resource allocation process. The CFO at UCR has been integrated into the overall planning and strategy for the university in partnership with the Provost. In this way, the CFO can speak not only to the amount of funding available, but also inform decisions regarding the optimal way to use that funding. Similarly, the Provost has been a full contributor in the ABC process and is conversant in the cost analysis of the various programs and funding available.

In this environment, these leaders work in tandem within a collaborative backdrop designed to facilitate transparency, the integration of goals and, ultimately, more value for every dollar spent. In UCR's experience, the true value of ABC will be realized when the financial and academic spheres of the university work in unison rather than in silos.

### **Budget model considerations**

ABC may be implemented within any type of university budget model. However, certain budget models encourage and facilitate an optimization approach to resource allocation, making ABC information even more useful in decision-making.

At UCR, the ABC methodology has been paired with an incentive-based budget model that is a variant of responsibility center management (RCM). UCR's previous budget process was based on the incremental allocation of funds by the Provost to the academic units based on stated needs. This created some perverse incentives. For example, because ensuring students can enroll in the courses they need to graduate is a high priority, units that were not offering sufficient courses could make a compelling case to get more resources. This created an incentive to provide fewer seats than students needed, as only units with shortages received more funding.

Under the incentive-based budget model, the majority of net new undergraduate tuition revenue is allocated to the academic units using a formula that is based on the number of courses, headcount majors, and improvement in graduation rates. In other words, all tuition is now allocated to the campus units such that units will no longer need or be able to request piecemeal funding. So the incentive to meet student demand for courses is now embedded into the resource allocation model. As their revenue per student credit hour produced is now fixed, expected, and transparent, unit heads now know how much tuition revenue they will receive for a given level of output and can focus on how to optimize those resources.

One of the virtues of incentivized budget models is that they permit an alignment of these decisions on instruction with the financial consequences of these decisions. Some will object, arguing that this is precisely what should be avoided, and that pedagogical decisions should be made on pedagogical, rather than financial grounds. However, in situations with limited resources, decisions cannot be made independent of cost — it is imperative to understand the financial implications of these decisions. ABC will be instrumental in helping to provide data needed to make informed decisions.

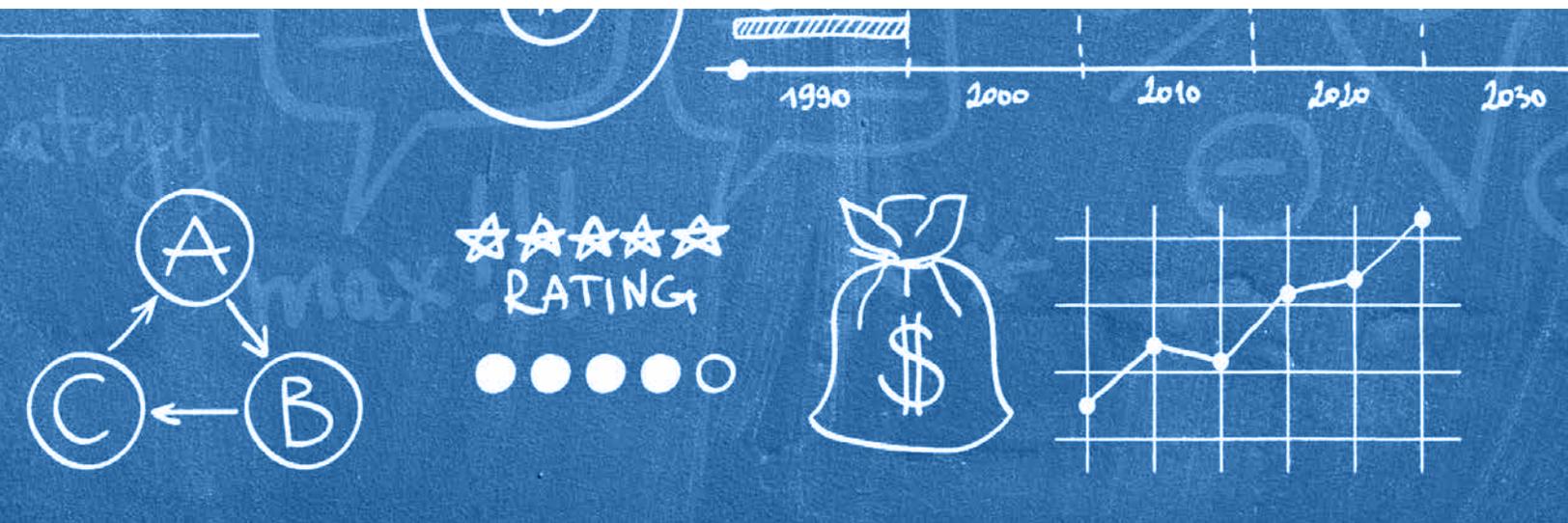
### **Creating a collaborative implementation process**

While ABC could have been implemented using only a small number of technical consultants, UCR wanted to create a broader campus understanding of ABC, so it included a variety of academic stakeholders during its implementation process. UCR did this recognizing that the ABC data will only be useful when understood and utilized by academic leadership on campus, including deans and department chairs. In order to gain support, these stakeholders were involved from the beginning of the implementation process and engaged frequently afterward. Since ABC is a completely new way of considering cost and outcomes, stakeholders were asked to examine and reflect on the conceptual framework. They were given plenty of time to consider, and then reconsider, ABC and its implications.

Stakeholders were initially engaged on the topic of UCR's budget model redesign, which also represented a different way of thinking of how the campus should operate. Since the new budget model required the development of cost allocation methodologies, it served as a primer for ABC and prepared campus units to start thinking holistically about the total cost of their operations, including both their direct spend and their portion of indirect administrative spend. The budget model was broad and inclusive, in order to cultivate support and understanding across campus. Concerted change management efforts, along with consistent communication with campus stakeholders, prepared UCR for the new budget model implementation, easing and addressing misgivings and hesitations through transparency and dialogue.

The Provost, CFO and their teams embarked upon a series of educational and collaborative meetings, both formal and informal, to introduce ABC to campus leaders, including deans, vice chancellors and department chairs. Regular meetings were scheduled with direct stakeholders, along with those involved in the data requirements, including deans and their unit CFOs, the university Chief Information Officer (CIO), the Registrar, the Office of Institutional Research, faculty and other leaders from administrative units, student affairs, human resources and the capital assets department.

UCR’s collaborative implementation process extended beyond internal stakeholders to include external partners. The successful implementation of ABC at UCR required the expertise and support of several external entities. Throughout the implementation process, UCR partnered closely and received support from Deloitte, Pilbara Group and Grant Thornton, The Bill and Melinda Gates Foundation and University of California’s system-wide office. The positive relationships among these external stakeholders contributed to momentum behind the ABC initiative.





# Section 3: Understanding and Using ABC Data



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## What information can ABC provide?

UCR partnered with Pilbara Group, a provider of ABC technology and services, to utilize their Analytical Costing Engine (ACE) software and build out UCR's ABC model. With Pilbara's help, UCR was able to design a number of different reports that would output the data stored within the ABC model. Because the ABC model was designed to drill down to the cost of individual courses in each department, it effectively stored all information at a per-course level. Each course entry contained a number of data fields that included the course's calculated revenue, expense, and margin, as well as information regarding type of class, class size, delivery mode, type of student enrolled, credit hours, etc. A sample record from one of the ABC reports is shown below, along with a screenshot from the ACE software portal showing the types of detailed data recorded within each course entry:

LEVEL	COURSE DELIVERY METHOD	TOTAL REVENUE	TOTAL EXPENSE	TOTAL MARGIN	COURSE STUDENT ENROLLMENTS	ACADEMIC FTE
LOWER DIVISION	LECTURE AND LAB	\$154,000	\$101,000	\$53,000	117	0.20
CREDIT HOURS	HOURS COURSE ADVISING	HOURS COURSE ASSESSMENT	HOURS COURSE CONTACT	HOURS COURSE DEVELOPMENT	HOURS COURSE MANAGEMENT	HOURS COURSE TUTORING
468.00	4.25	105.50	90.00	21.43	17.14	43.42
LECTURE HOURS PER QUARTER	LAB HOURS PER QUARTER	LECTURE SIZE CLASSIFICATION	LAB SIZE CLASSIFICATION	NUMBER OF SECTIONS - LECTURE	NUMBER OF SECTIONS - LAB	AVERAGE LECTURE SIZE
30	20	Very Large	Very Large	1	3	117
AVERAGE LAB SIZE	COURSE MATERIAL FEES	TECHNOLOGY FEES	STUDENT FTE	IN-STATE STUDENT FTE	OUT-OF-STATE STUDENT FTE	INTERNATIONAL STUDENT FTE
39	3,360	1,872	10.41	9.78	0.36	0.27

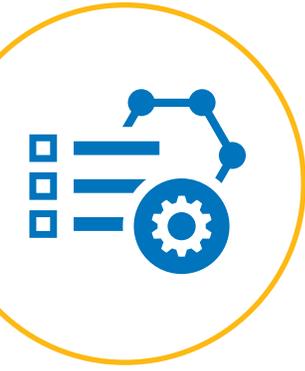
*This is a sampling of the data fields available and is not a comprehensive list.*

By having the entire cost structure of the university allocated down to a course-by-course level, it becomes possible to examine the data through different lenses – such as department, school, course level, course delivery type, and more. An example of this nesting structure in Pilbara Group’s Analytical Costing Engine is shown below. In this structure, revenue and expenses are captured on an individual course section level, but can be aggregated up to all offerings of that course, total lower division courses in the department, total courses in the department, total cost within the college, and total teaching cost for the university.

College of Engineering Data		
Revenue	Expense	Margin
\$32,500,000	\$31,005,000	\$1,495,000
\$12,585,000	\$10,009,000	\$2,576,000
\$12,585,000	\$10,009,000	\$2,576,000
\$6,485,000	\$4,848,000	\$1,637,000
\$434,000	\$317,000	\$117,000
\$154,000	\$109,000	\$45,000
\$133,000	\$99,000	\$34,000
\$147,000	\$108,000	\$39,000

- ORG11 : Bourns College of Engineering
- Computer Science
- D01003 : Computer Science & Engineering
- LOWER DIVISION
- CS 005 : LABORATORY**
  - CS 005 : LABORATORY (GRP A - ON CAMPUS - FALL )
  - CS 005 : LABORATORY (GRP A - ON CAMPUS - SPRING )
  - CS 005 : LABORATORY (GRP A - ON CAMPUS - WINTER )





## How ABC data can be utilized

As previously stated, Activity-Based Costing data should be used to increase transparency around course operations and facilitate decision-making, rather than being viewed as an accountability standard or scorecard. The information provided by UCR's ABC pilot will be used to foster important conversations across the institution around the balance between course efficiency and quality delivery. Three examples of "ABC Use Cases", and the decision-making processes into which they would feed, are highlighted below. It is important to note that due to the subjective nature of ABC cost allocation and the pilot status of UCR's ABC program, the dollar values shown in these examples should be taken as directionally correct figures – meant to facilitate further discussion and evaluation – rather than being viewed as absolutes.

### 1. Comparing margin and operating models across departments

In UCR's resource allocation model, the total amount of money a department is spending on instruction (the total cost of offering courses plus the salary of instructors the department employs) is not directly tied to the revenue those departments generate through instruction (tuition allocated on a per-credit basis). As a result, some departments may end up operating in "surplus" while others operate in "deficit" – though before this analysis, the exact magnitudes were unknown. By using the ABC model, academic leaders can compare the cost and revenues of different departments, along with other key metrics, to understand both best practices and areas for improvement.

As an example, here is a comparison of two departments within UCR's College of Humanities, Arts, and Social Sciences – both receive minimal (<\$100K) external research funding.

DEPARTMENT	REVENUE	COST	TOTAL MARGIN	# OF COURSES OFFERED	CREDIT HOURS DELIVERED	# OF ACADEMIC FTE	TOTAL STUDENTS ENROLLED
DEPT. A	\$13,218,000	\$10,235,000	\$2,983,000	80	43,308	24.85	8,969
DEPT. B	\$10,046,000	\$10,530,000	(\$484,000)	105	36,293	34.25	9,028

Looking at this data, a dean could quickly see that while Department A and Department B serve approximately the same number of students, they do so in very different ways. Department B offers more courses in total and has a higher total cost base due to the additional facilities and faculty required. Despite having fewer course options, Department A actually provides about 20% more total credit hours to students, due to offering mostly 5-unit courses while Department B offers mostly 4-unit courses. Using this information in conjunction with student outcome data for the two departments, the dean would be able to consider the question of whether the strategy of offering more high-unit and high-enrollment courses allows departments to maximize resources in providing the best offerings to students.

**2. Comparing cost structure of different teaching models for courses within departments**

Departments can deliver courses through a number of different teaching models, varying their offerings on dimensions such as course size and number of sections offered. These models often are believed to trade off on outcomes vs. cost (i.e., the more effective the teaching model, the more it may cost), but until now there has been no way to truly assess the economic costs of different models. With Activity-Based Costing, department chairs can understand the cost implications of various delivery methods before deciding how to optimize delivery of the required course within the resources they have available.

For example, two courses in a science department both deliver approximately equal credit hours to students and therefore have near-equal revenues. However, the costs for the second course are much higher:

LEVEL	COURSE	REVENUE	COST	MARGIN	CREDIT HOURS DELIVERED	TOTAL STUDENTS ENROLLED
LOWER DIVISION	Course A	\$518,000	\$381,000	\$137,000	1,808	452
UPPER DIVISION	Course B	\$489,000	\$541,000	(\$52,000)	1,700	425

The reason the second course costs so much more is because it operates with smaller class sizes – offering two lectures instead of one and nearly twice as many supplemental sections, in this case labs requiring wet lab space. This impacts not only the indirect cost of facilities allocated to the course, but also the direct cost of academic staff required for instruction.

LEVEL	COURSE	# OF ACADEMIC FTE	# OF LECTURES	AVERAGE LECTURE SIZE	# OF LABS	AVERAGE LAB SIZE
LOWER DIVISION	Course A	0.73	1	452	12	38
UPPER DIVISION	Course B	2.13	2	213	28	15

Now that the department chair is able to quantify the financial difference between these two course delivery models, he/she can use that information in conjunction with course outcome data (such as the percentage of students passing Course A vs. Course B) to decide which delivery models make sense for courses in the department. To be clear, the more hands-on course format for Course B may deliver significantly better outcomes for students and therefore validate the higher expenditure, but ABC will provide the cost data required to make an informed decision in this regard.

*Example 1: Identifying funding options for the most effective teaching models*

In many departments, courses that are known to improve student outcomes require a subsidy – and it can be difficult to know where the subsidy should come from. In this case, a Dynamic Genome course in the Biology department is an important part of the department experience, driving more confidence in research skills and application, higher student participation, and increased student retention in STEM fields – but it must be subsidized. This ABC-generated view shows the type of information the department chair and dean can use to inform decisions on how to reallocate or grow resources in order to invest more in the Dynamic Genome course.

Biology (Course Level Data): Dynamic Genome			
Revenue	Expense	Margin	
\$6,804,000	\$6,622,000	\$182,000	LOWER DIVISION
\$395,000	\$368,000	\$27,000	BIOL002 : LABORATORY
\$423,000	\$367,000	\$56,000	BIOL003 : ORGNSMS IN THEIR ENVIRON
\$2,089,000	\$1,646,000	\$443,000	BIOL005A : INTRO: CELL&MOLECULAR BIOLOGY
\$1,381,000	\$1,282,000	\$99,000	BIOL005B : LABORATORY
\$1,020,000	\$940,000	\$80,000	BIOL005C : LABORATORY
\$147,000	\$294,000	(\$147,000)	BIOL020 : DYNAMIC GENOME
\$805,000	\$613,000	\$192,000	BIOL030 : HUMAN REPRO&SEXUAL BEHAV
\$35,000	\$51,000	(\$16,000)	BIOL034 : HUMAN HEREDITY
\$37,000	\$51,000	(\$14,000)	BIOL040 : DISCUSSION
\$471,000	\$1,011,000	(\$540,000)	BIOL05LA : INTRO TO CELL&MOLECULR BIO LAB

*Example 2: Identifying which departments actually generate revenue*

Majors that are resource-intensive are often assumed to present limited growth potential. By using cost data at the departmental and degree level, it is possible to find some unexpected trends. For example, Biology and Computer Science (typically “expensive” majors) are shown below to produce small margins – and can be grown with no effect on the university’s financial stability.

Biology (Degree Level Data)			
Revenue	Expense	Margin	
\$21,970,000	\$21,709,000	\$261,000	<b>Biology</b>
\$550,000	\$519,000	\$31,000	Bachelor of Arts
\$20,607,000	\$19,873,000	\$734,000	Bachelor of Science
\$8,000	\$10,000	(\$2,000)	Bachelor of Science/Bachelo

Computer Science (Departmental Level Data)			
Revenue	Expense	Margin	
\$32,500,000	\$31,005,000	\$1,495,000	<b>ORG11 : Bourns College of Engineering</b>
\$2,645,000	\$3,036,000	(\$391,000)	Bioengineering
\$4,190,000	\$4,515,000	(\$325,000)	Chemical and Environmental Engine
\$1,475,000	\$1,645,000	(\$170,000)	College of Engineering
\$12,586,000	\$10,009,000	\$2,577,000	Computer Science
\$5,811,000	\$6,393,000	(\$582,000)	Electrical Engineering
\$908,000	\$562,000	\$346,000	Materials Science and Engineering
\$4,886,000	\$4,845,000	\$41,000	Mechanical Engineering

**3. Assessing difference in cost of student degrees**

One of the distinguishing features of a university is that there is a large degree of variability in the production inputs (courses) that eventually result in students’ desired end output (a degree). Some major programs require students to take a large number of lower-division courses across multiple departments, while others mandate a high degree of specialization with many upper-division courses from only one department. The university may also set rules regarding the minimum and maximum number of units a student enrolls in to be eligible for graduation, but the student has flexibility in the volume of course enrollment within the established floor and ceiling. These differences are widely acknowledged as a characteristic of the multidisciplinary university environment, but there has never been a way to quantifiably measure the financial impact of these different policies on the cost of a student’s degree.

With Activity-Based Costing, it is possible to assess the cost of each course a student has taken<sup>15</sup> – and therefore to assess the cost of a degree by looking at the sum of all courses a student has completed.

To get a better sense of the cost structure of different degree programs, university leadership would be able to look at the average cost of a degree across several different majors, using a sample of students as in the example below:

	ENGINEERING MAJOR 1 (N=42)	ENGINEERING MAJOR 2 (N=92)	SOCIAL SCIENCE MAJOR (N=268)	HUMANITIES MAJOR (N=25)
AVERAGE COST FOR DEGREE <sup>16</sup>	\$52,000	\$56,000	\$47,000	\$51,000
AVERAGE COURSES PER DEGREE	48.8	53.4	45.3	44.3

When looking at this sample, the first takeaway is that the cost of an engineering degree on a per-student basis is noticeably higher than that of a non-engineering degree. Interestingly, a major driver of this variance is in the number of total courses that students in each major are taking. This discrepancy in the number of courses per degree becomes even more pronounced when accounting for the amount of time students take to graduate.

AVERAGE COURSES PER DEGREE	ENGINEERING MAJOR 1	ENGINEERING MAJOR 2	SOCIAL SCIENCE MAJOR	HUMANITIES MAJOR
4 YEAR GRADUATES	47.0	51.3	44.4	43.7
5+ YEAR GRADUATES	50.5	57.8	49.6	45.6

Taking this into account, it becomes clear that a significant driver of difference in student degree cost between engineering and non-engineering majors is the amount of time to graduate. Even if engineering majors do require more courses for graduation on average than non-engineering majors due to accreditation requirements, this data shows that engineers graduating in 5+ years take significantly more courses than their peers graduating in 4 years, incurring costs for the institution that could be avoided if more engineering majors graduated in 4 years. With this knowledge, university leaders can seek out strategies to reduce the average time to graduation, freeing up resources that could be used for deployment of additional courses, expanding major offerings, or increasing department enrollment.

The background features a vertical strip on the left side with a dark blue background. It contains several white mathematical formulas and hand-drawn gear icons. The formulas include  $\sum_{i=1}^n t^n$ ,  $S \times \lim F(x,y)$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\log$ ,  $S = \int_a^b$ ,  $\sigma^2 \alpha$ ,  $a x \sim x = 1$ ,  $9/8 =$ ,  $e^x$ ,  $a$ ,  $\sum = 0$ ,  $m(p)$ ,  $(x,y)$ , and  $(e^x)' = e^x$ . The gear icons are of various sizes and are drawn with a sketchy, hand-drawn style.

## Section 4: Implementing the ABC Pilot

UCR's ABC pilot commenced in earnest in August 2015, immediately after the completion of UCR's budget redesign process.

The initial phases of the ABC implementation process took approximately 12 months. UCR is currently beginning a final roll-out phase, sharing the analysis and benefits of ABC across the academic units.



## High-level approach and implementation roadmap

UCR's ABC implementation consisted of four general phases:

- 1) Vendor selection and ABC model setup**
- 2) Strategic cost allocation**
- 3) Data validation**
- 4) ABC roll-out and adoption throughout UCR (ongoing)**

Phases 1-2 took approximately 6 months to complete, while Phase 3 took another 6 months. Phase 4 is ongoing, as the roll-out of ABC to campus stakeholders will occur over the next year.

Compared to expectations for similar ABC implementations, the UCR timeline was reduced, due primarily to two factors. First, the requirement to extract data from multiple campus databases and make them compatible was made easier by the interoperability of UCR's data. Most campuses do not have that luxury, and while this task only took UCR approximately two months, it could take 6 months to a year to complete for other campuses, with a significant price tag associated with it. The second advantage was that the work to select revenue and indirect cost allocation methodologies was already mostly completed due to prior budget model redesign work completed by UCR. As this work requires significant engagement from campus leadership, depending on the organization, this portion of the project could also add significantly to the implementation timeline.

Due to staff bandwidth constraints, UCR hired a consulting team over Phases 1-2 of the implementation to help with facilitating both the technical implementation and the change management aspect of the project. However, this work could have been done with approximately 2 internal staff members, a full-time technical financial expert and a full-time project manager.



UCR IMPLEMENTATION SUMMARY				
	PHASE 1 VENDOR SELECTION & ABC MODEL SETUP	PHASE 2 STRATEGIC COST ALLOCATION	PHASE 3 DATA VALIDATION & ANALYSIS	PHASE 4 ABC ROLL-OUT & ADOPTION
TIMELINE	3 Months	3 Months	6 Months	1 Year (Est. Next 12 Months)
SOFTWARE COST (12 MONTH LICENSE)	\$65,000			\$65,000
EXTERNAL CONSULTANTS FOR ABC MODEL IT IMPLEMENTATION (PILBARA)	\$350,000			Annual Update \$50,000
EXTERNAL CONSULTANTS (DELOITTE)	\$50,000	\$225,000	\$125,000	
INTERNAL STAFF (ESTIMATED)	1.5 FTE for 6 months or \$112,500		1.0 FTE for 6 months or \$75,000	1.0 FTE for 1 year or \$50,000

It is important to note that while UCR’s implementation of ABC to this point carried a total cost of approximately \$815,000 in non-staff costs through Phases 1-3, UCR only incurred direct costs of approximately \$300,000 due to significant support from the Bill and Melinda Gates Foundation, the UC Office of the President, and investments from Pilbara and Deloitte.





## Vendor selection and model setup

ABC has long been used in the private sector, so there are plenty of vendors capable of implementing ABC according to the requirements of private enterprises. The challenge was to find a vendor with an ABC tool robust enough to handle complex data systems, and who also understood the dynamic nature of a university setting. In order for UCR to implement ABC, it needed software with the capability to integrate the disparate data sources across the university, including financial, human resource, course information and student records data, as well as to contain and automate the cost allocation assumptions and drivers.

One of the primary reasons this type of costing methodology has not been attempted by more institutions is that the data needed to calculate the cost per course is so immense that it would be very difficult to analyze using the traditional tools typically available to finance professionals, such as Microsoft's Excel or Access.

UCR selected Pilbara Group as its software provider due to its long term experience performing ABC for universities in Australia. Pilbara has successfully navigated the unique structure and challenges of implementing ABC at a university and was ready to adapt its tool to an American setting. Pilbara's Analytical Costing Engine (ACE) software has powerful multi-dimensional analysis capabilities which enable institutions to deconstruct and analyze data in ways that were not possible in the past or only after hundreds of hours of data manipulation.

In order to build UCR's Activity-Based Costing model, Pilbara Group and Grant Thornton needed to integrate a number of different types of financial and non-financial data from across the institution including:

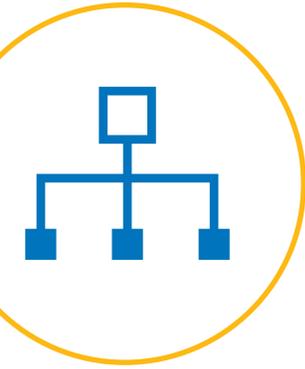
- [General Ledger Records](#)
- [Course Scheduling](#)
- [Student Records](#)
- [Space \(Facilities\)](#)
- [Human Resources and Payroll](#)
- [Instructor Time](#)

This data was acquired through the campus CIO and validated with campus data owners such as the Controller, Financial Planning and Analysis, Institutional Research, Registrar, Chief Human Resources Officer and Academic Personnel Office. After the data was identified and extracted, a thorough review was performed on the "cross-mapping" of data between the ABC model and current source systems for accuracy.

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The goal was to automate the model as much as possible to minimize the maintenance burden while still providing data at a granular enough level. By capturing much of the detail automatically from existing source systems and building allocation rules based on this data by using a powerful combination of tags and driver functionality, this manual effort was significantly reduced. However, as will be the case for virtually any institution, existing data systems (such as Financial Ledger) were not designed to support ABC. As a result, some manual mapping effort was required. For example, extramurally sponsored research funding is typically mapped at the central campus level. In order to align revenues with costs, this funding was manually mapped to the relevant departments based on fund numbers, principal investigators, research topics, and more.

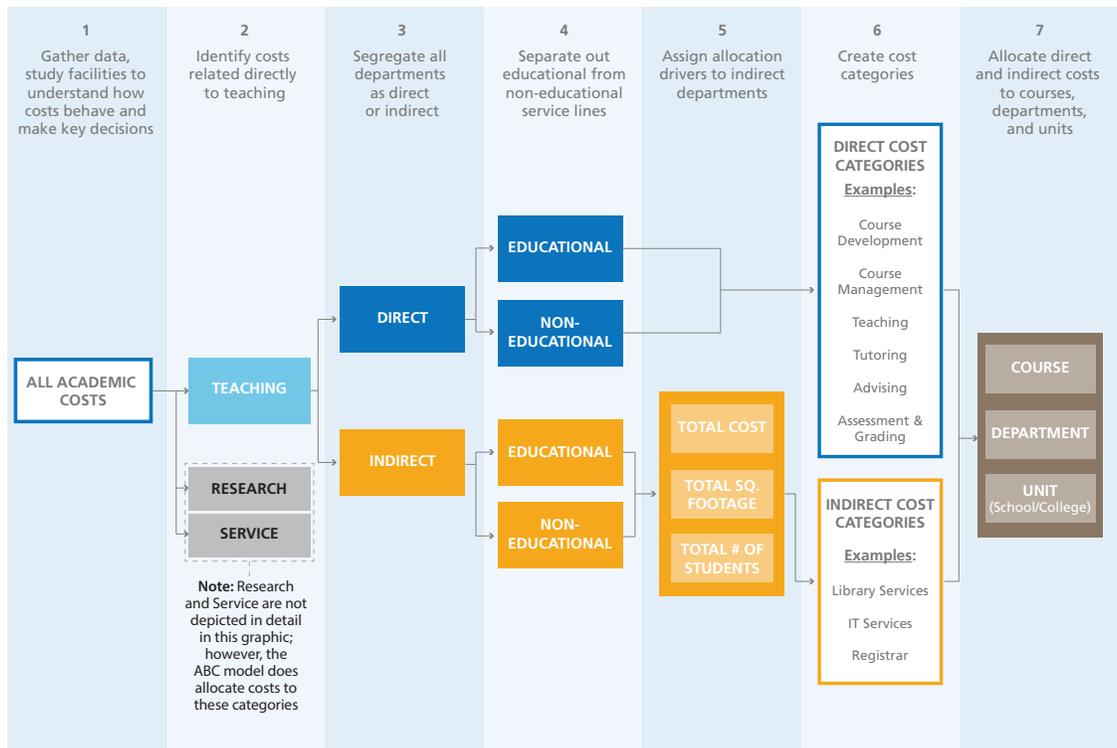




# Strategic cost allocation

Once UCR’s various data systems had been loaded into the Activity-Based Costing model, the next step was to devise an institution-specific methodology for allocating revenues and costs down to the course level. As mentioned earlier, UCR’s revenue allocation methodology had largely been determined during the incentivized budget process redesign, with tuition revenue allocated to academic units on the basis of total credit hours delivered. Therefore, the work during this phase centered on developing a strategic cost allocation methodology that would enable UCR to accurately allocate costs to both instruction activities and the broader supporting set of administrative activities of the university.

To begin, all of the university’s expenses captured from various data sources (GL, Payroll, etc.) were disaggregated into meaningful cost categories such as Teaching, Research, Service, and Auxiliary Enterprises. The costs within the Teaching category were then allocated across courses based on a specific set of methodologies and drivers, which may vary from institution to institution. The graphic below depicts the high-level steps used to break out all costs/ expenses information into meaningful data that could then be allocated to specific courses.



As mentioned above, it is important to note that institutions must make management allocation decisions to determine which expenses are relevant to course cost. One example of a management decision that could differ greatly by institution is how to account for the cost of research. Research universities are built on the belief that teaching that is based on the research enterprise is qualitatively superior to that which is not research-based. To the extent that ABC does not at least allocate some of the cost of research into the teaching cost, it is underestimating the cost of teaching at the research university. While this understatement may not affect a campus' ability to use this data for the purposes of innovating on its curriculum, use of this data to report on the complete cost of undergraduate education without some reasonable allocation of research cost would be a significant misuse of the tool. On the other hand, attributing the whole of research-related cost would be inappropriate as well.

### Direct costs

The direct costs for a given course are driven by the amount of time instructors spend on academic activities for that course. In order to properly allocate the direct costs of instruction to specific courses, two key questions must be answered:

#### *a. Size of Teaching Cost Pool:*

What proportion of time do the faculty spend on instruction vs. research, administration, public service, and other responsibilities? Does this vary by department? Does this vary by rank of the faculty?

#### *b. Course Effort Estimate:*

How do we determine the amount of total instructional time required for one course vs. another when allocating the teaching cost pool? (Total instruction time includes the six activities defined by the National Higher Education Benchmarking Institute – NHEBI)

For each of these questions, university leaders must decide on a set of rules that make the most sense for their institution. Depending on the level of time and resources available for ABC implementation, institutions may choose to follow one of these approaches:

1. Develop an “allocation methodology” that can be applied as a formula across the board to all instructors and courses. (Least time intensive)
2. Develop a set of “allocation sub-methodologies” that can be applied as formulas but vary based on instructor type, department, and course type. (Moderately time intensive)
3. Survey all instructors to understand how much time they spend on instruction and how much effort each course requires. (Most time intensive)

#### *Initial methodology:*

Given the lack of existing knowledge around ABC best practices for higher education in the US, UCR chose to run the ABC model using both Approaches #1 and #3 for a set of departments. This was done to determine whether there were noticeable differences in allocation outcomes across the approaches before deciding on a final approach for modeling across the entire university using ABC.

For Approach #1, UCR created a “generic profile” that would assume the following default scenarios:

*a. Size of teaching cost pool:*

Faculty spent 40% of their time on instruction, 40% on research, and 20% on other activities (based on standard industry default assumption)

*b. Course effort estimate:*

The amount of time spent on instruction for each undergraduate course would be calculated based on the following formula, regardless of department or course delivery format:

NUMBER OF HOURS REQUIRED					
COURSE DEVELOPMENT	COURSE MANAGEMENT	TEACHING	TUTORING	ADVISING	ASSESSMENT & GRADING
40hrs	Same as “Teaching”	Time spent in class	0.5hr X # of students enrolled	0.5hr X # of students enrolled	0.5hr X # of students enrolled

*The formula for graduate courses was similar but estimated more per-student time for tutoring, advising, and assessment/grading.*

To test Approach #3, UCR chose to survey a sample of faculty members in order to better understand faculty workloads and course effort requirements. UCR hired a Deloitte consultant team to help execute its pilot faculty course study and develop faculty and course-level profiles. For this pilot, faculty from five departments within two colleges were surveyed to collect data about their workload and time spent on educational activities. The information gathered from faculty interviews was then validated with department chairs.

The first objective of the interviews was to determine the amount of time faculty spend on three major categories: instruction, research, and public service – an important consideration since the amount of time spent on instruction directly impacts the size of each department’s instructional cost pool. As stated above, many institutions already have standard policies relating to this split of a faculty member’s time (for example, 40% time on instruction, 40% on research and 20% on service), but UCR chose to test this valuation to see if the allocation of faculty time was consistent across departments. The results of the pilot faculty survey showed that percent of time faculty spend on instruction did in fact vary significantly by department, with one pilot department reporting 30% of faculty time on instruction and another reporting 60% of faculty time on instruction.

The second objective of the interviews was to understand the amount of time faculty spent on instruction for specific courses to see if there were meaningful differences by department or course type. This was done by having faculty estimate how they allocated their instructional time across each of the direct course activities outlined by NHEBI. The data provided in this portion of the interviews allowed UCR to develop course profiles for the five surveyed departments. These course profiles showed that the relative time spent on different educational activities was typically consistent across departments, but varied significantly across different course delivery formats (lecture, lab, discussion, etc.).

In outlining the pilot, UCR attempted to capture both a spectrum of course and instructor types (such as TAs, lecturers, full professors, and assistant professors), with department chairs providing information on the time allocations for TAs and lecturers.

*Revised methodology:*

By comparing cost allocations for the five test departments in the “survey profile” model to the “generic profile” model, UCR was able to evaluate the outcomes of both approaches and also take into account the amount of effort/time/resources that each approach required. Given these considerations, UCR ultimately decided to initially use Approach #2 for direct cost allocation to the entire campus. This approach would provide a higher level of nuance than Approach #1, allowing departments to account for variance in research levels and teaching loads, while also being more feasible for a full roll-out than Approach #3, as it would not require a survey to be deployed at the individual faculty and course level. Specifically, UCR recommends the following methodology:

*a. Size of Teaching Cost Pool:*

Each department provides separate profiles of how academic staff allocate their time between instruction, research, and other activities. Distinct profiles will be provided for senior faculty, junior faculty, lecturers, and TAs, as these roles vary in effort allocation. These profiles will be created at the departmental chair level and do not require all instructors to be surveyed.

*b. Course Effort Estimate:*

For each type of course delivery format (e.g., lecture, lab, discussion, etc.), a custom formula will be devised to calculate the amount of instructional time that course will require. This formula will then be applied to all courses of that delivery format, regardless of department. Examples of how these formulas could vary based on delivery format are shown below:

NUMBER OF HOURS REQUIRED						
COURSE DELIVERY FORMAT	COURSE DEVELOPMENT	COURSE MANAGEMENT	TEACHING	TUTORING	ADVISING	ASSESSMENT & GRADING
LECTURE	20hrs	Same as “teaching”	Time spent in class	0hrs	0hrs	0.5hr X # of course credit hours
DISCUSSION	10hrs	0.5hr X “teaching”	Time spent in class	0.25hr X # of course credit hours	0.25hr X # of course credit hours	0hrs

Please refer to the Appendix for a template which may be used in gathering department-level instructor profiles.

**Indirect Costs**

The indirect costs for a given course are driven by the amount of non-teaching resources (facilities, administration, etc.) that the specific course requires. Indirect costs should not be evenly spread across all courses, because this would assume that all courses equally share the assorted costs of a university, ignoring the reality of actual resource consumption (for example, courses with labs require more expensive space). UCR’s indirect cost allocation methodology was largely determined through the incentivized budget process redesign. Through this redesign, administrative organizations were bundled into “cost pools”. In order to then distribute these expenses appropriately as indirect costs at the course level, the campus spent a substantial amount of time and effort developing cost allocation drivers. These drivers were developed by UCR leadership in consultation with key campus stakeholders.

A list of the indirect cost categories and their associated drivers are found in the table below:

TYPE OF EXPENSE	COST POOL	PRIMARY ALLOCATION DRIVER
INFRASTRUCTURE OPERATIONS	Facilities	Square Footage
	IT	Academic + Student + Staff FTE
ADMINISTRATION	Functional Administration (Finance, HR, etc.)	Academic + Staff FTE
	Central Administration (Chancellor, Planning & Budget, International Affairs, etc.)	
STUDENT AFFAIRS SUPPORT	Student Affairs	Undergraduate FTE/Graduate Student FTE
ACADEMIC & RESEARCH ADMINISTRATION	Research Administration	Academic FTE
	Academic Administration	Academic + Student FTE
STUDENT FINANCIAL AID	Student Financial Aid	Undergraduate FTE/Graduate Student FTE

With the strategic allocation of both direct and indirect costs at a course level, UCR’s ABC Model had the data required to provide valuable insights on the current cost structure of the university as it related to the university’s core function – instruction.

**USING ABC FOR ADMINISTRATIVE FUNCTIONS**

Activity-Based Costing (ABC) is also being applied to administrative functions at UCR, including the Shared Services operation. ABC has allowed Shared Services to identify the costs associated with administrative inefficiencies across campus and to then demonstrate the value, and necessity, of standard and streamlined business processes. The adoption of ABC combined with lean thinking and other improvement initiatives has created greater operational efficiency and utilization of personnel and resources. As a result, UCR’s Shared Service operation has saved participating campus units 43% of their salary and benefit costs in FY 15/16 for delivering the same services as the prior self-service approach.



## Data validation

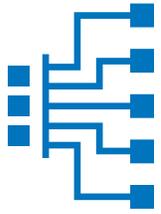
The data validation phase was critical in both understanding the ABC model and fine-tuning it to produce meaningful and valuable outputs. This work required validation of all data included in the model, including financial numbers, student, course, and space data. UCR comprehensively reviewed results from the pilot program data with key academic and administrative stakeholders, working with its vendors to look for anomalies in the outputs and to correct any errors or omissions. Examples of some model revisions that were made during this time include allocation of certain types of employees in academic vs. non-academic functions, classifications of cross-listed courses to the correct departments, and updates to the course scheduling master file.

In addition to correcting any data inaccuracies, this phase also included time to learn the capabilities of the ABC model, understand the allocation functionality, and fine-tune methodologies that were being adapted from the Australian to the US higher-education context.

For example, after an in-depth review of the formula used to calculate instructional time in UCR's "generic profile" scenario (discussed in depth in the prior section), the decision was made to base the formula on the number of total course credit hours (number of students enrolled times course unit value) rather than purely on the number of students enrolled, because the prior methodology had over-weighted the amount of instructional time allocated to low-unit courses.

Once data validation was completed, UCR had a working ABC model that could be used to generate valuable insights about the relative cost structures of courses across campus.





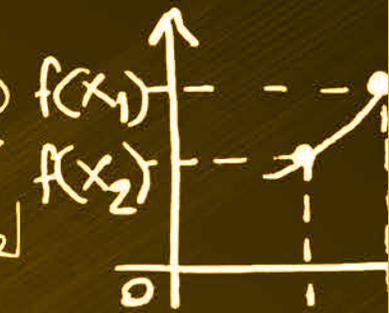
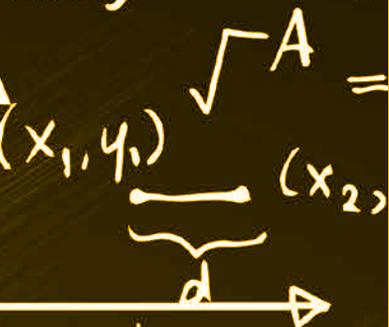
## ABC roll-out and adoption throughout UCR

The next phase of the ABC process, which will take place over the next year, includes the roll-out and adoption of UCR's ABC model across the campus. The goal of this phase is to empower academic leaders at UCR to begin answering questions related to the optimal slate of course offerings using ABC data. This phase will involve a high degree of engagement and collaboration with stakeholders such as deans and department chairs, and UCR's leadership team will focus on both facilitating workshops and developing dashboards that can be utilized by campus decision-makers to understand and evaluate ABC data.

Learning outcomes remain of primary importance and ABC data will be most informative when paired with this kind of student outcome data. Ultimately, UCR will include both types of data in a cost/quality model for optimizing resource allocation for teaching.



$$(iz) \sinh(z)$$



$$\sec(-x)$$
$$\sec^2(x) = 1 + \tan^2(x)$$

$$\operatorname{arccsch}(z)$$

$$(a \times b)^n = a^n \times b^n$$

$$\tanh(z)$$



$$\sim \exists x [p(x)]$$

## Section 5: Conclusion

Overall, UCR considers its ABC pilot project a success. The model has been built and tested and the data provided will allow UCR to begin answering the significant questions outlined in this white paper with more accuracy than previously possible. As UCR moves into its roll-out phase, a number of deans and department chairs have expressed strong interest in the tool. While others remain cautious, the Provost, CFO and their teams will begin the work of addressing those concerns with the same level of transparency and dialogue that marked the initial phases of the pilot.

While the broader UCR academic community becomes more familiar with ABC and its possibilities, campus leaders have already begun using ABC data to think about increased enrollment. Faced with more than a thousand additional first-year students, UCR deans and department chairs must figure out not only how to meet demand, but what it will cost. ABC has already been essential in helping UCR budget for this growth.

As UCR moves forward in refining its ABC model and using the ABC data in partnership with academic leaders, it is important to note that the model will be most effective when coupled with student outcome data. As currently designed, the ABC model can identify areas in need of further investigation related to cost and other efficiency-related metrics. However, once linked to student outcome data, it will be possible to use the model to begin evaluating the relative tradeoffs of different course design/offering options. The true value of ABC will be realized when its cost data is analyzed in tandem with outcome data in order to better inform discussions relating to the cost/quality relationship.

In completing the ABC pilot, UCR discovered a number of caveats that could influence whether other institutions would choose to commit the time and expense to develop their own ABC tool:

### **1. Cost and time:**

Campus leaders across institutions will need to consider the significant resources necessary for a successful ABC implementation in order to decide if such a project would be feasible and/or in line with their stated objectives.

### **2. Budget system:**

The ABC tool appears particularly suited to an RCM model, because the RCM model decentralizes budgetary responsibility. In a traditional incremental budget model, there would be a disjuncture between the location of budgetary authority (the Provost) and course planning. ABC could be made to work in this environment, but would likely require a radical centralization of course planning.

### **3. The potential for misuse (and related fear of the model):**

ABC is a management tool, not an accountability tool. Each institution will design its budget model and ABC tool to create the incentives that it values. There is much discretion in how to define and allocate indirect cost pools. As a result, any attempt to compare costs across institutions will be misleading – but for many it will be tempting to do so.

Despite the caveats that might lead other campuses to forego development of this tool, UCR has determined that ABC will help promote allocation of funding to be as closely linked to the university mission and goals as possible. UCR remains enthusiastic about the prospects for ABC across the university and has experienced strong engagement with peers around the nation who have readily expressed interest in the potential uses of ABC.

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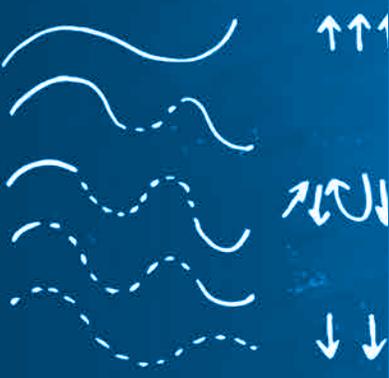
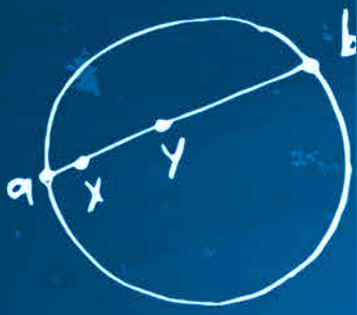
Anthony Pember, Dan Caricato, and Michael Gerding

We are also grateful for the thought leadership of Bill Massy, who participated throughout the entire process and was generous with both his time and energy.

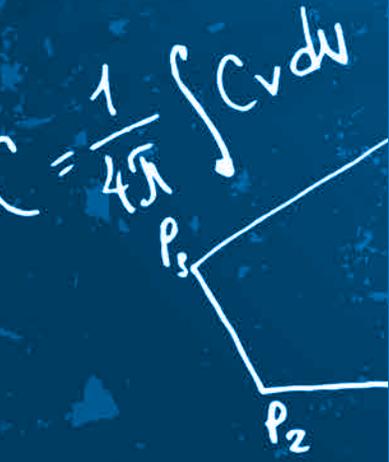
Finally, this project could not have been possible without the financial support of the UC Office of the President and the Bill and Melinda Gates Foundation.

$$\pi(R-l)^2 \leq$$
$$(2q+p+2)^{\frac{s}{2}}$$

$$n = q + \frac{p}{2}$$



$$r(\cos \theta + i \sin \theta)$$
$$\cos n\alpha = P_n(\cos \alpha)$$
$$\sin n\alpha = Q_n(\cos \alpha)$$



$$|P_1' P_n'| \geq |P_2' P_n'|$$

# Appendix

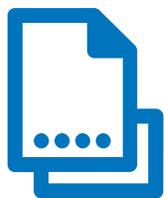
Template for gathering department-level faculty profiles



## Appendix

TITLE CODE	INSTRUCTOR EFFORT ESTIMATE				
	INSTRUCTION			RESEARCH*	OTHER
	UNDERGRADUATE TEACHING	GRADUATE TEACHING*	TOTAL		
TAs					
LECTURERS					
ASSISTANT PROFESSORS					
ASSOCIATE PROFESSORS					
PROFESSORS					

*\*\*“Graduate Teaching” should not include time spent on individual student research advising. This should be counted in “Research”.*



## Endnotes

- <sup>1</sup> Integrated Postsecondary Education Data System
- <sup>2</sup> Throughout this paper, “faculty” will be used to reference ladder rank faculty. When various titles are included, such as TAs and lecturers, “instructional personnel” or “instructors” will be used.
- <sup>3</sup> University of California Federal Update, November 2015 [http://ucop.edu/federal-governmental-relations/\\_files/COC-report/11-November-2015.pdf](http://ucop.edu/federal-governmental-relations/_files/COC-report/11-November-2015.pdf)
- <sup>4</sup> U.S. News and World Report Website: <http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/national-universities/campus-ethnic-diversity>; UCR Institutional Research Website: <http://ir.ucr.edu>
- <sup>5</sup> Students of color include African American, Native American, Chicano/Latino, Asian American, Native Hawaiian; UCR Institutional Research Website: <http://ir.ucr.edu>.
- <sup>6</sup> University of California 2015 Accountability Report, Section 2.2.1; US Department of Education “Trends in Pell Grant Receipt and the Characteristics of Pell Grant Recipients”, Table 1.2: <http://nces.ed.gov/pubs2015/2015601.pdf>
- <sup>7</sup> UCR 2020: The Path to Preeminence: <http://strategicplan.ucr.edu/documents/UCR%202020%20-%20Final.pdf>
- <sup>8</sup> University of California 2013 Accountability Report, Indicator 8.1.1; UCR Institutional Research Website: <http://ir.ucr.edu>
- <sup>9</sup> UCR Institutional Research Website: <http://ir.ucr.edu>
- <sup>10</sup> University of California 2016-17 Budget for Current Operations and Three-Year Financial Sustainability Plan: [http://www.ucop.edu/operating-budget/\\_files/pres/2014-15/2016-17\\_Budget\\_and\\_Sustainability\\_Plan-11-19-15.pdf](http://www.ucop.edu/operating-budget/_files/pres/2014-15/2016-17_Budget_and_Sustainability_Plan-11-19-15.pdf)
- <sup>11</sup> UC Office of the President, “Financial Accounting: Campus Financial Schedules”, Schedule A excluding the State financial aid allocation: <http://www.ucop.edu/financial-accounting/financial-reports/campus-financial-schedules/>; UCR Institutional Research Website: <http://ir.ucr.edu>
- <sup>12</sup> Brighouse, Harry (2010). “Ethical Leadership in Hard Times: The Moral Demands on Universities,” *Futures Forum* 2010, p.51-56. <https://net.educause.edu/ir/library/pdf/ff1008s.pdf>
- <sup>13</sup> Ibid.
- <sup>14</sup> Massy, William F. (2016). “Course-Level Activity-Based Costing as an Academic and Financial Tool,” TIAA Institute and NACUBO, p.4. [https://www.tiaainstitute.org/public/pdf/institute\\_series\\_course\\_level\\_activity\\_based\\_costing.pdf](https://www.tiaainstitute.org/public/pdf/institute_series_course_level_activity_based_costing.pdf)
- <sup>15</sup> A “per-student course cost” for each UCR course was derived by dividing the total cost by the number of enrolled students.
- <sup>16</sup> “Degree costs” were calculated by summing all the individual “per-student course costs” for each course a student had taken while pursuing their degree. This includes both major and non-major courses.