DRAFT

SWOT ANALYSIS – REPORT
CULLEN COLLEGE OF ENGINEERING
COLLEGE OF TECHNOLOGY

UNIVERSITY of HOUSTON

SWOT Analysis

Task Force

The SWOT task force was organized on March 24, 2022 with the goal of obtaining feedback on the question, “Should the UH Colleges of Engineering and Technology be merged?” The charge given to the members of the task force was to; review and provide comments on the proposed scope of work, identify stakeholders to provide input, identify and provide any relevant data, and review draft document prepared for the Chancellor and Provost. The SWOT Task Force was chaired by Greg Bean, Executive Director of GEMI, C.T. Bauer College of Business with support from Joseph Curtin, Associate Provost - Institutional Research & Effectiveness. The members of the committee were:

Ahmed Senouci, Professor, College of Technology
Kirill Larin, Professor, College of Engineering
Dmitri Litvinov, Professor, College of Engineering
Amaury Lendasse, Associate Professor, College of Technology
Fatima Merchant, Professor, College of Technology
Lakis Mountziaris, Professor, College of Engineering
Hanadi Rifai, Professor, College of Engineering
Pradeep Sharma, Professor, College of Engineering
Consuelo Waight, Associate Professor, College of Technology
George Zouridakis, Professor, College of Technology

LISTENING SESSIONS & SURVEY

To collect input, the committee identified four groups of individuals to solicit feedback. Ten Focus groups of about ten participants each were organized to meet with college staff (2 groups), faculty (4 groups), program experts (2 groups) and administrators (2 groups). All of the groups except the staff groups included participants from both colleges. The members were provided a document with background material on the two colleges as well as a list of seven questions which were used to structure the sessions. Both documents are included in the appendix. In addition to the ten focus groups, a survey was sent to members of the College Advisory Boards for both the College of Engineering and the College of Technology. A summary of the input received from these groups that participated in the SWOT (Strengths, Weakness, Opportunities, and Threats) analysis is provided below.

It should be noted that some participants felt unsure of how to respond to questions not knowing what the intended purpose and the motivation of a merger ((cost savings), perception (rankings), or other). The facilitator explained that this effort was an initial exploration of the potential benefits and challenges of a merger and that no decision on merging had been made and no thinking had been done about any aspects of a merged college should a merger proceed.

STRENGTHS

Feedback from all groups expressed confidence in both colleges and felt that each college displayed a multitude of strengths and provided an excellent experience for their students and stakeholders.

Technology

- Strong on entire value chain, application of technology/"hands-on" experiences
- Creative and Innovative programs, including non-technical programs and many minors
- Opportunities for students who don't meet COE admissions criteria
- Strong continuing learning/executive education offerings (certificates) with associated revenue
- Reputation for producing "workforce ready" students
- Strong industry involvement
- Strong non-tenure track faculty; Industry experience
- Culture of caring

Engineering

- Research productivity and funding
- PhD programs
- Strong tenure/tenure track (TTT) faculty
- Strong government funding
- Common first year curriculum/PROMES support program
- Higher 1st year retention/six year graduation rates
- National rankings
- National Academy Memberships
- High quality, students and graduates

WEAKNESS

Weakness identified for the programs were mostly aligned with limited resources or programs that they feel are necessary to move each college up to the levels expected of a Top 50 research University.

Technology

- Ph.D. Programs
- High Student/Faculty ratios
- Low funding

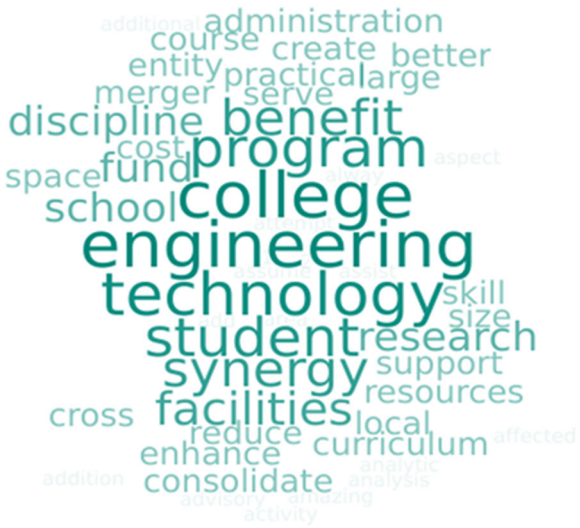
Engineering

- Accessibility to diverse populations
- Lack of some essential program areas
- Lacks the size (# of students) compared to other Top-50 engineering programs

Comments were also made about students being confused at times with differences between programs such as Mechanical Engineering and Mechanical Engineering Technology and which college they should be getting advising from, application requirements etc.

OPPORTUNITIES

Feedback from the sessions were able to identify many new and positive opportunities that would be facilitated through a merged college. Some of those mentioned include:



- Sharing between similar programs and greater combined size and breadth
    - Construction Management (i.e., project management) and Civil & Environmental Engineering (Construction Engineering)
    - Biotechnology/Computational Health Informatics (COT)and Biomedical Engineering (COE)
    - Mechanical Engineering Technology (COT) and Mechanical Engineering/Materials Science and Engineering (COE)
    - Electrical Power Engineering Technology (COT) And Electrical Engineering (COE)
    - Computer Engineering Technology/Computer information Systems/Cybersecurity/Networking Communications (COT) and Computer Engineering & Analytics/Systems Engineering/Engineering Data Science (COE)
    - Supply Chain Logistics and Technology (COT) and Industrial Engineering (COE)
- Potential to create a regional Supply Chain Center of Excellence (including Bauer)
- More Technology Leadership and Innovation Management (COT) content in COE programs
- More Human Resource Development/Organization Leadership and Supervision/Foresight (COT) content in COE programs (links between engineering and human behavior in classes and research, better soft skills for COE students)
- Potential Engineering Education graduate degree program
- Apply COT expertise to grow COE-related continuous leaning programs/certificates
- New pre-engineering program for COT-admitted students to support potential transfer to COE programs (similar to COE common 1st year curriculum and PROMES support program)
- Common career fairs
- Shared/optimized lab facilities
- Strengthened student organizations serving a larger, broader student base

Some of the benefits that would be derived from a merger and new opportunities for students were:

- Expanded number of completion pathways in the larger, broader college that leads to higher retention and completion rates for all areas.
- Easier access to courses from (what is now) the other college.
- Development of new programs that incorporate both the theoretical and practical views of the discipline
    - Provide the soft-skills (HR and Management) that often overlooked in engineering programs
- Access to additional recruiting opportunities for graduates

Benefits to University of Houston faculty were listed as:

- Increased opportunities to pursue inter-disciplinary research grants
- Opportunity to serve as graduate advisors for students in areas that are currently located in the other college.
- No longer a need for joint appointments in the two colleges
- Access to Ph.D. students for research that is currently conducted in the College of Technology.

Staff identified the ability to expand their skill set through new and broader responsibilities as the primary benefit to them.

THREATS

Threats to a successful merger were listed as challenges that would need to be adequately addressed in order for the merger to create the opportunities and gain the potential benefits. The areas that would need to be addressed are:

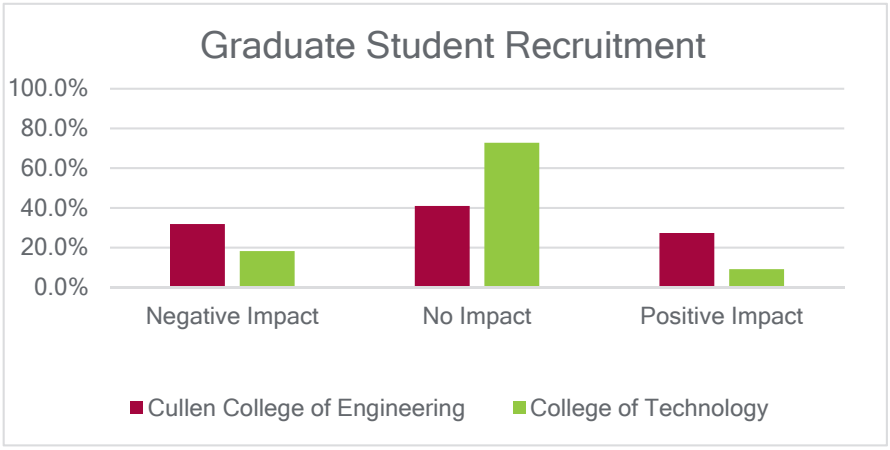
- Maintaining access for lower-GPA students to technology programs
- Need for additional funding of COT programs to relieve some of the current financial stress
- Managing locational challenges – main campus vs Sugarland vs Katy
    - Capturing synergies without co-location
- Maintaining distinct faculty expectations
    - Research output and funding generation
    - Conference presentations, articles, books v. journal articles
    - Tenure and rank advancement processes
    - Non Tenure/ tenure track faculty in administration (voting rights)
- Identify path for any COT programs that don't "fit" COE-type technical programs (I.e., Retail and Consumer Science, Digital Media)
- Maintaining "merger" vs "COE takeover" theme (i.e., include "Technology" in new college name, balance administrative appointments)
- Avoiding loss of identity (brand recognition) of some of the Technology programs and loss of connections to business and industry
- Address more mechanical issues (update by-laws, faculty senate representation)
- Creating a clear narrative on the logic of the merger and benefits for stakeholders of both colleges.

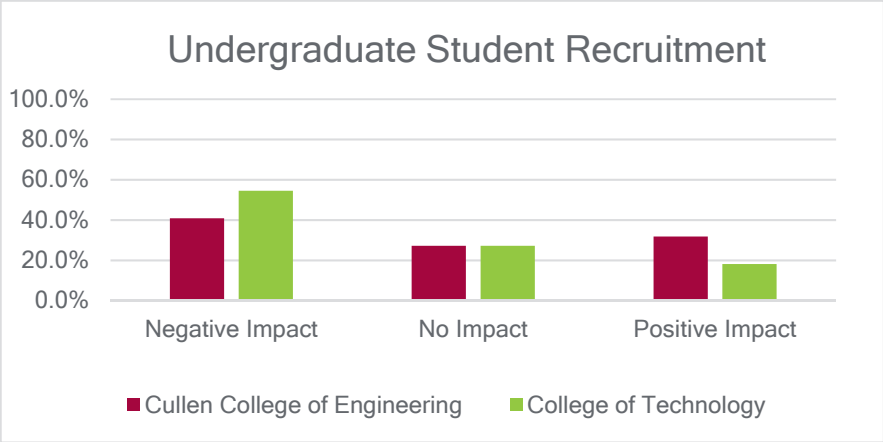
If these threats/challenges are not adequately addressed, negative outcomes of a merger could include:

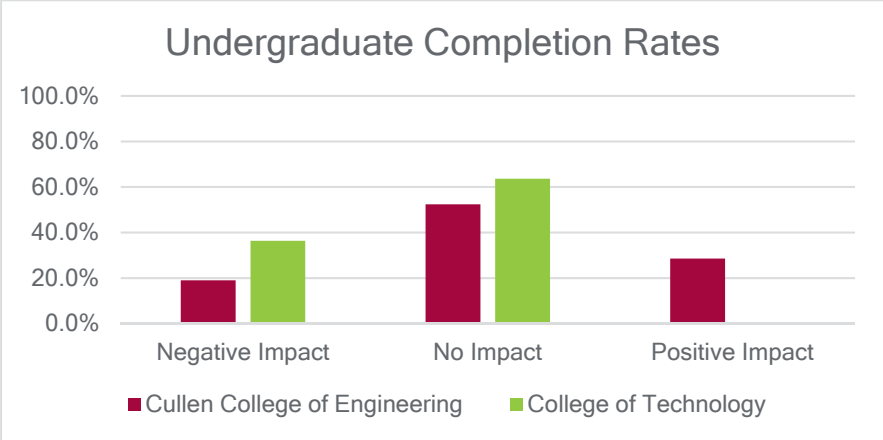
- Loss of student enrollment (tuition) for students who don't meet College of Engineering admission standards.
- Loss of student enrollment and industry funding support due to weaker brand identity.
- Loss of student enrollment due to departure of key COT faculty due to continued low funding, changed expectations, or loss of influence in decision-making
- Loss of student enrollment due to the degradation of currently successful Technology programs that become a lower-priority, see reduced funding and are allowed to slowly disappear.

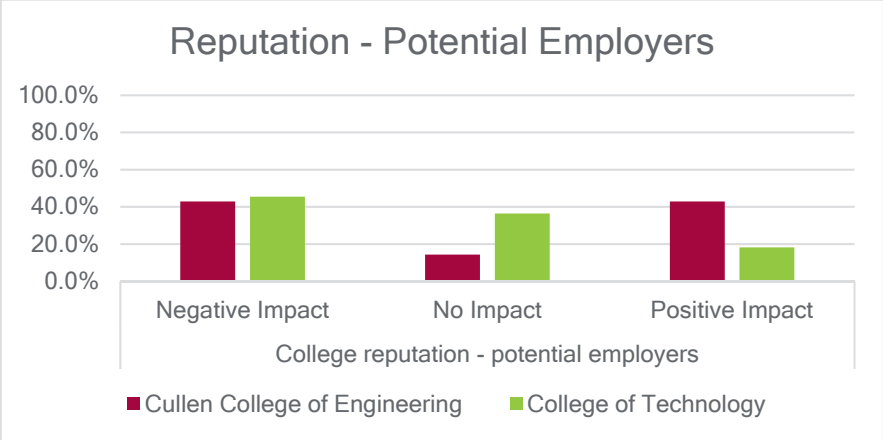
COLLEGE ADVISORY BOARDS

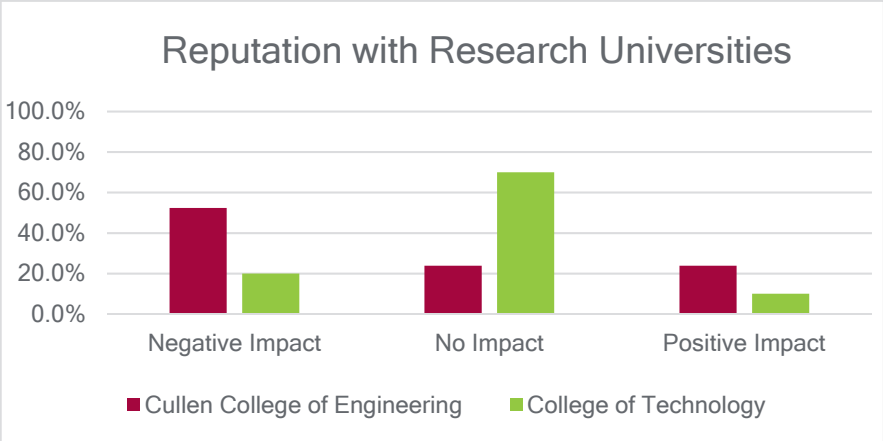
College Advisory Boards were invited to respond to a short on-line survey (included in the appendix). Eleven members of the College of Technology and twenty-two members of the College of Engineering boards completed the survey. Open ended responses from advisory board members were in-line with comments observed in the SWOT focus groups. Results of one set of survey questions posed to the boards was "What would be the impact of the merger on…." The distribution of responses to seven areas are shown in the graphs below.




Undergraduate Student Recruitment
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
Cullen College of Engineering
College of Technology


Undergraduate Completion Rates
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
Cullen College of Engineering
College of Technology


Reputation - Potential Employers
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
College reputation - potential employers
Cullen College of Engineering
College of Technology


Reputation with Research Universities
100.0%
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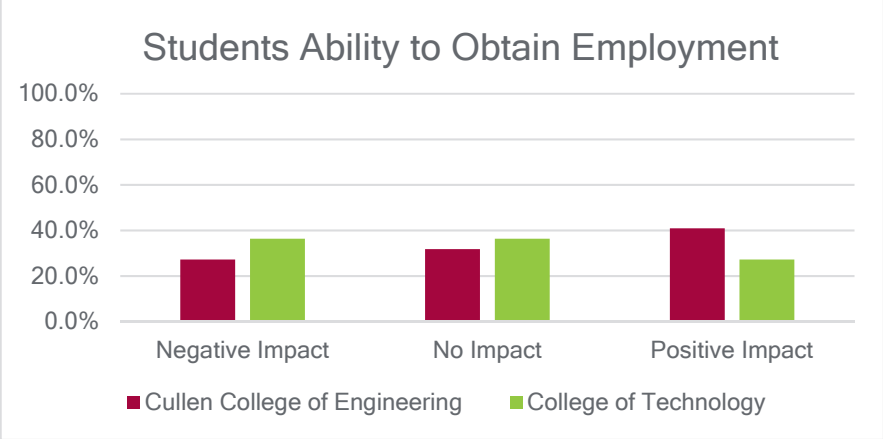
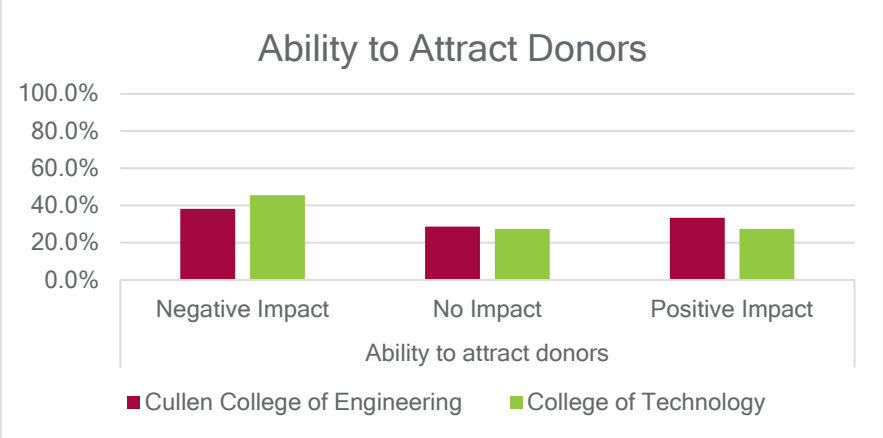
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
Cullen College of Engineering
College of Technology


Students Ability to Obtain Employment
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
Cullen College of Engineering
College of Technology


Ability to Attract Donors
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Negative Impact
No Impact
Positive Impact
Ability to attract donors
Cullen College of Engineering
College of Technology

It should be noted that most national research universities have engineering and technical programs combined into one college or school. A review of a selection of top 100 Universities ranked by U.S. News area of study labeled: *Engineering Technologies and Engineering Related Fields* revealed that the most common names used for colleges were the College of Engineering or a School of Engineering and Applied Sciences. The universities included in the ranking were both public and private, national universities. Of the University web sites reviewed for this report, only Purdue University (ranked 49) had a completely separate academic division that is designated as the Polytechnic Institute (table 1). Many of these colleges and schools included a variety of programs such and digital media, management etc. that are currently housed in the UH College of Technology. Based on the review of national programs, it would seem unlikely that these programs would become lost in a merger. The merger could potentially add to exposure to College of Technology programs when a search is focused on Colleges of Engineering.

Table 1 - Sample of U.S. News Area of Study Rankings 2022

Engineering Technologies and Engineering Related Fields
National Universities

Name	City/State	Ranking	Name of Engineering/Technology Programs
Princeton University	Princeton, NJ	1	School of Engineering and Applied Science
Columbia University	New York, NY	2	School of Engineering and Applied Science
Harvard University	Cambridge, MA	2	School of Engineering and Applied Science
Massachusetts Institute of Technology	Cambridge, MA	2	School of Engineering
Yale University	New Haven, CT	5	School of Engineering and Applied Science
Stanford University	Stanford, CA	6	School of Engineering
University of Chicago	Chicago, IL	6	School of Molecular Engineering
University of Pennsylvania	Philadelphia, PA	8	School of Engineering and Applied Science
California Institute of Technology	Pasadena, CA	9	Division of Engineering and Applied Science
Duke University	Durham, NC	9	School of Engineering
Johns Hopkins University	Baltimore, MD	9	
Northwestern University	Evanston, IL	9	School of Engineering and Applied Science
Rice University	Houston, TX	17	School of Engineering
University of California--Los Angeles	Los Angeles, CA	20	School of Engineering and Applied Science
University of Florida	Gainesville, FL	28	College of Engineering
University of California--Irvine	Irvine, CA	36	School of Engineering
University of California--Davis	Davis, CA	38	College of Engineering
University of Texas at Austin	Austin,TX	38	School of Engineering
University of Georgia	Athens, GA	48	College of Engineering
Purdue University--West Lafayette	West Lafayette, IN	49	College of Engineering - Polytechnic Institute
Texas A&M University	College Station, TX	68	College of Engineering
Baylor University	Waco, TX	75	School of Engineering and Computer Science
Brigham Young University--Provo	Provo, UT	79	College of Engineering
Michigan State University	East Lansing, MI	83	College of Engineering
University of Delaware	Newark, DE	93	College of Engineering
Auburn University	Auburn, AL	99	College of Engineering
University of Utah	Salt Lake City, UT	99	College of Engineering

https://www.usnews.com/best-colleges/rankings/national-universities?study=Engineering+Technologies+and+Engineering-Related+Fields&_sort=rank&_sortDirection=asc&_mode=table

OTHER QUESTION AREAS:

ACCREDITATION:

Because the merger of the colleges is an administrative/ organizational structure change and not a change to the programs within each college, there would be no direct impact to either SACSCOC or ABET accreditation. Accreditation issues becomes relevant when programs are moved (discontinued) from one campus to another, programs are closed or if resources are significantly reduced (faculty, staff, labs, library) that they no longer meet minimum requirements of the accrediting agency for a quality program.

SACSCOC: Internal changes to organizational structure would not impact SACSCOC accreditation and are not part of the SACSCOC substantive change policy. While not directly part of the merger discussion, completely moving programs from the main campus to the Sugarland/Katy campus (no longer offered at the main campus) is a substantive change and requires SACSCOC action in the form of a notification or approval.

> *"SACSCOC accredits an entire institution. Accreditation extends to all programs and services of an institution wherever located and however delivered. SACSCOC does not accredit individual programs, locations, or portions of an institution. However, some new programs, locations, and other institutional changes are subject to notification and/or approval as defined in Substantive Change Policy and Procedures"*
> *https://www.sacscoc.org/app/uploads/2019/08/SubstantiveChange.pdf*

ABET Accreditation: ABET accreditation is at the program level and is not impacted by a shift in administrative reporting from one college to another. Program accreditation should not be impacted by a merger of the two colleges. If re-accreditation schedules of the multiple ABET accredited programs could be synced to all occur at the same time, there may be some savings in time and effort to prepare the multiple reports.

> *"We accredit programs only–not degrees, departments, colleges, institutions, or individuals. We define a program as an integrated, organized experience that culminates in the awarding of a degree. The program will have program educational objectives, student outcomes, a curriculum, faculty, and facilities, as described in the accreditation criteria. We do not accredit certification, training, or doctoral programs."*
> https://www.abet.org/accreditation/

ABET, along with other accrediting agencies (ATMAE, ACCE, ACCGC, AAFCS) will require a notification of changes to leadership positions that impact the programs. UH would be required to submit the names of a new dean and department chair if impacted. With the retirement of Dean Ambler, notification will be required informing the accrediting agency of the individual who is filling that leadership role.

RANKINGS

U.S. News - The overall University of Houston Best- Colleges Undergraduate ranking for Public National Universities would not be impacted by the merger. The merger has the possibility of improving the ranking if the benefit of increased research expenditures is obtained.

U.S. News Undergraduate Engineering program rankings, UH is classified as Engineering - Doctorate Offered. UH is tied, ranked at #86 overall. UH is not ranked in any of the sub-categories (e.g. Civil, Chemical, Biomedical, and Industrial). Changes to our organizational structure would most likely not have any impact on these ranking since they are based solely on peer assessments.

> *"The undergraduate engineering program rankings were based solely on peer assessment Surveys. To appear on an undergraduate engineering survey, a school must have an Undergraduate engineering program accredited by ABET. These programs are split into two groups: schools whose highest engineering degree offered is a doctorate and schools whose highest engineering degree offered is a bachelor's or master's."* https://www.usnews.com/best-colleges/rankings/engineering

U.S. News Graduate School program rankings are based on data provided to U.S. News by the Cullen College of Engineering.

"A doctorate in engineering gives students a chance to shift their focus, further specialize or learn to manage others in the field. These degrees can be research-based or professional. The latter mostly takes a managerial and technical approach. The best engineering schools offer graduate programs designed to deepen engineering skills and expand career options. These programs marry technical curriculum with a background in professional skills like management, finance and communication."

> *"To start, U.S. News surveyed 214 engineering schools that grant doctoral degrees. This data collection was used for the overall rankings, for 13 specialty rankings and for populating each school's profile on usnews.com. Statistical data was collected in fall 2021 and early 2022"*
>
> *"Engineering specialty rankings, such as chemical engineering and civil engineering, are based solely on peer assessments by department heads in each specialty area."*
>
> https://www.usnews.com/education/best-graduate-schools/articles/engineering-schools-methodology

The Cullen College graduate school currently ranks 71st overall and the Petroleum Engineering program is ranked #10 in the nation.

A merger of the Cullen School of Engineering and the College of Technology is not likely to have a significant impact on the specialty rankings since they are based solely on peer assessment and if the merger is done properly a programs reputation should not suffer through the organizational shift. One area of concern is the overall College of Engineering ranking where low funding in the College of Technology could impact ratios in the data. These would be:

- average research expenditures per faculty member,
- percentage of faculty in the National Academy of Engineering

Ratios where a merger could help or hinder are:

- full-time doctoral students to full-time tenured or tenure-track faculty
- full-time master's students to full-time tenured or tenure-track faculty

The last area of concern would be the impact on student selectivity. It is unknown what the impact of a new admission policy would be on selectivity measures. Since this only involves admission to graduate level programs, the differences in admission policies that exist at the undergraduate level would not impact these measures.

ASEE – Top Producer Lists

The College of Technology is currently recognized by the American Society of Engineering Education (ASEE) as the top producer bachelor's degrees in technology in 2020. UH was also recognized as the top producer of Technology bachelor degrees awarded to underrepresented minorities. These rankings would not be impacted by a merger of the two colleges

QS World Ranking

QS World rankings are based primarily on reputation surveys along with the number of international students, international faculty, student/ faculty ratio and faculty citations. In the QS World Ranking, the UH Engineering program is currently ranked 308th in the World. As a note, in 2022 QS changed the category label from *Engineering* to *Engineering & Technology*.

CONCLUSION

The SWOT analysis has identified both benefits and challenges of a potential merger of the Cullen College of Engineering and the College of Technology. The information gathered through this process should be used as a reference for areas of focus should the decision to proceed with a merger take place.

Background data and information is found in the Appendix

Appendix

Analysis of Impact on Rankings
College of Engineering – College of Technology Merger

Undergraduate Level: Engineering Programs
https://www.usnews.com/education/best-colleges/articles/undergraduate-engineering-programs-methodology

The U.S. News & World Report Best Undergraduate Engineering Programs rankings are based solely on the judgments of deans and senior faculty at peer institutions. The institutions ranked are grouped by those that offer doctoral degrees and those that offer only bachelor's or master's degrees.

U.S. News also asked respondents for nominations of up to 15 of the best undergraduate engineering programs in 12 specialty areas:

• Aerospace / aeronautical / astronautical	• Electrical / electronic / communications
• Bioengineering / biomedical	• Environmental / environmental health
• Biological and agricultural	• Industrial / manufacturing / systems
• Chemical	• Materials
• Civil	• Mechanical
• Computer engineering	• Petroleum

Schools receiving the most mentions in each specialty appear on the site ranked in order by the number of mentions. A school or program had to receive seven or more top-15 nominations in a specialty area to be listed.

Finding:

1) There is no indication the merger would negatively impact the measures determining the University of Houston's overall Best College Ranking – Undergraduate National Universities.
    a. The ranking of the Technology - Mechanical Engineering Tech program may see a positive impact through association with a College of Engineering.

Graduate Level: Engineering Programs

The publisher invites Engineering Programs that grant doctoral degrees to provide data and participate in the U.S. News Graduate Program rankings. Programs rankings are based on scores in four categories.

1. **Quality assessment (40%)**
    a. Peer Assessment Score (25%) – Survey of Engineering School Deans and Deans of Graduate Studies at Engineering Schools
    b. Recruiter Assessment Score (15%) – Survey of corporate recruiters, employers, and company contacts. Engineering schools provide U.S. News with the names of respondents for the recruiter assessment survey.
2. **Faculty resources: (25%)**
    a. Doctoral Degrees Awarded (6.25%)
    b. Student to Faculty Ratios
        i. Full-time doctoral students to full-time, tenured or tenure-track faculty (7.5%)
        ii. Full-time master's students to full-time, tenured or tenure-track faculty (3.75%)
    c. Percentage of faculty in the National Academy of Engineering (7.5%)
3. **Research Activity Indicators (25%)** *U.S. News' statistical surveys use the definition of research expenditures employed by the American Society for Engineering Education* (ASEE).
    a. Total Research Expenditures
    b. Average Research Expenditure per Full-Time Faculty Member

4. **Student Selectivity (10%)**
    a. Mean GRE Quantitative Score (6.75%)
    b. Acceptance Rate (3.25%)

Assumptions:

1. UH College of Technology was not previously ranked due to a lack of doctoral program offerings
2. Based on ASEE definitions, non-engineering disciplines/programs housed in a college of engineering that are not engineering programs will not be included in the engineering total counts. Computer science programs outside the College of Engineering will not be added to the engineering totals.
3. ASEE Disciplines are:

ASEE Engineering Disciplines	ASEE Engineering Technology Disciplines
Aerospace Engineering	Aerospace Engineering Technology
Agricultural Engineering	Agricultural Engineering Technology
Architectural Engineering	Architectural Engineering Technology
Biomedical Engineering	Civil Engineering Technology
Chemical Engineering	Computer Engineering Technology
Civil Engineering	Construction Engineering Technology
Civil/Environmental Engineering	Electrical Engineering Technology
Computer Engineering	Engineering Technology (General)
Computer Science (inside engineering)	Industrial/Manufacturing Engineering Technology
Computer Science (outside engineering)*	Mechanical Engineering Technology
Electrical/Computer Engineering	Other Engineering Technology Disciplines
Electrical Engineering	
Engineering (General)	
Engineering Management	
Engr. Science and Engr. Physics	
Environmental Engineering	
Industrial/Manufacturing Engineering	
Mechanical Engineering	
Metallurgical and Materials Engineering	
Mining Engineering	
Nuclear Engineering	
Other Engineering Disciplines	
Petroleum Engineering	

Findings:

The actual impact on the College of Engineering's overall ranking is difficult to assess. The most probable areas of impact are those associated with ratios, including (1) Student to Full-Time Faculty ratios, (2) percent of faculty in the NAE, and (3) average research expenditures per faculty member. The main impact will be as a result of the College of Technology ASEE program data that will be added to the College of Engineering data on the U.S. News and ASEE reports. The actual impact on College of Engineering rankings will depend on the weighting and method used by U.S. News for their publication year.

Specialty Ranking Impact:

Engineering schools provide U.S. News with the names of schools granting doctoral degrees in each specialty. Specialty rankings in 2023 were in the disciplines of:

- Aerospace Engineering
- Agricultural Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Science (inside engineering)
- Electrical Engineering
- Environmental Engineering
- Industrial/Manufacturing Engineering
- Material Engineering
- Mechanical Engineering
- Nuclear Engineering
- Petroleum Engineering

Rankings in specialty areas are based solely on peer assessments by department heads in each specialty area. Since the UH College of Technology does not currently offer any doctoral programs in the listed specialty areas, there would not be any impact at the specialty level.

Summary:

There would not be any anticipated impact of the University of Houston's overall U.S. News Best Colleges undergraduate ranking.

For discipline-specific graduate rankings, the publisher collects data by discipline and degree level. Therefore, non-engineering programs in the College of Technology would not become part of the data used in ranking for the College of Engineering programs.

Engineering Potential Concerns: The most significant concern for a negative impact would be at the graduate level and based on the impact of including the Mechanical Engineering Technology. The degree of impact depends on the number of students, full-time tenure/tenure track faculty, the student to faculty ratios within Engineering, and the specialty discipline. A reduced percentage of faculty who are members of the NAE should also be anticipated when more faculty are included in the counts.

Engineering Unknown: The comparative research productivity of the Mechanical Engineering Technology faculty in the two colleges could impact the research dollars per full-time faculty measure. While the degree of impact is unknown, it would be based on the research productivity of the Mechanical Engineering Technology faculty in the College of Technology as compared to the College of Engineering Mechanical Engineering faculty.

Engineering Positive Outcomes: The total research dollars would increase with the added dollars from the Mechanical Engineering Technology program. Also, the Mechanical Engineering Technology program may benefit in reputation being associated with a College of Engineering instead of a College of Technology.

As with any U.S. News ranking, the process and criteria are subject to change from year to year, and actual impacts are not possible to measure with any degree of certainty.