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LETTER FROM THE EDITOR

This volume of AIR Professional File includes two very different types of investigations—one using large scale national data and the other an in-depth case study.

The first article, *National Trends in Federal Student Loan Borrowing by Income Group and First-Generation Status*, is the result of research conducted as part of the 2018 NCES Data Institute. The Institute provides intensive training on the use of NCES datasets and research methodologies. Monnica Chan and her colleagues analyzed data from the National Postsecondary Student Aid Study over a 16-year span to explore student loan debt burdens across family income groups and parental education level. Their findings, some of them surprising, contribute to the ongoing dialogue about college affordability.

In the second article, *Community College Business Intelligence*, Leezet Llorance describes the process, implementation, and impact of a comprehensive business intelligence system at a community college in Texas. The project was notable for its innovative blending of appreciative inquiry with BI tools and processes. Llorance details how the transformational impact of this effort enhanced decision-making at the college and helped deliver on its commitments to stakeholders.

Before you go, take a moment to consider what you want to do with that paper or project you planned to present at the 2020 AIR Forum. Within the in-person Forum falling victim to the pandemic, you have the opportunity to reach an even larger audience for your work by publishing it in the AIR Professional File. Why not get off the couch and send it?

To your good health,

Sharron Ronco

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National Trends in Federal Student Loan Borrowing by Income Group and First-Generation Status

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Abstract

Students are increasingly likely to use student loans to finance their postsecondary education. This article examines how students' use of federal loans changed from 2000 to 2016 by students'

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family income group and parental education level[1]. We use logistic regression analysis and nationally representative data from the National Postsecondary Student Aid Study. We find that the odds of a student taking out a loan have converged over time across family income groups and across parental education levels, even after controlling for institutional sector and student demographic characteristics. Low-to-moderate-income students are now just as likely to borrow as are low-income students; likewise, continuing-generation college students are just as likely to borrow as are first-generation college students. Converging borrowing behavior across student groups has important implications for how we measure and benchmark college affordability.

Keywords: student loan, debt, income, first-generation

INTRODUCTION

College affordability has become a defining issue for students, advocates, and policymakers (Goldrick-Rab, 2016). Evolving policies surrounding financial aid, disinvestment of states from higher education, and increasing participation of low-income students in postsecondary education have shifted the ways students pay for college (Akers & Chingos, 2016). Whereas eligible students once received grants to offset college costs, students today often borrow federal student loans to supplement grant aid and their own financial resources. The impact of these changes has led to postsecondary students borrowing at unprecedented rates.

Within the United States, student borrowing has reached record levels, recently surpassing $1.59 trillion, with the average student loan debt per household tripling over the past 20 years (Board of Governors of the Federal Reserve, 2019). In 2017, nearly two out of three (65%) graduating undergraduate students took out student loans, with an average debt per student of $28,650 (The Institute for College Access & Success [TICAS], 2018). Disaggregated data show that low-income students are more likely to borrow, and they subsequently graduate with higher debt burdens. In 2011–2012, 55% of bachelor's degree recipients from the highest family income quartile graduated with student loan debt, compared to 79% of those from the lower half of the income distribution (Baum, Elliott, & Ma, 2014). These statistics highlight the growing imbalance among students who need to borrow and those who do not. Furthermore, the average amount borrowed among 2016 college graduates receiving a Pell Grant, a frequently used proxy for low-income status (Soria, 2018), was $31,200, while first-generation college students borrowed approximately $26,700 (TICAS, 2019). This $4,500 difference illustrates that borrowing patterns among these seemingly monolithic groups are more heterogeneous than the extant literature often treats them.

In this article, we examine how borrowing patterns have changed for students from different family income groups and by parental education level across almost two decades. More specifically, we use nationally representative data from the National Postsecondary Student Aid Study (NPSAS) to understand how the odds of borrowing have changed and the extent to which average loan amounts changed among undergraduate students from 2000 to 2016. The following two research questions guided our study:

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1. The term "parental education level" refers either to students whose parents have completed at least a bachelor's degree (i.e., continuing-generation college students) or to students whose parents have no college (i.e., first-generation college students). We use the terms "parental education level," "parents' highest education level," and "generational status" interchangeably within this article.

Framing Questions

1| How have the odds of a student taking out a loan changed from 2000 to 2016 among undergraduates across family income groups, and by first-generation college student status?

2| How has the average amount of student loans among undergraduate borrowers changed from 2000 to 2016 across family income groups and first-generation status among undergraduate borrowers?

We find that, between 2000 and 2012, and irrespective of family income group and parental education level, students were increasingly more likely to take out student loans over time. And, although the share of students borrowing fell between 2012 and 2016, students are still borrowing at higher rates than in the past. Results highlight that by 2016, the borrowing rates of low-to-moderate-income students were indistinguishable from the borrowing rates of low-income students. Similarly, continuing-generation college students are just as likely to take out student loans as first-generation college students. The convergence in borrowing patterns across these student groups illustrates a fundamental shift in student financing of higher education: Students across all family income groups increasingly borrow to cover the costs of college, with lower-income students taking on greater loan burdens relative to their higher-income peers.

Before presenting our results in detail, we first situate our work within the broader empirical literature on student borrowing and describe our data and methods. We then discuss the implications of our work and propose questions for institutional researchers, academic leaders, and policymakers to consider in their decision-making.

LITERATURE REVIEW

Escalating college costs have widespread implications, especially for students from low-income backgrounds and/or those from first-generation households that already face a myriad of barriers on the pathway to college (Ardoin, 2017; Goldrick-Rab, 2016; Hillman, Gast, & George-Jackson, 2013; Roderick, Nagaoka, Coca, & Moeller, 2009). High college costs, both perceived and actual, can have important effects on students' decisions whether to attend college and, if so, which college to attend (Dynarski, Libassi, Michelmore, & Owen, 2018). The prospect of needing to borrow can even deter some students' participation in higher education altogether (Boatman, Evans, & Soliz, 2017). Identifying why and how borrowing has increased over time is paramount to understanding how students participate and succeed in higher education. In this section we summarize why student borrowing has increased; how borrowing affects students before, during, and after college; and who is most affected by student debt.

Why Student Borrowing Has Increased

The growth in student borrowing over time has been attributed to a number of political, economic, and social conditions. These changes include evolving policies surrounding financial aid, divestment of states from higher education, and increasing participation in postsecondary education, especially among low-income students and racially minoritized students, both of whom tend to have greater financial need (Akers & Chingos, 2016; Baum, 2016; Gordon & Hedlund, 2019; McMillan Cottom, 2017).

EVOLVING POLICIES SURROUNDING FINANCIAL AID

Financial aid programs have a long history in the U.S. postsecondary system; the Higher Education Act of 1965 developed student grant aid and low-interest loan programs, such as the Educational Opportunity Grant program and the Federal Family Education Loan program. As a result of these programs, college attendance became a viable option for low-income students. Although these early financial aid policies concerned need-based grant aid, as the cost of college began to rise in the mid- to late-1970s policies shifted to expand access to loans. For example, the Middle Income Student Assistance Act of 1978 removed income restrictions for unsubsidized loans, thereby expanding the federal student loan program to moderate-income students.

Amendments to the Higher Education Act in 1992 led to the expansion of non-need-based loan programs, particularly through the creation of the Free Application for Federal Student Aid (FAFSA), the Direct Loan pilot program, unsubsidized Stafford loans, and elevated borrowing limits (Gladieux, 1995). Policy changes in the early 2000s decreased loan fees, increased loan limits, amended interest rates, shifted the disbursement of federal loans from the Federal Family Education Loan program to the Direct Loan program, and increased the maximum federal Pell Grant award. By 2012, total education loan debt exceeded total auto loan debt for the first time, surpassing the $1 trillion mark (FinAid, 2010). In 2016, 83% of students participated in federal financial aid programs, and 46% of full-time, first-time degree- or certificate-seeking undergraduate students were awarded student loans as part of their aid (National Center for Education Statistics [NCES], 2017).

DIVESTMENT OF STATES FROM HIGHER EDUCATION

Increased rates of borrowing can also be attributed to growing college costs, especially as a result of the relative decline of public investment in higher education over time (Akers & Chingos, 2016). Between 2007 and 2017 state funding for higher education decreased 8% per full-time enrolled student, with an 11% decrease since 1987 (adjusted for inflation; College Board, 2019). Shrinking state appropriations have led to institutions' growing reliance on private money, which accounts for increases in tuition and fees (Curs & Singell, 2010; Kelchen, 2016).

INCREASING PARTICIPATION IN POSTSECONDARY EDUCATION, ESPECIALLY AMONG LOW-INCOME AND RACIALLY MINORITIZED STUDENTS

In addition to shifts in policy and fiscal support, the large debt total can also be attributed to increased participation in higher education over time, both in terms of total enrollment and in terms of recent growing student diversity (Snyder, de Brey, & Dillow, 2019). Although high-income students and white students have historically participated in college at higher rates than low-income students and racially minoritized students, these enrollment gaps have been closing over time, with economically and racially diverse students all relying more heavily on loans to meet high college costs (Chan et al., 2019; Goldrick-Rab, 2016).

How Borrowing Affects Students Before, During, and After College

As more students incur educational debt, it is

important for policymakers to understand the effects of loans on students during and after college. Although identifying these effects can be methodologically challenging due to inherent differences between borrowers and non-borrowers, the evidence associates borrowing with adverse long-term economic outcomes for students (Akers & Chingos, 2016; Baum, 2016).

In 2015, more than a million students defaulted on federal direct loans (Perna, Kvaal, & Ruiz, 2017). Students who do not complete a college credential and those who attend for-profit institutions are more likely than their peers to default on student loans (Looney & Yannelis, 2015; Perna et al., 2017). Financially independent, first-generation, and racially minoritized students are also more likely to have difficulty repaying loans, as measured by default rates, negative amortization rates, and repayment rates (Looney & Yannelis, 2015). Additionally, while research demonstrates mixed results for each of these outcomes, at least some quasi-experimental work has found that debt negatively affects graduate school attendance for students who attended public institutions (Zhang, 2013); deters graduates from lower-paying, public-interest careers in nonprofit, government, and education sectors (Field, 2009; Rothstein & Rouse, 2011); and is negatively associated both with being married and having children (Velez, Cominole, & Bentz, 2019), and with home ownership (Bleemer, Brown, Lee, Strair, & van der Klaauw, 2017; Mezza, Ringo, Sherlund, & Sommer, 2016).

Who Is Most Affected by Student Debt

Given that not all students borrow equal amounts, the negative effects of borrowing are most likely to be seen among those who borrow the most. Examining how borrowing varies across student groups and how those differences change over time is one way to ascertain whether college is unaffordable, and for whom.

Generally, lower-income students are more likely than their higher-income peers to borrow (Hillman, 2015). Similarly, first-generation college students are also more likely to borrow compared to their continuing-generation peers (Furquim, Glasener, Oster, McCall, & DesJardins, 2017; Houle, 2014). Parents with undergraduate degrees may be better able to help their child navigate complicated financial aid processes and to promote college-going behavior (McDonough, 1997). Students' socioeconomic background and institutional price may also inform observed differences in college choice and resulting borrowing behaviors.

Using the National Longitudinal Study of Youth 1997 (U.S. Bureau of Labor Statistics, 1997), Houle (2014) found that institutional price moderates the likelihood and level of borrowing. Students' family income and parental education levels more strongly predict borrowing behavior at higher-cost institutions. Too, although socioeconomically advantaged and continuing-generation students are more likely to borrow in order to attend selective and elite institutions, socioeconomically disadvantaged and first-generation college students are more likely to enroll in institutions with lower completion rates, such as public 2-year colleges and costly for-profit institutions (Cataldi, Bennett, & Chen, 2018; Looney & Yannelis, 2015; McMillan Cottom, 2017).

Although there is a need for additional research on the short- and long-term effects of borrowing, better understanding the differences in borrowing behavior across student groups may be one step toward addressing the lower educational attainment rates of low-income and first-

generation college students. This article builds on the existing literature on borrowing differences across students' socioeconomic status by using a nationally representative sample to explore how the amounts borrowed and the odds of borrowing for more socioeconomically disadvantaged and first-generation college students have changed over time (i.e., from 2000 to 2016).

DATA AND METHODS

To address our research questions, we analyze trends in undergraduate borrowing using publicly available data from the NPSAS through the NCES DataLab PowerStats tool. NCES DataLab allows users to conduct research and access results on unit record NCES data sets such as NPSAS without the need to obtain a restricted-use license. The DataLab has three analytic tools—QuickStats, PowerStats, and TrendStats. For this analysis we used PowerStats, a tool that allows users to generate descriptive analysis, correlation matrices, and regression analysis. Specifically, we used the logistic regression function to identify whether students' family income group and parental education level predict a student's likelihood of borrowing.

NPSAS is a survey administered every four years by NCES to a nationally representative sample of undergraduate and graduate students to collect data on financial aid. NPSAS uses a cross-sectional complex survey design, first collecting data from a sample of institutions eligible for Title IV federal funding, then collecting data on a sample of enrolled students from these institutions. Data come from institutional records, the National Student Loan Data System, and other administrative sources. Due to its use of administrative instead of self-reported data, NPSAS is one of the most accurate and comprehensive sources of student financial aid data (Brown, Haughwout,

Lee, & van der Klaauw, 2011). In 2018, NCES began conducting administrative waves of NPSAS in 2-year cycles to supplement the 4-year administrations.

To explore how the likelihood of a student taking out a federal loan has changed over time across student groups, we conducted logistic regression using a binary measure of whether a student takes out a federal Title IV loan (excluding PLUS Loans, which are student loans available to the parents of dependent students) as our outcome, using data from NPSAS surveys administered to undergraduates in 2000, 2004, 2008, 2012, and 2016. Similar to all regression analyses, logistic regression can identify an association between predictors and outcomes while controlling for all other covariates. Logistic regression is useful when an outcome variable is binary and analyzes whether predictors are associated with the binary outcome.

In our analysis we look at how demographic characteristics, such as a student's financial dependency or parental education level, change their likelihood of borrowing over time. First, we categorized students into four income categories: low-income (family income $29,999 or less in the survey year), low-to-moderate income ($30,000–$59,999), moderate-to-high income ($60,000–$99,999), and high income (family income of $100,000 or more). We categorize students as first-generation if they report that the highest parental education level was, "did not complete high school," "high school diploma or equivalent," or "vocational or technical training." We categorize students who report other parental education levels, such as, "less than 2 years of college," "associate's degree," and "higher levels", as continuing-generation students in order to maintain consistency across each survey administration.[2] Students are defined as financially independent for the purposes of federal student aid if they are 24 years of age or older, have legal dependents, are

married, are a veteran or active duty member of the armed forces, are emancipated minors, or were in foster care when 13 years of age or older, among other possible criteria. Additionally, we also control for race/ethnicity and institutional sector enrolled.

FINDINGS

Table 1 shows the average amount of Title IV loans borrowed and the percent of students who borrowed federal funds over the past five NPSAS administrations by family income, race/ethnicity, institution type, dependency status, and generational status. The number of students borrowing federal funds has increased over time, with 28% of students borrowing in 2000 and 36% of students borrowing in 2016. These changes are not isolated to students from the lowest income category. For example, in 2000, 25% of moderate-to-high-income students borrowed, compared to 37% in 2016. Borrowing increased even more dramatically among high-income students, with the share of students borrowing nearly doubling from 2000 to 2016.

Across NPSAS waves, the average amount borrowed increased from $4,211 to $6,729. The average amount among borrowers has continuously increased across income categories, with the largest increase occurring between the 2008 and 2012 NPSAS surveys. Importantly, the average amount borrowed among low-income students increased at a faster rate compared to high-income students between 2012 and 2016. First-generation college students borrowed similar amounts to continuing-generation college students from 2000 to 2012, but in 2016, first-generation college students borrowed about $250 more on average than continuing-generation college students.

In Table 2, we estimate how race/ethnicity, income, sector attended, financial dependency status, and parents' highest education level affect the likelihood of students borrowing over time. All other family income groups are less likely to borrow compared to low-income students (reference group), although borrowing rates converge over time (Figure 1). In 2000, the odds of borrowing for low-income students were 2.5 times greater than the odds of borrowing for moderate-to-high-income students; by 2016 the odds of borrowing for low-income students had fallen to 1.25 times greater. Similarly, compared to low-to-moderate-income students, the odds of borrowing for low-income students were 1.6 times higher in 2000 than in 2016. These differences in borrowing rates closed over time, such that by 2016, low-to-moderate-income students had similar odds of borrowing as their low-income peers. Similarly, whereas in 2000, the odds of borrowing for first-generation college students were 1.3 times higher compared to continuing-generation students, these two groups of students borrowed at similar rates in 2016. Although these main predictors of socioeconomic disadvantage show a converging trend, it is important to emphasize that the overall probability of borrowing for our reference group (dependent, first-generation, white, low-income students attending a public 4-year institution) fell between 2012 and 2016 (Figure 2). It is also important to note that the likelihood of borrowing appears to diverge from 2000 to 2016 across students' race/ethnicity. Compared to white students, Black students have higher, and continually increasing, odds of borrowing. Asian and Hispanic students, conversely, have lower, and continually declining, odds of borrowing relative to their white peers.

2. Parental education levels were determined through student interviews. For interview nonrespondents, students' financial aid applications were used to fill in parental education levels. The financial aid application uses fewer categories (e.g., less than high school, high school, college) for parental education level than the student interview. Because information on higher levels of parental education, such as bachelor's degree, master's degree, first professional degree, and research and professional doctoral degrees, varies across survey years and whether the information is derived from the student interview or financial aid application, we focus on the difference between first-generation college students and continuing-generation college students.

Table 1. Average Amount Borrowed via Title IV Loans (excluding PLUS Loans) and Percent of Students Borrowing Title IV Loans by Family Income, Race/Ethnicity, Institution Type, Dependency Status, and Generational Status, 2000–2016

	2000 $	2000 %	2004 $	2004 %	2008 $	2008 %	2012 $	2012 %	2016 $	2016 %
Family Income										
Low-income	4,492.11 (31.35)	32.93 (0.39)	4,791.98 (31.99)	36.71 (0.51)	5,433.66 (26.89)	40.03 (0.34)	6,578.20 (26.66)	43.90 (0.37)	7,033.65 (31.42)	36.47 (0.28)
Low-to-moderate income	4,074.08 (34.08)	25.85 (0.41)	4,464.12 (33.43)	32.87 (0.47)	5,181.75 (37.03)	34.25 (0.38)	6,489.61 (48.93)	39.50 (0.48)	6,760.92 (55.36)	37.65 (0.47)
Moderate-to-high income	3,858.49 (45.27)	24.95 (0.54)	4,085.94 (43.88)	30.01 (0.7)	4,753.77 (40.06)	33.68 (0.47)	6,293.89 (48.49)	37.47 (0.77)	6,426.57 (52.64)	37.14 (0.52)
High income	3,848.42 (73.48)	18.64 (0.79)	3,911.47 (51.79)	23.41 (0.75)	4,471.85 (35.27)	26.85 (0.45)	6,204.69 (45.93)	33.51 (0.57)	6,192.89 (39.45)	34.57 (0.48)
Race/Ethnicity										
White	4,197.74 (25.27)	27.69 (0.32)	4,462.88 (27.05)	32.53 (0.55)	5,019.26 (22.31)	34.66 (0.28)	6,422.70 (25.72)	40.07 (0.32)	6,664.08 (27.13)	37.58 (0.36)
Black or African American	4,264.18 (76)	34.82 (1.69)	4,648.30 (74.91)	40.66 (1.65)	5,372.53 (50.01)	45.45 (0.92)	6,691.46 (57.27)	50.72 (0.82)	6,953.85 (53.21)	49.21 (0.76)
Hispanic or Latino	4,204.84 (105.05)	24.66 (1.26)	4,349.21 (60.9)	28.68 (0.92)	5,199.69 (56.23)	30.93 (0.72)	6,350.16 (63.89)	34.08 (0.84)	6,642.96 (66.53)	28.79 (0.6)
Asian, Native Hawaiian, or other Pacific Islander	4,292.42 (120.01)	21.04 (1.23)	4,431.97 (93.5)	22.23 (0.93)	5,016.17 (101.27)	23.22 (1.05)	6,276.83 (105.89)	27.69 (1.02)	6,670.17 (121.6)	21.36 (0.81)
American Indian or Alaska Native	3,813.00 (287.67)	22.69 (3.1)	4,667.85 (237.8)	29.03 (3.74)	4,713.70 (392.38)	32.29 (3.63)	5,998.10 (248.95)	40.98 (2.95)	6,425.67 (409.57)	29.49 (2.64)
Other	4,230.70 (173.86)	21.95 (2.28)	4,530.46 (157.02)	32.96 (2.04)	5,010.48 (329.82)	31.45 (3.55)				
More than one race	4,252.78 (155.28)	24.79 (1.53)	4,498.00 (141.61)	32.96 (1.37)	5,446.41 (139.11)	38.54 (1.4)	6,618.27 (118.59)	44.06 (1.4)	6,882.75 (130.51)	39.75 (1.55)
Institution Type										
Public 2-year institution	2,950.18 (63.18)	4.98 (0.12)	3,066.31 (135.85)	8.52 (0.21)	3,677.87 (45.71)	10.25 (0.11)	4,681.01 (48.11)	16.68 (0.22)	4,724.33 (40.29)	12.92 (0.15)
Public 4-year institution	4,110.35 (35.02)	39.79 (0.29)	4,590.30 (32.33)	44.17 (0.32)	5,178.92 (28.86)	43.04 (0.15)	6,587.23 (22.92)	48.04 (0.23)	6,743.82 (28.16)	45.02 (0.24)
Private not-for-profit 4-year institution	4,687.59 (46.32)	51.97 (0.62)	4,845.48 (48.07)	55.35 (0.52)	5,598.04 (42.82)	56.80 (0.38)	7,108.48 (43.01)	59.69 (0.37)	7,195.16 (37.55)	54.94 (0.35)
Private for-profit institution	4,462.93 (108.66)	76.14 (1.24)	4,704.73 (81.27)	76.69 (0.6)	5,383.56 (73.53)	81.75 (0.63)	7,025.94 (20.19)	70.78 (0.19)	7,783.79 (41.74)	62.32 (0.63)
Attended more than one or other institution types	4,094.98 (55.11)	33.23 (0.92)	4,370.18 (137.42)	33.39 (0.86)	5,030.34 (50.33)	40.69 (0.59)	6,473.00 (53.96)	45.96 (0.97)	6,715.38 (52.51)	45.75 (1.07)
Dependency Status										
Dependent student	3,763.01 (25.35)	34.52 (0.37)	3,920.22 (22.32)	36.72 (0.44)	4,539.16 (22.01)	36.90 (0.27)	5,832.40 (23.94)	41.40 (0.29)	5,966.16 (24.44)	40.35 (0.24)
Independent student	4,933.17 (44.45)	21.00 (0.31)	5,230.30 (33.72)	28.37 (0.33)	5,794.67 (25.53)	33.07 (0.26)	7,099.49 (30.45)	39.04 (0.3)	7,699.81 (33.83)	32.46 (0.24)
Generational Status										
No college	4,185.87 (29.58)	33.09 (0.41)	4,498.74 (30.06)	33.53 (0.34)	5,179.76 (26.53)	36.94 (0.33)	6,483.26 (30.83)	42.92 (0.34)	6,905.81 (48.78)	33.50 (0.4)
College	4,197.97 (24.6)	31.75 (0.34)	4,477.78 (32.11)	31.87 (0.3)	5,076.82 (19.3)	33.68 (0.23)	6,474.40 (25.39)	38.47 (0.25)	6,659.69 (23.49)	37.76 (0.21)
Overall	4,211.21 (14.36)	27.69 (0.1)	4,485.64 (22.35)	32.58 (0.14)	5,115.96 (11.09)	35.04 (0.08)	6,463.71 (15.48)	40.19 (0.1)	6,728.59 (14.43)	36.46 (0.09)

Table 2. Logistic Regression on Student Borrowing from NPSAS, by Wave

	2000 Odds-Ratio	2004 Odds-Ratio	2008 Odds-Ratio	2012 Odds-Ratio	2016 Odds-Ratio
Race/Ethnicity (Reference Group: White)					
Black	1.32*** [1.13, 1.55]	1.36*** [1.17, 1.58]	1.38*** [1.28, 1.48]	1.41*** [1.31, 1.53]	1.59*** [1.47, 1.72]
Hispanic	0.77*** [0.69, 0.86]	0.76*** [0.69, 0.85]	0.68*** [0.64, 0.73]	0.70*** [0.63, 0.77]	0.68*** [0.63, 0.73]
Asian/Pacific Islander	0.57*** [0.49, 0.67]	0.51*** [0.46, 0.56]	0.47*** [0.42, 0.52]	0.46*** [0.42, 0.51]	0.38*** [0.34, 0.43]
American Indian/Alaskan Native	0.83 [0.54, 1.26]	0.99 [0.73, 1.35]	0.92 [0.68, 1.24]	0.81~ [0.63, 1.02]	0.80 [0.59, 1.08]
Other	0.50*** [0.38, 0.66]	0.89 [0.73, 1.08]	0.71~ [0.48, 1.06]	0 —	0 —
More than one race	0.77*** [0.63, 0.94]	1.00 [0.87, 1.14]	1.07 [0.92, 1.25]	1.15* [1.00, 1.32]	1.10 [0.96, 1.27]
Income (Reference Group: Low-Income)					
Low-to-moderate income	0.61*** [0.56, 0.66]	0.72*** [0.67, 0.78]	0.74*** [0.70, 0.78]	0.76*** [0.71, 0.81]	0.96 [0.90, 1.02]
Moderate-to-high income	0.41*** [0.38, 0.45]	0.52*** [0.47, 0.57]	0.58*** [0.54, 0.62]	0.64*** [0.57, 0.71]	0.84*** [0.78, 0.90]
High income	0.19*** [0.17, 0.22]	0.30*** [0.28, 0.33]	0.32*** [0.30, 0.34]	0.42*** [0.38, 0.47]	0.53*** [0.50, 0.57]
Sector Attended (Reference Group: Public, 4-Year)					
Private nonprofit 4-year institution	0.08*** [0.08, 0.09]	0.11*** [0.11, 0.12]	0.14*** [0.13, 0.14]	0.19*** [0.19, 0.20]	0.18*** [0.17, 0.18]
Public 2-year institution	1.96*** [1.81, 2.12]	1.67*** [1.57, 1.77]	1.90*** [1.83, 1.98]	1.69*** [1.62, 1.77]	1.55*** [1.49, 1.61]
Private for-profit institution	5.14*** [4.31, 6.14]	4.05*** [3.68, 4.45]	5.81*** [5.29, 6.37]	2.32*** [2.22, 2.43]	2.06*** [1.93, 2.21]
Attended more than one or other types	0.67*** [0.61, 0.74]	0.66*** [0.61, 0.71]	0.93*** [0.88, 0.98]	0.91~ [0.83, 1.00]	1.05 [0.96, 1.15]
Financial Dependency Status (Reference Group: Dependent)					
Independent	0.45*** [0.42, 0.48]	0.54*** [0.51, 0.57]	0.58*** [0.55, 0.61]	0.67*** [0.62, 0.72]	0.62*** [0.59, 0.65]
Parents' Highest Education Level (Reference Group: No College)					
College	0.75*** [0.70, 0.80]	0.79*** [0.76, 0.84]	0.81*** [0.78, 0.85]	0.78*** [0.74, 0.82]	1.04 [0.98, 1.09]
N	39,300	75,300	107,300	90,200	87,400
Pseudo R²	0.2462	0.2187	0.2249	0.1516	0.1456

*Notes:* ~ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Estimates were generated using the U.S. Department of Education, National Center for Education Statistics, PowerStats Tool. The 95% confidence intervals are reported in brackets. The sample includes students enrolled at a Title IV-eligible institution, but not located in Puerto Rico. The sample was created using the COMPTO87 and T4ELIG variables. Sample sizes represent a coarsened number of cases. Race/ethnicity is based on the NPSAS variable RACE (RACE2 used in 2000 data). RACE categories have changed across NPSAS administrations. Estimates are reported for "Asian, Native Hawaiian or Pacific Islander" across all years for consistency across administrations. The "other" race category was removed from the survey in NPSAS:12 and NPSAS:16. Furthermore, students were able to self-identify as Hispanic or Latino in addition to another race (e.g., white or black) in all survey years. Institutional sector is based on variable SECTOR4 in all years. Two- and four-year for-profit institutions are categorized together. Other covariates are based on variables DEPEND and CINCOME. Income levels are defined as low: $29,999 or less; low to moderate: $30,000 to $59,999; moderate to high: $60,000 to $99,999; and high: $100,000 and above.

Figure 1. Odds of Borrowing Over Time Relative to Low-Income Students, 2000–2016
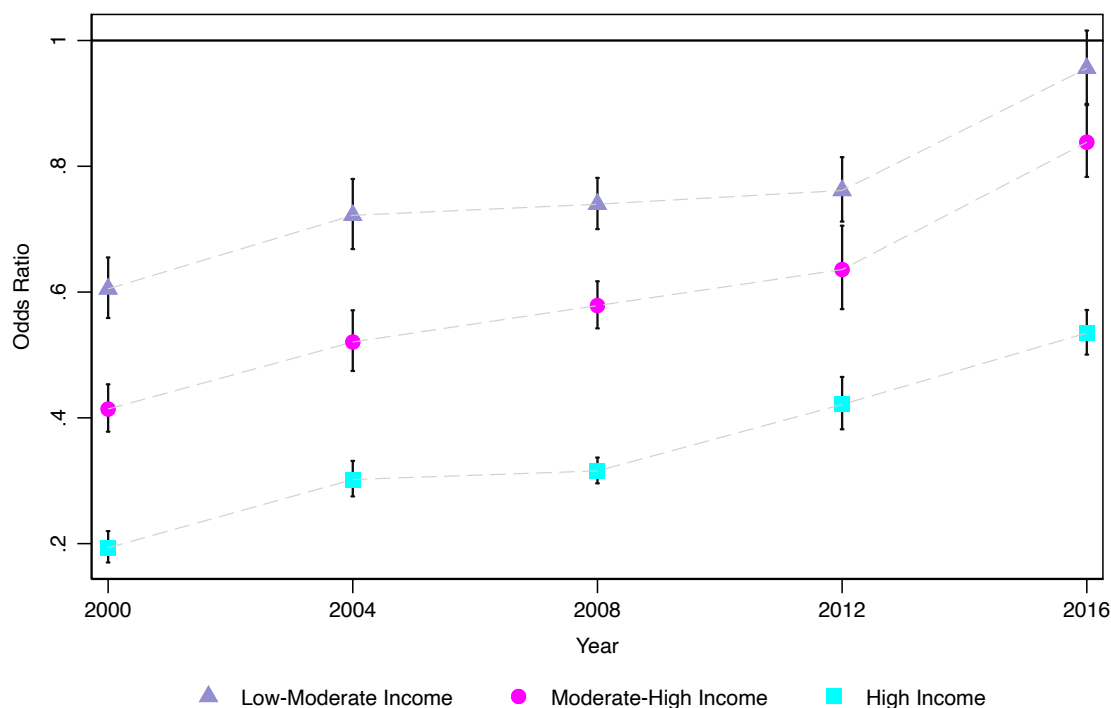
Notes: This figure plots the estimated odds of borrowing for dependent, first-generation, white undergraduates attending a public 4-year institution by family income group, relative to the odds of borrowing for low-income students (set to 1 across all years). The 95% confidence intervals are represented by the vertical lines.

Taken together, these results suggest that students are not only borrowing more but that, historically, socioeconomically advantaged students are now borrowing at rates similar to their less-advantaged peers.

DISCUSSION AND IMPLICATIONS

The purpose of this study was to explore student loan debt burdens across family income groups and by parental education level. Our results indicate that undergraduates were more likely to borrow, and to borrow more, over time (from 2000 to 2016). Our analyses show a convergence in borrowing patterns between low-income and low-to-moderate-income students, even after controlling for sector enrolled, financial dependency status, and race/ethnicity.

This finding is supported by the borrowing rates we observe across income categories: In 2000, one in three low-income students borrowed, compared to one in five high-income students. By 2016, however, one in three students borrowed across all income categories. We find a similar convergence in borrowing behavior across students with different parental education levels. By 2016, first-generation college students and continuing-generation college students borrowed at similar rates. Although low-income and first-generation college students are often categorized as less socioeconomically advantaged compared to high-income and continuing-generation peers, our findings contribute to the ongoing dialogue about college affordability by suggesting that college is becoming unaffordable, even for the country's more affluent students.

Figure 2. Likelihood of Borrowing for Dependent, First-Generation, White Students Attending a Public 4-Year Institution, by Family Income Group, Over Time
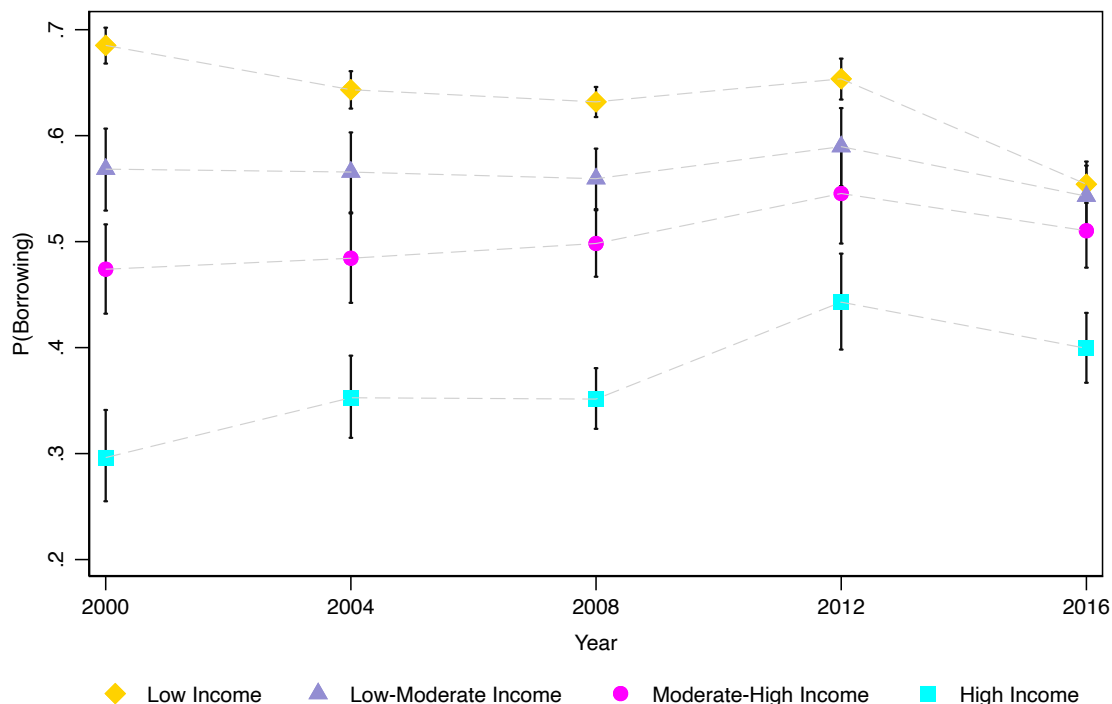
Notes: This figure plots the probability of borrowing for dependent, first-generation, white students attending a public 4-year institution across time for all four income categories in our analysis. Probabilities were calculated from the estimated odds ratios presented in Table 2.

While these findings are alarming, this study provides a framework for understanding larger trends in borrowing against which institutional researchers and administrators may contextualize student loan debt burdens of students on their campus. Researchers can use the NCES DataLab PowerStats tool to further refine our analysis for a particular campus by selecting and filtering specific institutional characteristics (e.g., public master's degree–granting institutions). In addition, DataLab tools allow researchers to select other markers of college affordability, such as PLUS Loan participation. Although institutional-level identifiers for NPSAS are unavailable via public NCES DataLab tools such as PowerStats, researchers can take advantage of public Integrated Postsecondary Education Data System (IPEDS) data, or seek restricted-use access to NPSAS data files for further analysis.

In addition to institutional benchmarking, future research should consider what students are borrowing to pay for. For example, traditional costs (e.g., tuition and fees) or extracurricular and nontuition costs of college (e.g., housing, clothing, and course materials) may offer nuanced perspectives on why students continue to borrow beyond tuition and fee expenses. More understanding of why students assume so much debt, how those decisions may vary across students' economic backgrounds, and the short- and long-term implications of these behaviors is needed to better understand the current context of student borrowing for higher education.

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Community College Business Intelligence

A Case Study at Lone Star College–Tomball Campus on a
Business Intelligence Approach to Community College Challenge

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Abstract

The purpose of this research study was to explore the process, implementation, and impact of a business intelligence (BI) strategic system at Lone Star College–Tomball Campus (LSC-T), Texas, to determine the effectiveness of BI on community college decision-making.[1] This research study (a) explored the process of implementing a new BI strategic system model at LSC-T, (b) evaluated the value of that system, and (c) gauged the impact of the new model on the college faculty and staff. The significance of this research study is the evaluation of the effect of BI on LSC-T's decision-making processes.

The design of this research is an intrinsic case study. Three instruments were used to gather data for this study: (a) interviews, (b) review and analysis of secondary or existing data, and (c) observational fieldwork. A significant outcome of the LSC-T effort was a 10.02% growth in contact hours over five consecutive semesters. A surprise in this exploration was the blending of David Cooperrider's appreciative inquiry process with the inquiry framework defined by Priyadarshini Chaplot, Kathy Booth, and Rob Johnstone to establish an appreciative inquiry framework.

A recommendation for further research on a BI strategic implementation would be the effect of using the blended appreciative inquiry framework with a commitment to a project planning methodology.

Keywords: community college, business intelligence, appreciative inquiry framework, business intelligence strategic system, Lonestar College-Tomball

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INTRODUCTION

Business intelligence (BI) uses methods and technologies that collect, store, report, and analyze business data to help organizations make better business decisions (EDUCAUSE, n.d.). Like universities, community colleges face many challenges, and perhaps they too could make better decisions by applying BI (Chakraborty, 2013). Chakraborty (2013) has written, "BI and analytics help optimise the entire education sector from the perspective of every stakeholderthe [sic] student, the institution, the faculty, the government and the industry." Some community colleges have implemented a BI strategic system to improve accountability that is linked to one of its most important challenges: funding. Other challenges beyond funding are changing learner preferences; changing learner demographics; increased competition; new educational alternatives; and an insufficient supply of qualified employees, compliance, rules, regulations, and guidelines (Komp & Nielson, 2016). In addition to these challenges, Chen (2017) published a paper in the Community College Review that identified seven problems community colleges face: low completion rates, large numbers of unprepared students, a wide workforce–skills gap, an undefined mission to meet the needs of students in the 21st century, minimal collaboration among schools, lack of community support, and lackluster results (Chen, 2017). These seven problems and challenges can be grouped into three categories: (a) accountability and performance, (b) strategy, and (c) organization.

Many companies within the corporate world have implemented a BI strategic system to achieve success and increase accountability to their stakeholders and to improve performance. So then why has this phenomenon not been accepted within higher education, and in particular within community colleges? The ideation of BI strategic systems by community colleges has begun to help them become more accountable to their stakeholders: students, taxpayers, and local communities. For example, Houston Community College in Texas has simplified its accreditation process using BI (Houston Community College, n.d.). Houston Community College implemented an academic dashboard in 2016. The benefits of implementing the dashboard were improved program review and enrollment management, replacement of individual spreadsheets, and the reduction of manual effort for data extraction. These benefits caused a positive impact on Houston Community College's accreditation and bottom line (HCC Academic Dashboard, 2017). As a result, the dashboard earned Houston Community College the 2017 Best of Texas Award for the best data analytics/business intelligence project.

In 2011, Cuyahoga Community College, in Cleveland, Ohio, implemented an enterprise data warehouse for historical data and an operational data store for current data. Cuyahoga Community College's reporting capabilities were expanded as a result (Cuyahoga Community College, n.d.). Later, in 2013, Cuyahoga Community College implemented an all-college dashboard with student-success metrics displaying current data (Cuyahoga Community College, n.d.). Additionally, St. Petersburg College, in St. Petersburg, Florida, used BI to improve baccalaureate-student success (Community College Baccalaureate Association, 2015). Between the fall of 2011 and the spring of 2014, St. Petersburg College implemented more than 20 dashboard elements that displayed student information.

These dashboards allowed quick access to information that the provosts and deans need to make decisions (Community College Baccalaureate Association, 2015). Although community colleges are implementing BI components, as businesses have been doing since BI's resurgence in 1956 (Heinze, 2014), a full BI strategic system consisting of multiple BI components based on real-time data to support decision-making is new to academia, unlike in business.

Statement of the Problem

Very limited research has been conducted on the value of a comprehensive BI strategic system to address challenges in community colleges. Therefore, the problem addressed in this study is the need for real-time decision-making to support one particular challenge of community colleges— namely, the new accountability requirement of community colleges to their stakeholders. Whereas the research literature has provided evidence that BI components are being implemented at some community colleges, comprehensive BI strategic implementation by a community college is rare. A comprehensive BI strategic implementation for accountability and performance involves the organization (people, processes), technology, and of course the data (Kuster & Rouse, 2009). Kuster and Rouse (2009) remarked, "Few institutions have experience in BI implementations and can articulate their deliverables, expected timeframes and projected costs. With the goal of providing 'take-action analytics' for the institution's urgent and emerging issues, a typical deliverable may need to integrate student, employee, financial, and external data." Some community colleges in Texas have implemented BI strategic systems as their new

business model. This research study will examine one Texas college's implementation of a BI strategic system to enhance decision-making and to deliver on commitments.

Purpose of the Study

BI can enable institutions to know their student (and faculty) customers; maximize student retention; capitalize on alumni loyalty; quickly respond to enrollment changes; manage curricula to market demand; improve admission, registration, and other process efficiencies; seek additional grants via better measurable objectives; and minimize time and effort involved in compliance reporting (Kuster & Rouse, 2009). The purpose of this research study was to explore the process, implementation, and impact of a BI strategic system at LSC-T in order to determine the effectiveness of BI on community college decision-making. The focus of this study was on the innovative approach by a community college to implement a business solution for an academic problem. The goal was to understand this process and its impact on the college.

Design of the Study

Three instruments were used to gather data for this case study: interviews, review and analysis of secondary or existing data, and observational fieldwork. Interviews were with the leader of the Office of Analytics & Institutional Reporting of the Lone Star College–System Office (LSC-SO), and the president and vice president of instruction of LSC-T who participated in the BI strategic implementation. For this study, constructed data consist of diagrams, charts, tables, and summaries to form a model created from secondary or existing

data on this institution's process. In addition, a third source of data collection came from observational fieldwork, which allowed for the observation of events and activities at LSC-T. The data collected from interviews, BI strategic system implementation documentation, and observation were segmented into implementation process, BI value, and college impact. The strategy used to promote qualitative research validity was triangulation.

In conclusion, a single community college in Texas was studied to understand its innovative process to implement a BI strategic system. Although the reasons for deciding to implement a BI strategic system was part of the research discovery, the focus was on the process to address the issues identified, and not on the issues themselves. BI is potentially critical to the success of a community college's decision-making process: "Attempts to analyze data without BI are clumsy" (Drake, 2017). Community colleges can potentially move to advanced analysis with BI.

CASE STUDY

The Issue

The new president of LSC-T, Lee Ann Nutt, inherited a budget in 2015 that had been reduced significantly—by 55% from 2014—due to declining contact hours. To create a sense of urgency, the president held a college-wide town-hall meeting to appeal to the hearts and minds of administration, faculty, and staff. Presentations reminded the college of events of the past year for their students and the community of LSC-T. All these joyful experiences would be lost if the economic

evidence of a 55% decreased budget were not addressed now. The president followed the pride-filled emotional response of the college to its past experiences with an address concerning the urgency to increase contact hours (Kotter, 2008). Data were presented with an explanation of the calculation of contact hours. The president explained that the calculations indicated declining contact hours and a declining budget over the four years prior to her administration.

Stakeholders

An external partnership was established between LSC-T and the Office of Analytics & Institutional Reporting. The external partnership allowed for a new strategic initiative methodology to be defined and unfolded within a culture of appreciative inquiry. The Office of Analytics & Institutional Reporting added value by offering a methodology of principles, tools, and practices to drive processes within guidelines.

Internally at LSC-T, four strategy groups were organized consisting of faculty and administration (Nutt, 2016, p. 5). Internal partnerships among the four strategy groups were needed to identify initiatives by examining their college's status quo in relation to strategic objectives, to solicit input from stakeholders from various departments/divisions, and to define risk management for the success of their initiatives. From an academic leadership standpoint, a means to engage faculty and staff at a community college in the institution's change process is advantageous. An aid to the exploration of the impact on behavioral change at a community college due to the implementation of its BI strategic system comes from David Cooperrider and Diana

Whitney's book *Appreciative Inquiry: A Positive Revolution in Change*. They define appreciative inquiry as a narrative-based process of positive change. They illustrate it as a cycle of activity that starts by engaging all members of an organization or community in a broad set of interviews and deep dialogue about strengths, resources, and capabilities (Cooperrider & Whitney, 2005, p. 15).

Data

As stated earlier, to address the issue of declining contact hours at LSC-T, the president offered an explanation of the calculation of contact hours in her town-hall meeting. The contact hours of the previous year (March–March) were the basis for funding the upcoming academic year (August–August). There are 10 categories of contact hours to be considered. Each of the following five categories consists of both fundable and nonfundable contact hours, for a total of 10 categories: (a) academic (credit), (b) workforce (credit, noncredit), (c) corporate, (d) community education, and (e) corporate college. Academic credit fundable is the largest category, followed by workforce credit fundable, making those the primary categories for contact hours. Since state funding is based on contact hours and accounts for 23% of the college's budget, an increase in academic and workforce credit fundable courses (enrollments, course offerings) should cause an increase in contact hours and thus an increase in state funding. The president of LSC-T set a goal of 104,154 contact hours over 5 academic years (Nutt, 2015, p. 51). How was this numeric goal calculated?

To reach the 5-year goal of an additional 104,154 contact hours, as mentioned previously, the president of LSC-T defined four growth strategies to guide initiative planning: (a) scholarships (to generate more, award more, and use more), (b) offerings (to offer more, schedule smart, and publicize more), (c) awards (to provide more certificates and degree opportunities), and (d) students (to enroll more and retain more) (Nutt, 2015, p. 63).

The analytics team of the Office of Analytics & Institutional Reporting was tasked with the implementation of the initiatives (defined by the four strategy groups) as scorecards with the following data elements:

- Initiative name (character data type)
- Initiative start date (numeric data type)
- Initiative end date (numeric data type)
- Key performance indicator (KPI) target value (numeric calculated value)
- KPI actual value (numeric calculated value)
- KPI metric (formula to evaluate input factors to determine success/failure results)

The institutional reporting team of the Office of Analytics & Reporting was tasked with KPI analysis as a narrative/report to be displayed on the scorecard.

For the KPI analysis report, comparison of the previous year's data with the current year's data was vital in the trend analysis for predictive analytics. In addition, prescriptive analysis could be used to determine which areas to focus on.

To monitor the implementation of initiatives, the four strategy teams at LSC-T were initially responsible for implementation project plans for each initiative using the Franklin Covey project management essentials methodology (FranklinCovey, 2013).

Resolution

THE RESOLUTION: PART A: WHAT DO WE NEED TO WORK ON? WHAT IS OUR AFFIRMATIVE TOPIC? SWOT ANALYSIS.

The new LSC president tasked the analytics team at LSC-SO to facilitate the alignment of administration and faculty with the four growth strategies by defining an operational roadmap (LSC-SO, 2015a, p. 2). To determine the current perspective of faculty and administration on their institution, the analytics team chose qualitative analysis using surveys and focus groups with the intention of mapping the answers to a SWOT (Strengths, Weaknesses, Opportunities, and Threats) diagram (Chaney, personal interview, 2017; Nutt, personal interview, 2017).

The answers to the 23 questions were placed into 21 categories and labeled according to the SWOT diagram. Each of the following is according to administration and faculty:

- LSC-T's strengths are (1) resonant leadership, (2) academic programs (veterinary technology, pharmacy technician, registered nursing, surgical technology, and drama), (3) community support, and (4) grit and growth mindset.

- LSC-T's weaknesses are (1) bounded rationality, (2) marketing strategy, (3) strategic partnerships, (4) student retention, (5) singular focus on the LSC-T community, (6) linguistic barriers, and (7) skewed fixed versus variable costs ratio.

- LSC-T's opportunities are (1) rebranding, (2) vet tech high school program on weekends, (3) campus facility optimization, (4) targeted demographic marketing, (5) online programs (international market), and (6) optimal scheduling.

- LSC-T's threats are (1) budget challenges, (2) nostalgia for sovereignty, (3) legacy/insular culture, and (4) few traditional growth options.

These SWOT results were reviewed by the president for prioritization and assignment to the four strategy growth groups. The groups were then assigned members to form cross-functional teams of administration and faculty. To assist the strategy groups, the analytics team delivered an operational roadmap document that included scope, approach, major activities, dependencies, assumptions, timelines, and the key business and financial benefits (LSC-SO, 2015a). This roadmap was used by the lead of each strategy focus group to define initiatives to increase contact hours, taking into consideration the identified strengths, weaknesses, opportunities, and threats assigned to them (Nutt, personal interview, 2017). Administration and faculty worked together to vet their initiatives to determine which were viable tactically within 1 year and strategically over a span of 5 years by identifying inhibitors to the initiatives and solutions to these inhibitors using an initiative feasibility rubric defined by the analytics team (Chaney, personal interview, 2017; Nutt, personal interview, 2017).

Action plans for the implementation of the vetted initiatives were expected to be defined by the teams. Project plans with timelines, resources, and deliverables were to be developed and maintained by each team lead for execution, monitoring, and accountability of the initiatives. The team leads met with the president on a regular standing schedule for status and feedback. These efforts were supported by a culture of inquiry.

Once planning began, it became clear a process was needed within the framework of the culture of inquiry; therefore, the process of appreciative inquiry was adopted and then applied to form a culture of appreciative inquiry for this effort. The process starts by engaging all members of an organization in dialogue about their positive core (strengths, resources, capabilities). It then moves them through a series of activities focused on envisioning bold possibilities. From there, it asks them to discuss and craft propositions that will guide their future together. Finally, it evolves into the formation of teams to carry out the new dream and designs for their future (Cooperrider & Whitney, 2005).

THE RESOLUTION: PART B: HOW DO WE DO THIS? THE CULTURE OF APPRECIATIVE INQUIRY WITH THE BOSTON CONSULTING GROUP (BCG) MATRIX.

To answer the question, "How do we keep up the communication momentum between faculty and administration on this long journey from identifying and vetting initiatives and their action steps to executing and monitoring them?," the president of LSC-T embraced appreciative inquiry. This mindset enabled a climate of no fear at the college, which freed everyone to offer ideas, to explore, and to discover (Nutt, personal interview, 2017): "She sold the vision, followed it up, did not micromanage, and gave people freedom," according to Quentin Wright, vice president of instruction of LSC-T (Wright, personal interview, 2017).

To support administrative decisions, community colleges routinely use their institutional databases and metrics to assess institutional effectiveness in terms of accreditation standards, graduation and transfer rates, and course schedules. Because of these efforts, some community colleges have successfully established a culture of evidence (Dowd, 2005). The next step is to analyze the data collected. That is, colleges cannot simply report on the data, but also need to understand and apply the data to increase student success and strengthen the institution, thereby making data actionable. The application of data insights can be achieved by defining action steps at each level of the institution. A culture of appreciative inquiry is the next step (Chaplot, Booth, & Johnstone, 2020). Routinely collecting data on student performance and institutional effectiveness (culture of evidence), combined with the institution-wide inclusion of practitioners to engage with these data and to define, implement, and monitor action plans, provides the building blocks of a culture of appreciative inquiry when focusing not on the negatives of an institution, but on its positives. This positive focus is the central point in the appreciative inquiry process to help an institution to grow by identifying and nourishing what it does right. It does not replace a culture of evidence; rather, it adds people, action, and data insight to it. This is what was needed at LSC-T under the leadership of its new president (Nutt, personal interview, 2017): "Her leadership to bring appreciative inquiry about cannot be underestimated" (Wright, personal interview, 2017). The institution needed to grow from a culture of evidence into a culture of appreciative inquiry (Chaney, personal interview, 2017) in order to work together from all four strategy growth groups to execute and monitor the vetted initiatives and their action steps.

There are five stages to build a framework (Chaplot et al., 2020) to support a culture of appreciative inquiry: a definition of the focus of inquiry (Stage 1) that shapes the data collection (or culture of evidence) and presentation (Stage 2) that is the basis of exploration (Stage 3) that is used to define action steps (Stage 4). The final stage (Stage 5) is the measurement of the action steps. Within this framework, a circular process of discovery of the institution's positive core was followed by envisioning bold possibilities (dream) and coconstructing propositions to guide the institution's future (design)

to a destiny that is sustained. "The real power of combining these things is in developing processes **in the context** of a methodology and applying methodologies in the context of a framework and most importantly, when you utilize all of those things **in the context of YOUR business"** (emphasis in original; Scottellis, 2008). Figure 1 is the appeciative inquiry framework that evolved from this project. It is a blending of David Cooperrider's appreciative inquiry process with the inquiry framework defined by Priyadarshini Chaplot, Kathy Booth, and Rob Johnstone (2020).

Figure 1. LSC-T's Culture of Appreciative Inquiry (Process within a Framework)
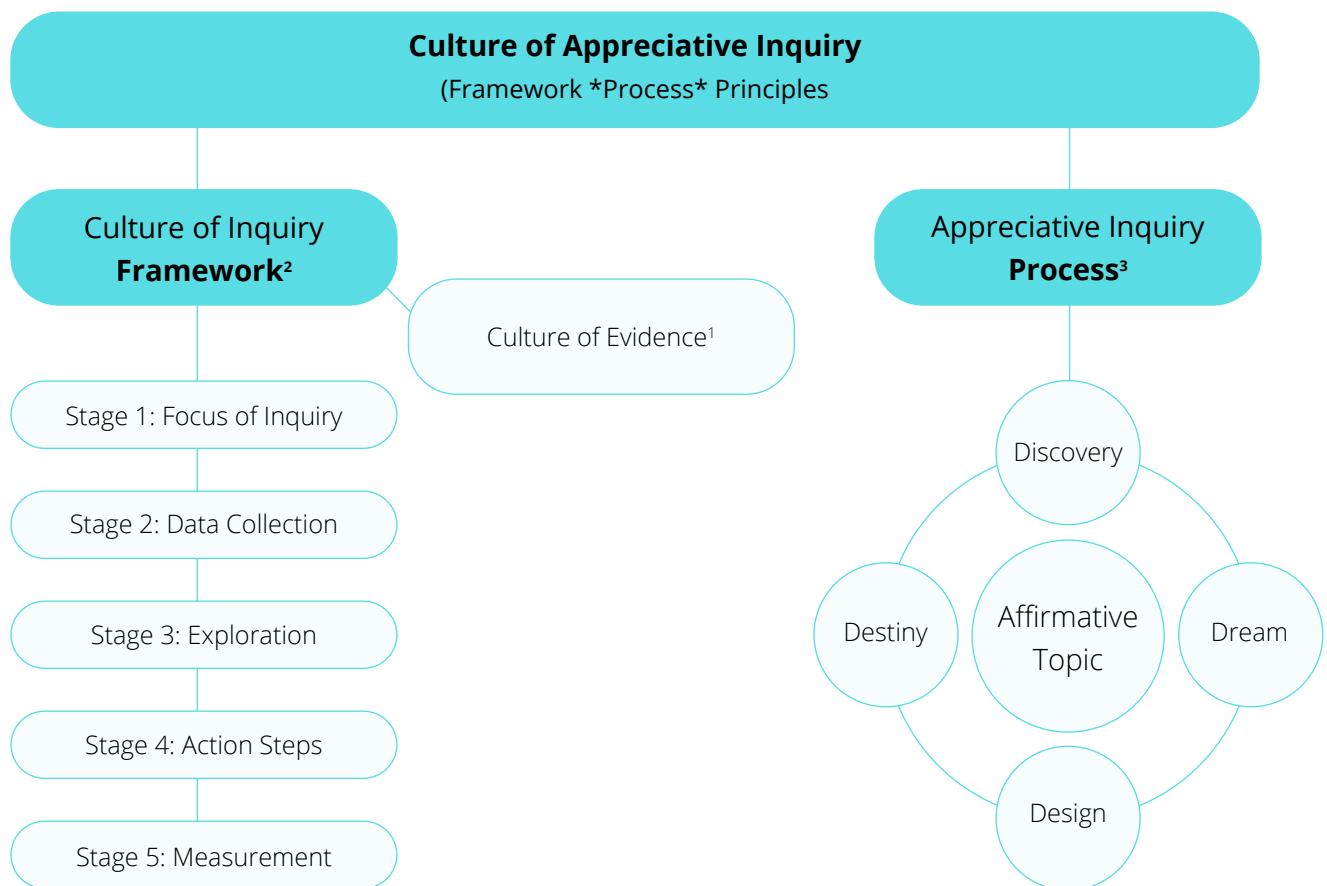
Source: Adapted from Chaplot et al. (n.d.); Cooperrider & Whitney (2005).

The current culture of the LSC-SO rests on six core cultural beliefs:

- **Students Matter:** I engage and support each student to achieve their goals.
- **Inspire Excellence:** I celebrate successes and value contributions of all employees.
- **Act Intentionally:** I create goals and make decisions based on meaningful data.
- **Better Together:** I share knowledge and encourage collaboration to reach common goals.
- **No Fear!:** I am empowered to effect positive change.
- **Trust!:** I practice transparent communication, encourage dialogue, and cultivate trust. (Lone Star College [LSC], 2015, p. 10)

The current LSC-SO culture was the starting point for applying two criteria of the culture of appreciative inquiry to LSC-T: leadership support, and investment for an institution-wide strategy, i.e., large-scale change and support (Chaplot et al., 2020).
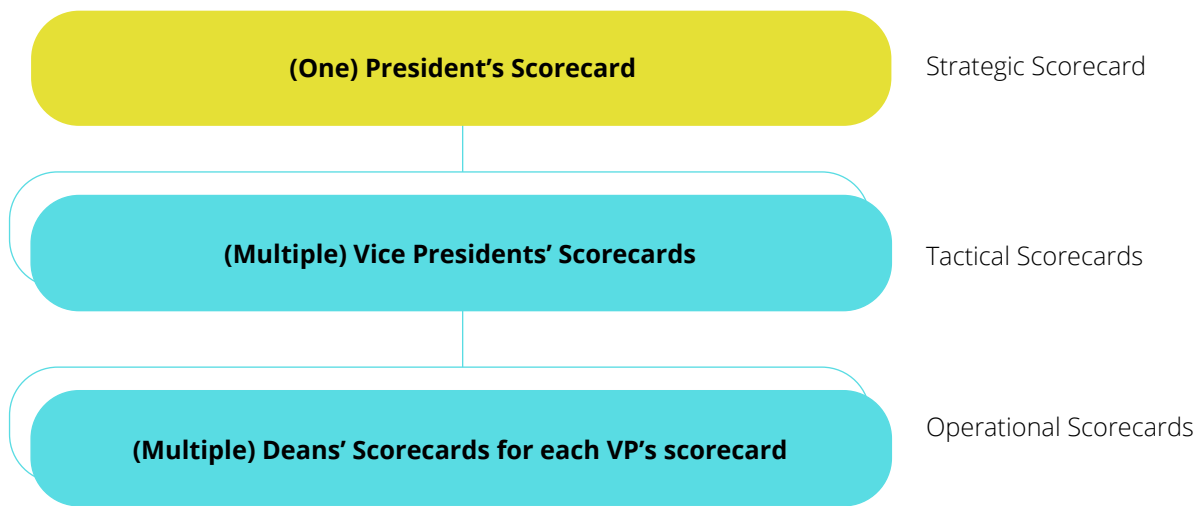
INQUIRY FRAMEWORK STAGE 1: FOCUS OF INQUIRY

The focus of inquiry was increased enrollment, without which there cannot be student success. The president of LSC-T adopted the chancellor's strategic goals listed above. As a result, her vice presidents, deans, department chairs, faculty, staff, and students were affected at her college. Appreciative inquiry shifted the mindset from problem analysis to positive core analysis based on the discovery of the strengths and opportunities (affirmative topics) identified in the SWOT analysis.

INQUIRY FRAMEWORK STAGE 2: DATA COLLECTION AND PRESENTATION

Promotion of student success by beginning with increased enrollment (defined in the president's town-hall meeting by increasing contact hours) shaped the data collection and presentation efforts that were led by the analytics team working with the president of LSC-T and her cabinet and faculty.

To support a culture of evidence, data from the student information system was stored independently on a server as the transaction system. To reduce traffic on this server due to report requests and data queries, a copy of it was made and used as a reporting system. This infrastructure supports a culture of evidence. With a culture of inquiry, a warehouse is also needed for archived and aggregated data to support visualization implemented as dashboards and scorecards (a type of dashboard). The use of scorecards allows the analytics team to implement not only a performance measurement framework, but also a strategic planning and management system for each level of the institution. The president's strategic plan could then evolve from a document to a strategic system. In the future, if the other areas of the president's strategic plan, particularly financials, are added to the scorecard, it will become a balanced (comprehensive) scorecard (Balanced Scorecard Basics, n.d.). The BI infrastructure team of the Office of Analytics & Institutional Reporting was responsible for the scorecard infrastructure planning using the concepts of Robert Kaplan and David Norton (Balanced Scorecard Basics, n.d.). Figure 2 was the proposed hierarchical structure of scorecards (to track contact hours in real time) offered to the president of LSC-T.

Figure 2. Hierarchical Structure of Scorecards Proposed by the Office of Analytics & Institutional Reporting

(One) President's Scorecard	Strategic Scorecard
(Multiple) Vice Presidents' Scorecards	Tactical Scorecards
(Multiple) Deans' Scorecards for each VP's scorecard	Operational Scorecards

Source: Adapted from LSC-SO (2015c).

INQUIRY FRAMEWORK STAGE 3

Exploration (Initiatives)

Data exploration at LSC-T consisted of multiple brainstorming sessions/workshops to identify initiatives to address enrollment increase and its role as the first step to student success. Participants at discussions included all levels of the institution (Nutt, personal interview, 2017). The appreciative inquiry process allowed participants to dream bold possibilities for LSC-T as they envisioned results of high numbers of contact hours and a sustainable budget.
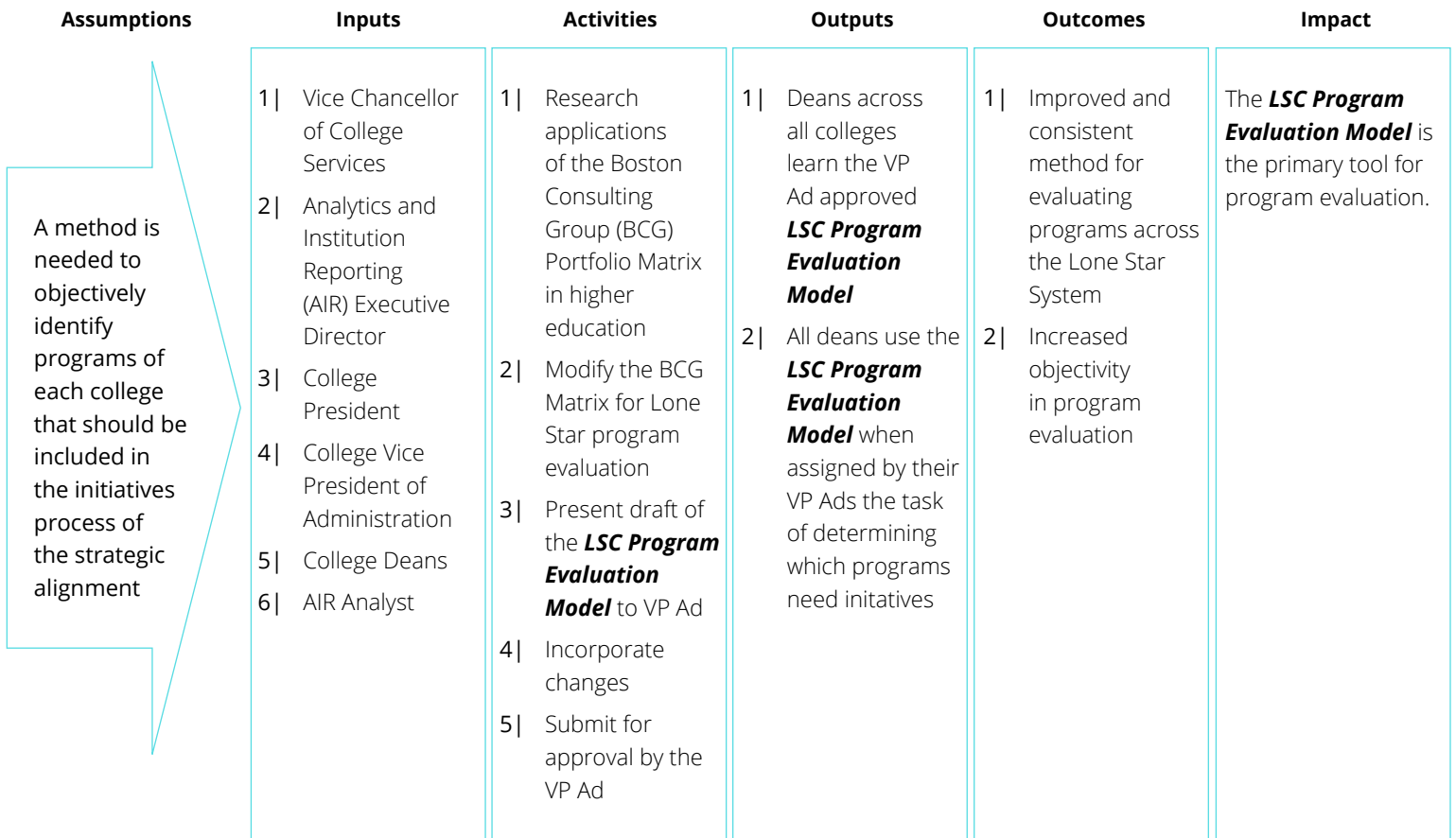
LSC-T initiatives were vetted using the initiative feasibility rubric defined by the analytics team. Vetting activities consisted of identifying inhibitors and solutions to the inhibitors and calculating feasibility scores for initiatives based on the feasibility score of all inhibitor/solution combinations for each initiative (Chaney, personal interview, 2017; Nutt, personal interview, 2017).

Exploration: BCG Matrix → LSC Program Evaluation Model

When all programs requiring initiatives cannot be easily and quickly identified, a method is needed to objectively identify programs to be included in the initiatives process. The logic model in Figure 3, based on Paul McCawley's process (McCawley, 2001), shows how the analytics team defined an LSC program evaluation model based on the BCG portfolio matrix.

Figure 3. Proposed Logic Model for LSC Program Evaluation Model

| Assumptions	Inputs	Activities	Outputs	Outcomes	Impact
A method is needed to objectively identify programs of each college that should be included in the initiatives process of the strategic alignment	1| Vice Chancellor of College Services 2| Analytics and Institution Reporting (AIR) Executive Director 3| College President 4| College Vice President of Administration 5| College Deans 6| AIR Analyst	1| Research applications of the Boston Consulting Group (BCG) Portfolio Matrix in higher education 2| Modify the BCG Matrix for Lone Star program evaluation 3| Present draft of the **LSC Program Evaluation Model** to VP Ad 4| Incorporate changes 5| Submit for approval by the VP Ad	1| Deans across all colleges learn the VP Ad approved **LSC Program Evaluation Model** 2| All deans use the **LSC Program Evaluation Model** when assigned by their VP Ads the task of determining which programs need initatives	1| Improved and consistent method for evaluating programs across the Lone Star System 2| Increased objectivity in program evaluation	The **LSC Program Evaluation Model** is the primary tool for program evaluation.

Source: Adapted from LSC-SO (2016).

The BCG portfolio matrix model, although used primarily by corporations, has been considered in academia for evaluation of faculty allocation at Carroll University (Debrecht & Levis, 2014), curriculum planning at Sam Houston State University (Sam Houston State University, n.d.), analysis of existing programs to be considered for investment at DePaul University (Mohr, 2011), and school product and services by the National College for Teaching & Leadership. Newbould was the first to discuss customization of the BCG portfolio matrix model for the evaluation of academic programs offered at universities (Wells & Wells, 2015). The goal of the Office of Analytics & Institutional Reporting was to customize the model for community colleges for the strategic evaluation of academic and workforce programs (resource allocation and growth) for an increase in enrollment. First, the office took the time to learn the BCG portfolio matrix model.

After learning the BCG portfolio matrix model, they customized it for LSC's environment and community college program evaluation. Figure 4 is the customized version for LSC.

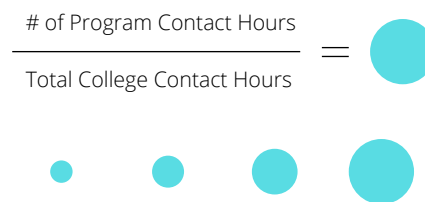**Figure 4. LSC Program Evaluation Model: Initial**
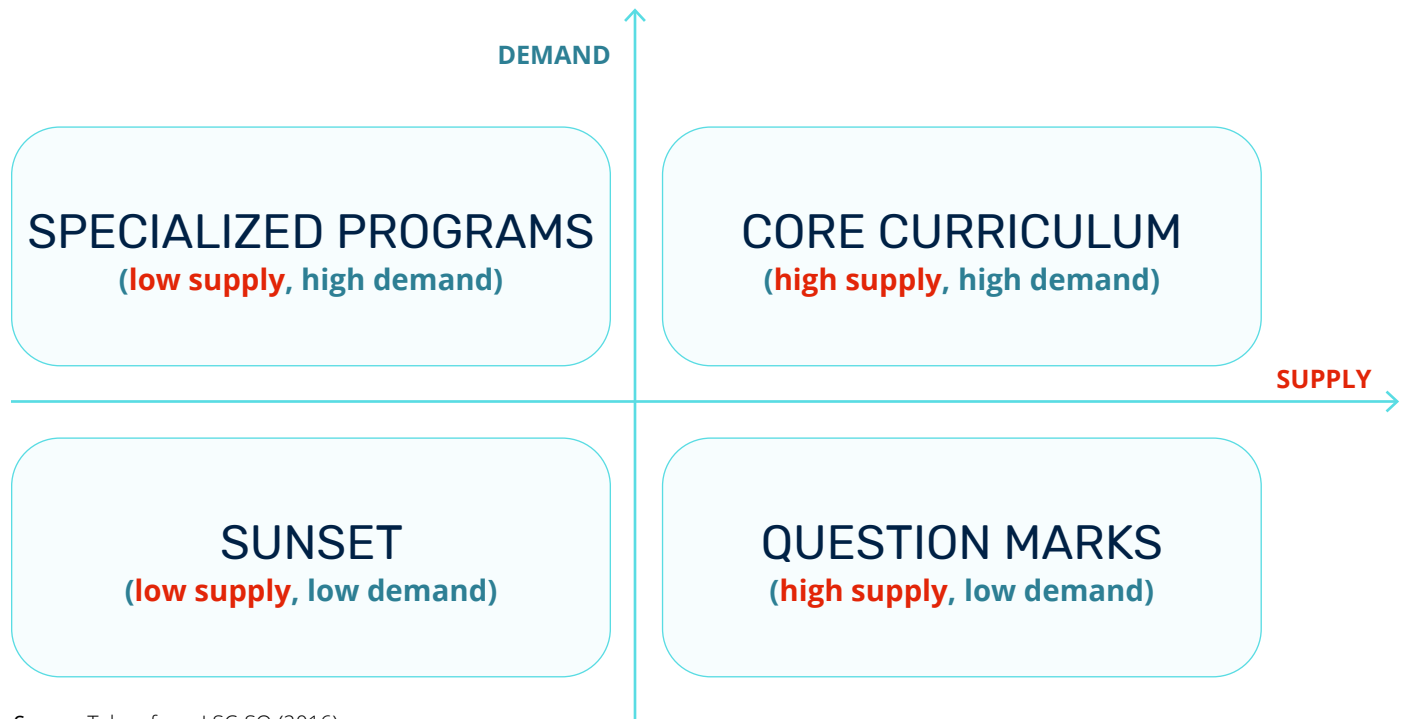
Source: Taken from LSC-SO (2016).

The following steps were offered to explain how to use LSC's new model for program evaluation (Jurevicius, 2013):

1| Select the academic/workforce program.

2| What are the contact hours for the program?

3| What are the contact hours for all college programs?

4| Plot the information on the grid to determine the strategy/recommendation (QuickMBA Strategic Management, 2015).

4.1. Program contact hours are represented by the size of a circle in relation to a circle representing the total college contact hours.
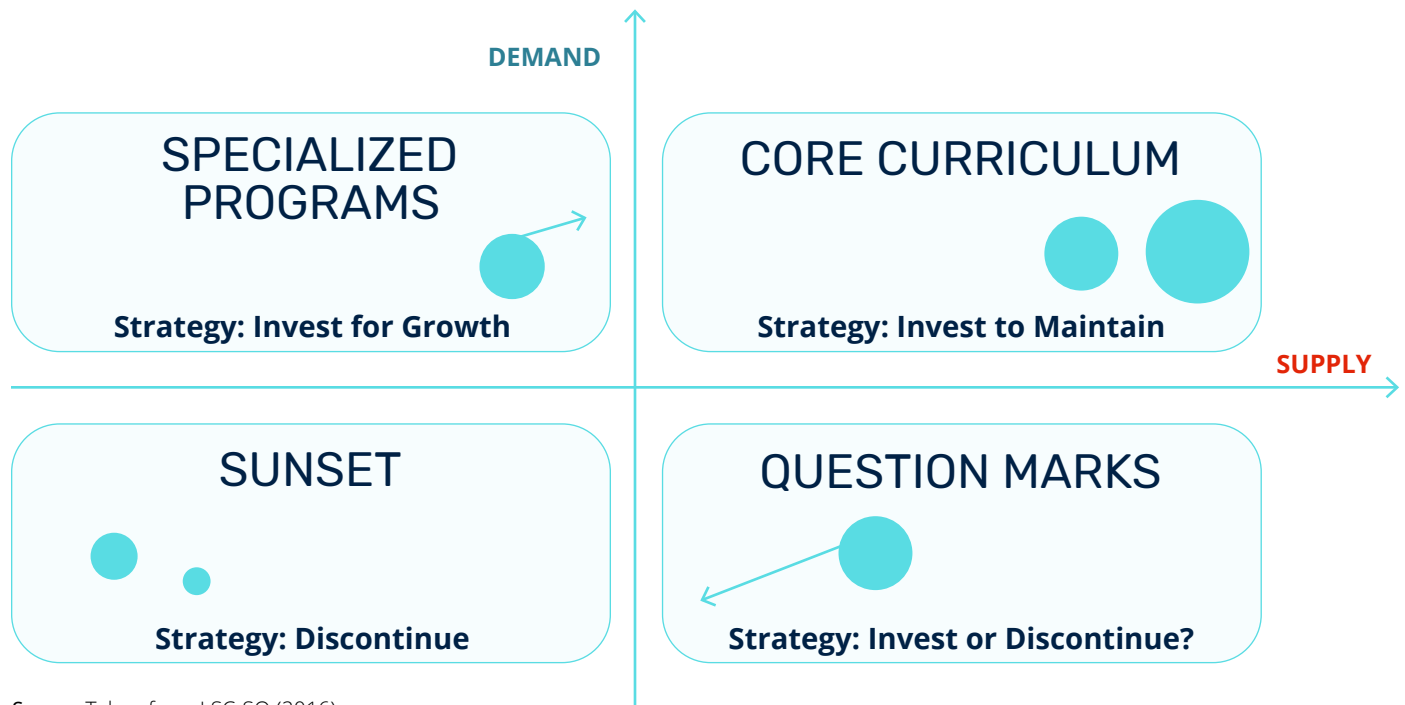

4.2. An arrow indicates the expected future position of the program.

4.3. Figure 5 is a plotted example.

Figure 5. LSC Program Evaluation Model: Final

Source: Taken from LSC-SO (2016).

The BI infrastructure team was responsible for mapping the initiatives in the scorecard implementation (Chaney, personal interview, 2017; Nutt, personal interview, 2017). Once initiatives were vetted and a final set had been approved by the president of LSC-T, the next task in this newly defined process for LSC-T was to define action steps for execution and monitoring of vetted initiatives.

INQUIRY FRAMEWORK STAGE 4: ACTION STEPS: PROJECT MANAGEMENT METHODOLOGY

Stage 4 involves detailed analysis of the student success and enrollment initiatives to define action steps. Essentially, the goal is to answer the question, "How are we going to implement XYZ initiative?" Office of Analytics & Institutional Reporting leadership was responsible for defining a project management methodology tailored to higher education. They adopted the Franklin Covey project management essentials methodology and applied it to this academic effort. The next step was the rollout of project planning workshops for LSC-T. These workshops explained that the previously defined action steps (of each group's initiatives) were to become the work breakdown structure of their project plans. Since start and end dates were mandatory for initiatives, it was explained in the workshops that those dates would become the start and end dates of the associated project plans. Post workshop, it was agreed that each strategy

group not only would define project plans for their initiatives but also would determine the frequency of status meetings and progress reports on their project plans. Since all levels of the institution were involved, there would be multiple project plans that would be connected and roll up into a master institution project plan. Project plans could then become the means to monitor the execution of vetted initiatives campus-wide. But monitoring was not enough: It was also necessary to have accountability.

INQUIRY FRAMEWORK STAGE 5: MEASUREMENT: KEY PERFORMANCE INDICATORS

Stage 5 addresses accountability through the implementation and monitoring of KPIs, which consist of a metric, a target value, and an actual value. The goal is for the actual value to equal the target value over a specified time as well as to make apparent any gaps between the two. KPIs are useful in determining the institution's effectiveness and operational efficiency. KPIs offer an objective way of determining if the strategic initiatives for student success and enrollment are working by offering verifiable measurements of accomplishments, not just the work performed (Balanced Scorecard Basics, n.d.). The monitoring of initiative execution (from Stage 4) combined with accountability ensures the sustainability of the college's efforts to increase enrollment and student success, which becomes the completion of the appreciative inquiry cycle; the realization of the Destiny phase.

The core metrics for enrollment (contact hours) and student success for LSC-T's BI strategic system are (a) headcount, (b) first-time-in-college persistence fall to spring, (c) first-time-in-college persistence fall to

fall, (d) student completion of developmental math requirements within a year, (e) student completion of developmental reading requirements within a year, (f) student completion of developmental writing requirements within a year, (g) number of students transferred to 4-year institution, and (h) number of degrees and certificates awarded overall by campus (LSC-SO, 2015b, p. 8). The analytics team and the BI infrastructure team were responsible for linking KPIs to initiatives in a scorecard implementation that would be LSC-T's BI strategic system (Chaney, personal interview, 2017; Nutt, personal interview, 2017).

A major feature of the BI strategic system is inquiry and analysis (Nutt, personal interview, 2017). An analyst from the institutional reporting team was assigned to work directly with the president of LSC-T, her cabinet, and her council. The institutional reporting analyst assisted with data analysis to answer such questions as, What happened?, Why did it happen?, Why will it happen?, and How can we make it happen? (Kellen, Recktenwald, & Burr, 2020) when monitoring the progress of initiatives and their associated KPIs. These focus questions align with the different types of analytics: descriptive, diagnostic, predictive, and prescriptive (Norris & Baer, 2013) and help to direct the flow of analysis to decision-making. The institutional reporting team and the analytics team worked together on reporting and data analytics to support decision making at LSC-T. The looping flow of inquiry and analytics is depicted in Figure 6, which was developed by the researcher.
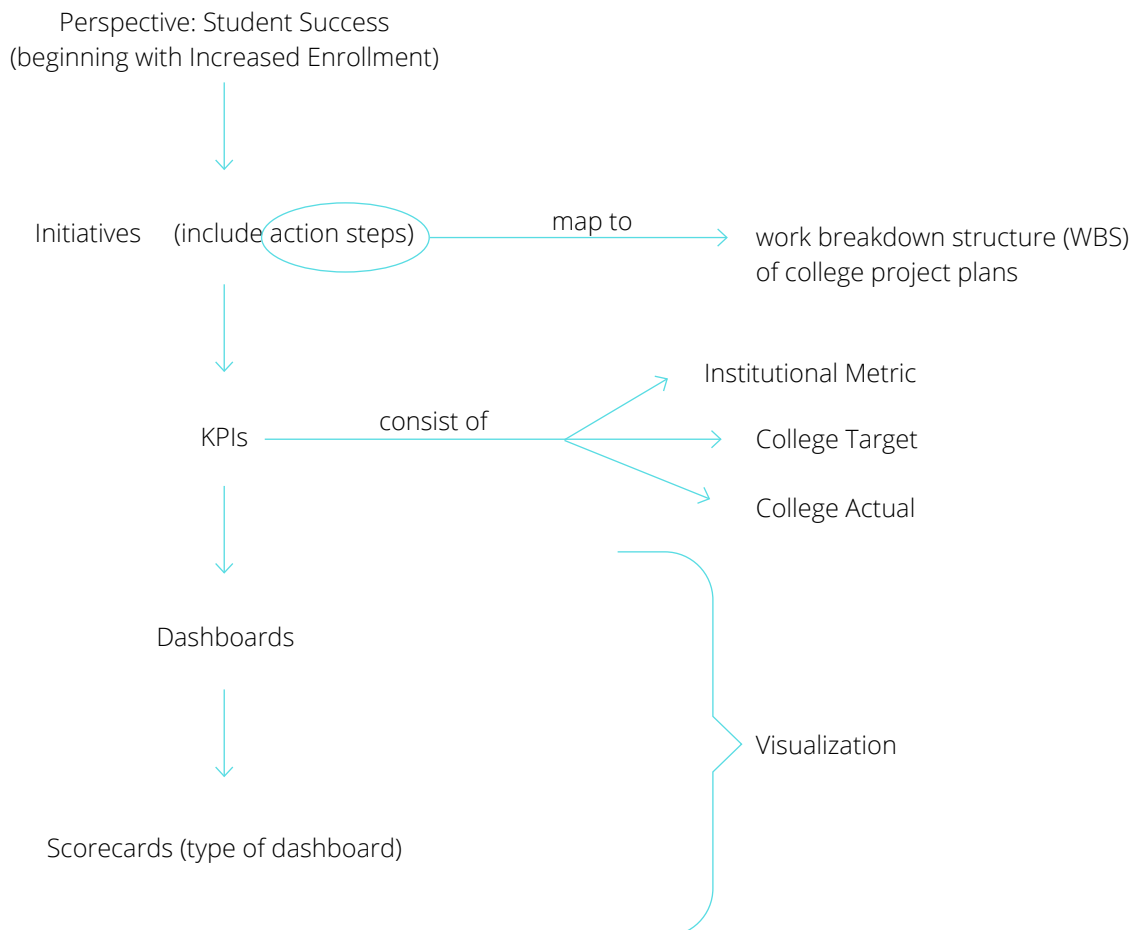
Figure 6. Inquiry and Analysis Flow

What happened?   **Why did it happen?**   **Why will it happen and how can we make it happen?**

HINDSIGHT
Via Descriptive Analytics

INSIGHT
Via Diagnostic Analytics

FORESIGHT
Via Predictive Analytics and Prescriptive Analytics

Source: Adapted from Norris (2013).

Figure 7 depicts the connections of initiatives and KPIs for the proposed scorecard implementation of the overall perspective on student success and enrollment. Notice that the action steps of initiatives map outside the implementation to administration through the work break down structure of college project plans.

Figure 7. Hierarchy of Implementation of Accountability

Perspective: Student Success
(beginning with Increased Enrollment)

Initiatives   (include action steps) — map to → work breakdown structure (WBS) of college project plans

KPIs — consist of → Institutional Metric / College Target / College Actual

Dashboards

Scorecards (type of dashboard)

Visualization

Source: Adapted from personal interviews with M. Chaney (2017, September 29) and L. A. Nutt (2017, September 26), L. M. Llorance, interviewer.

SUMMARY

A surprise in this exploration of a BI implementation at LSC-T was the unfolding of an appreciative inquiry framework that supports LSC-T's efforts: "LSC-Tomball used an Appreciative Inquiry framework that emphasized open and creative communication (inquiry) with a positive mindset (appreciation)" (Chaney, personal interview, 2017). What is unique at LSC-T is the blending of David Cooperrider's apprecia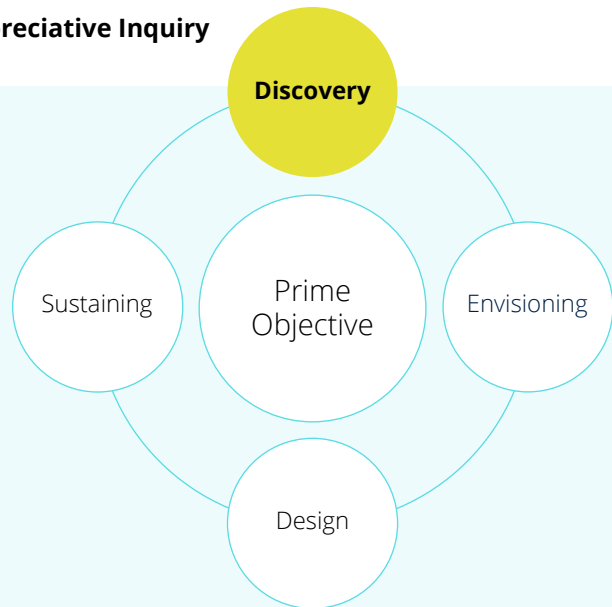tive inquiry process with the inquiry framework defined by Priyadarshini Chaplot, Kathy Booth, and Rob Johnstone (2020) to establish an appreciative inquiry framework.

Another unique point is that inquiry was campus-wide. According to LSC-T's president, Lee Ann Nutt, "This was and still is a campus-wide effort supported by no fear of inquiry. It is dependent on participation by everyone" (Nutt, personal interview, 2017).
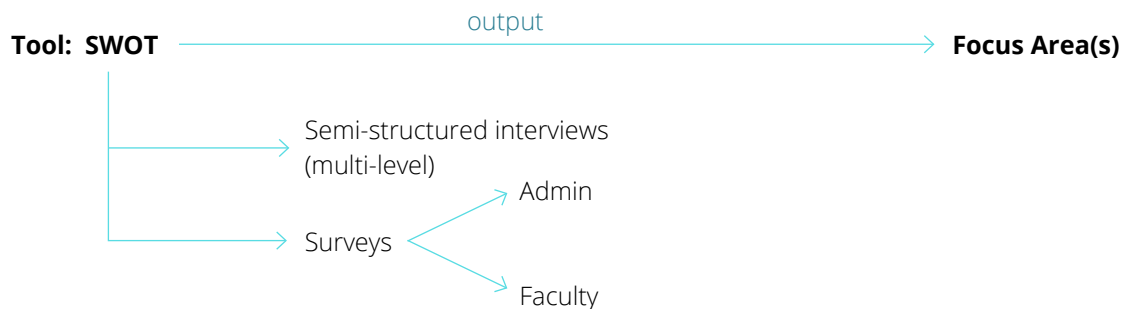
Figure 8 depicts this new appreciative inquiry framework integrated with the BI tools used by LSC-T at each of the five stages of the framework.

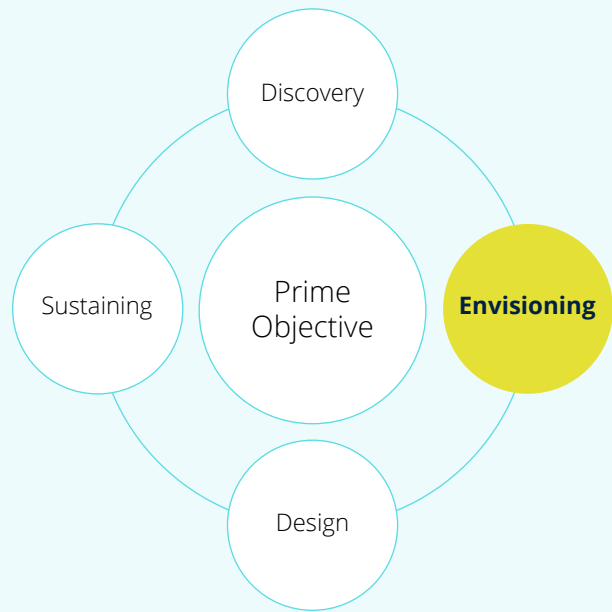**Figure 8. The Evolved Version of the Culture of Appreciative Inquiry**
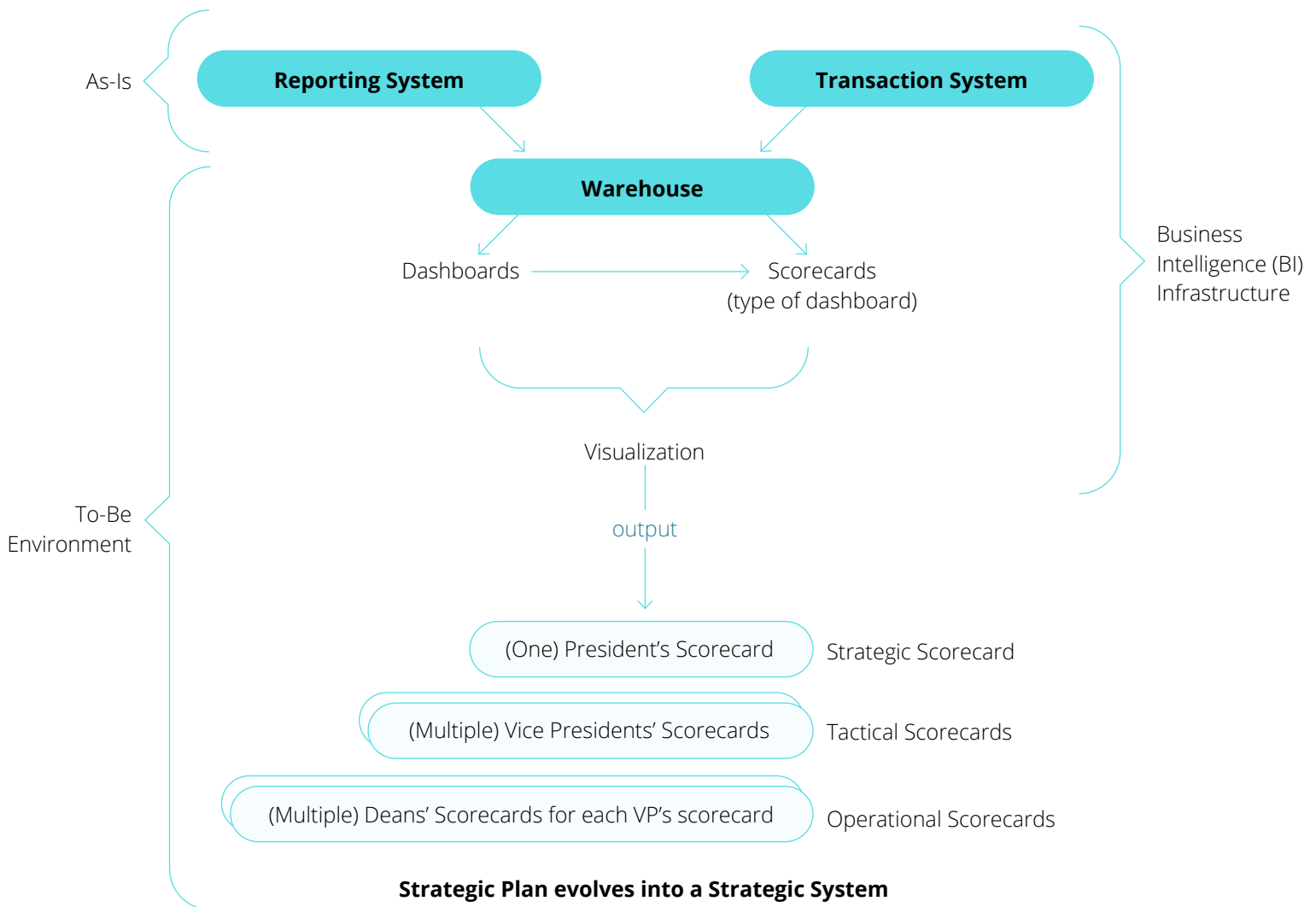
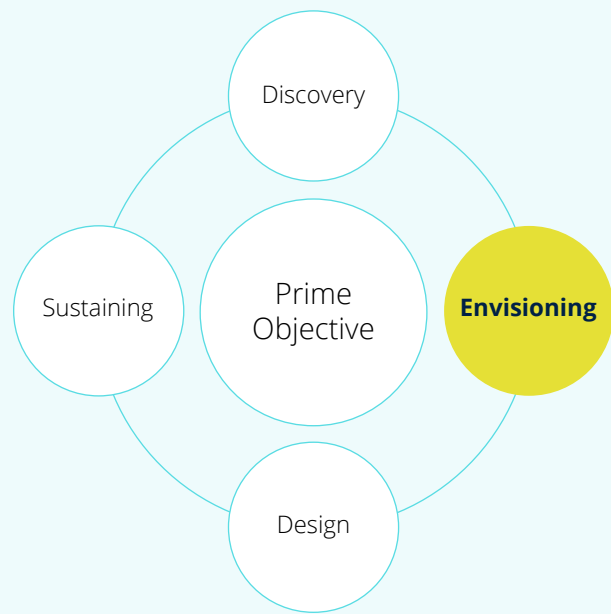

STAGE 1
Focus of Inquiry

WHAT DO WE NEED TO WORK ON?

Tool: **SWOT** → output → **Focus Area(s)**

- Semi-structured interviews (multi-level)
- Surveys
  - Admin
  - Faculty

STAGE 2
Data Collection and Presentation

Discovery

Sustaining

Prime
Objective

Envisioning

Design

Visualization

As-Is

Reporting System

Transaction System

Warehouse

Dashboards ⟶ Scorecards
(type of dashboard)

Business
Intelligence (BI)
Infrastructure

Visualization

output

To-Be
Environment

(One) President's Scorecard — Strategic Scorecard

(Multiple) Vice Presidents' Scorecards — Tactical Scorecards

(Multiple) Deans' Scorecards for each VP's scorecard — Operational Scorecards

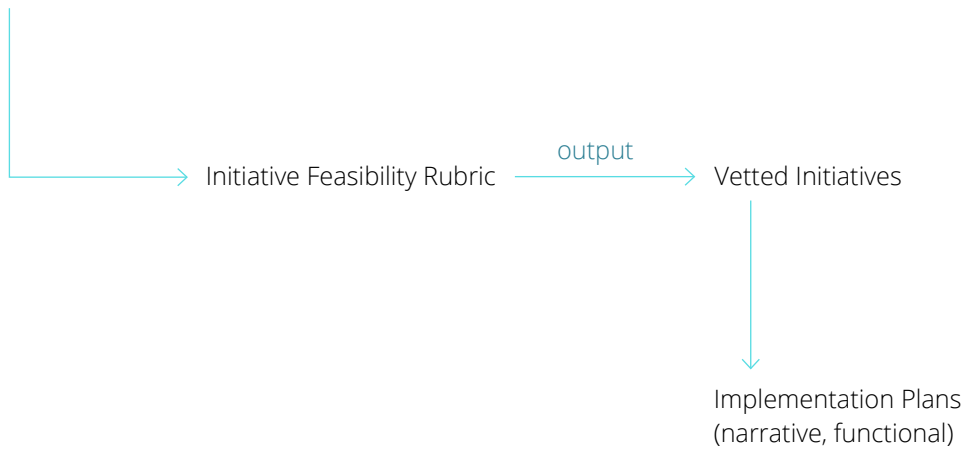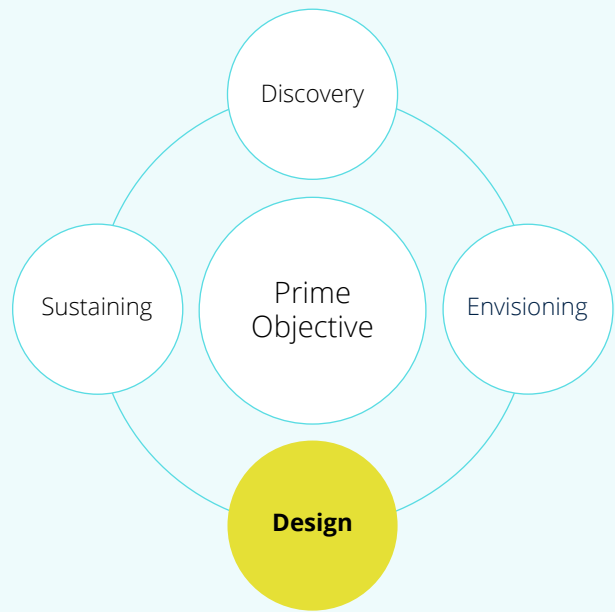**Strategic Plan evolves into a Strategic System**

STAGE 3
Exporation

IDENTIFY INITIATIVE(S) FOR FOCUS AREA(S)

Tool: Workshops (internal, external)

Initiative Feasibility Rubric → *output* → Vetted Initiatives

Implementation Plans
(narrative, functional)

STAGE 4
Action Steps

Discovery

Sustaining

Prime Objective

Envisioning

Design

Tool: Workshops on Covey's Project ⟶ **COVEY'S PRINCIPLES**

output

Project Plan
- Work Breakdown Structure (tasks, start dates, end dates)
- Risks (blockers and solutions, from Stage 3)

Status Meetings

Progress Reports

Discipline 1: Focus

Discipline 2: Leverage

Discipline 3: Engagement

Discipline 4: Accountability

STAGE 5
Measurement

Discovery

Sustaining

Prime Objective

Envisioning
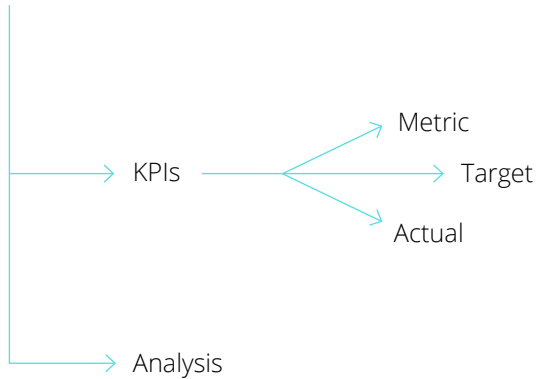
Design
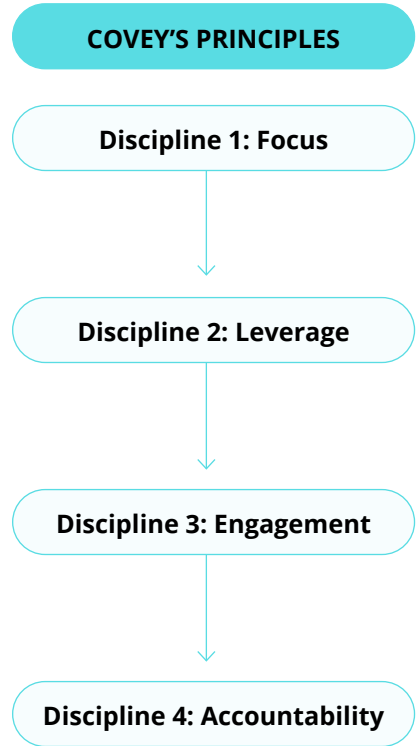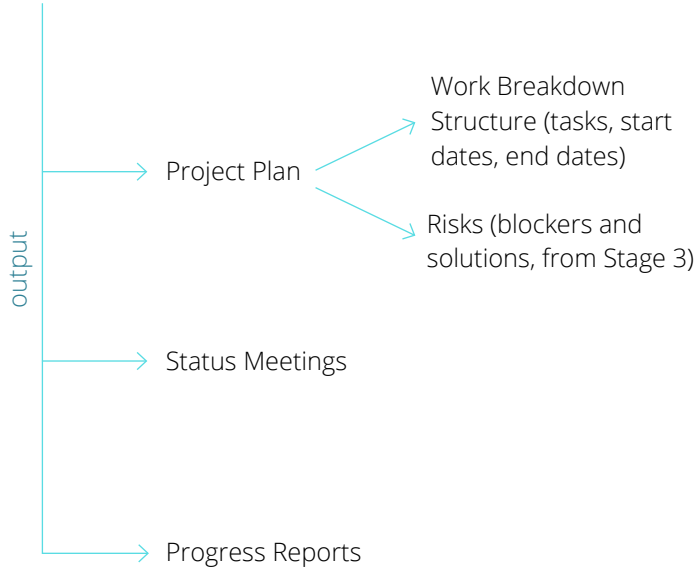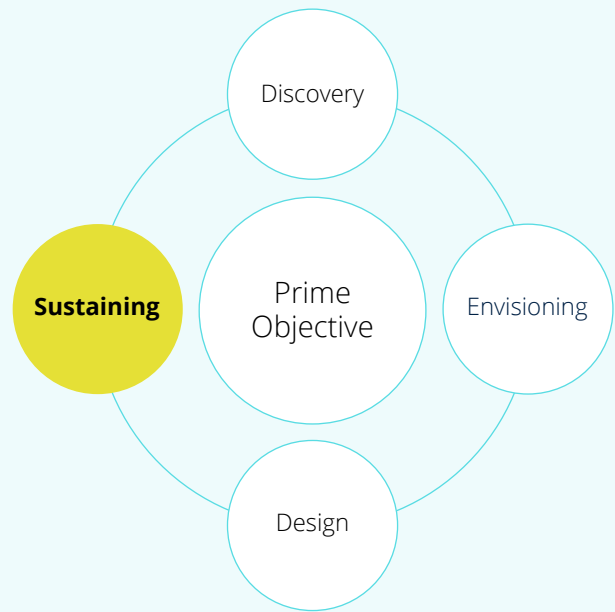
HOW ARE WE GOING TO MONITOR THE ACCOUNTABILITY OF THE IMPLEMENTATION OF THE XYZ VETTED INITIATIVE?

Tool: Workshops on Scorecards (from Stage 2)

KPIs

Metric

Target

Actual

Analysis

What happened?

Why did it happen?

Why will it happen and how can we make it happen?

HINDSIGHT
Via Descriptive Analytics

INSIGHT
Via Diagnostic Analytics

FORESIGHT
Via Predictive Analytics and Prescriptive Analytics
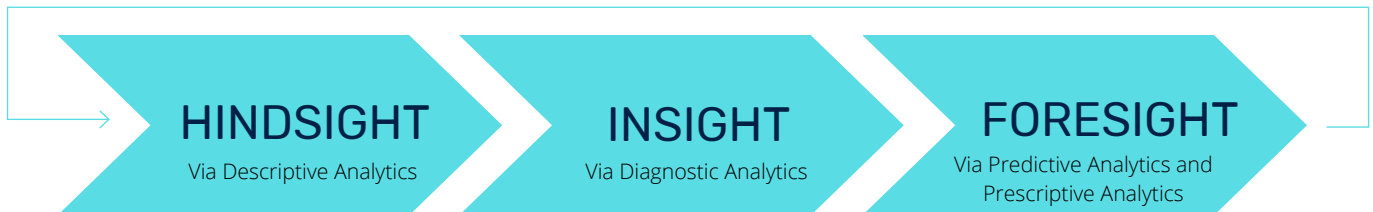
Analytics were used by the focus groups to determine what was happening with enrollment numbers and to prescribe a change to increase the enrollment numbers. Before claiming that a prescribed change had occurred, the groups and executive leadership tracked enrollment numbers through meetings and Analytics & Institutional Reporting reports. As a result, LSC-T has experienced five consecutive semesters of growth. During that period (Spring 2015 to Spring 2017), LSC-T had a 10.02% growth (Wright, personal interview, 2017). Fiscal year 2018 is LSC-T's best-funded fiscal year in many years (Nutt, personal interview, 2017).

In addition, of the $1 million available to all six LSC colleges to be allocated based on performance, LSC-T received more than $500,000. The second-ranking college was allocated approximately $300,000. Thus, the smallest of the six colleges received the highest allocation for performance (Nutt, personal interview, 2017). Another area examined for decisions based on data was the vet tech program. There was a 60% growth in this program after decisions were made based on program data evaluation (Nutt, personal interview, 2017). Based on these results, it appears that BI has enhanced decision-making with increased enrollment numbers that led to additional funding allocation to LSC-T.

A recommendation for further research would be the effect of using the blended appreciative inquiry framework for a BI strategic implementation with a commitment to the project planning methodology for the entire project. The goal would be to determine advantages of timeliness delivery and enhanced college-wide communication among and between strategy focus groups. Another recommendation for further research would be the effect of using a warehouse instead of a reporting system as the backend for dashboards and scorecards. In this case study, the completion of the development and deployment of the warehouse was still active. Due to its incompletion, the backend was a reporting system of transactional data. The goal of further research would be to explore the implementation of the warehouse of aggregated data, its challenges, and its effectiveness when deployed.

The implementation of the visuals of the hierarchical structure of scorecards was not complete at the time of this case study. Another recommendation for further research would be the effect of a complete hierarchical structure of scorecards including visuals. The goal would be to explore the implementation and learn how challenges are overcome. In addition, research could seek to determine if transparency and accountability are enhanced and, if so, the results on performance due to increased transparency and accountability.

Full BI strategic implementations by community colleges are rare but might not be for long. Ongoing research of additional implementations could help the entire community college system in America. Valuable considerations based on this research are the selection and customization of BI tools in alignment with the culture of the college. In addition, applying the tools within an inquiry framework that supports an appreciative inquiry process can and has produced a college-wide transformational impact.

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APPENDIX: DATA COLLECTION

Data for this research study were collected from interviews, BI strategic system implementation documentation, and observation. The program documentation collected includes the following (details in references):

Program Documentation

1| LSC. Lone Star College strategic plan 2015–2020.

2| LSC. Lone Star College system district policy board manual (4th ed.).

3| LSC. Organization chart.

4| LSC-SO. Scorecard and KPI watch lists.

5| LSC-SO. Tomball tactical initiatives workshop.

6| LSC-SO. LSC program evaluation model.

7| LSC-T. 2012–2015 strategic plan Lone Star College–Tomball.

8| Nutt. State of the college address.

9| Nutt. Tomball 2020 report strategy group findings.

Field Observations

The fieldwork for this exploration consisted of the following qualitative observations of events and activities at LSC-T:

1| KPI/dashboard/scorecard presentation @ LSC-T, facilitated by the Office of Analytics & Institutional Reporting on August 10, 2015, 10:00 a.m.–12:00 p.m.

2| Initiatives workshop @ LSC-T, facilitated by the Office of Analytics & Institutional Reporting on September 2, 2015, 2:00 p.m.–4:00 p.m.

3| LSC program evaluation model @ LSC-SO, facilitated by the Office of Analytics & Institutional Report, presented to vice presidents of administration on December 15, 2015, 10:00 a.m.–11:00 a.m.

4| Project management methodology presented to LSC-T president and vice president of instruction on June 14, 2016, 9:00 a.m.–10:30 a.m.

5| Project management methodology presented to LSC-T College Leadership Council on July 11, 2016, 10:00 a.m.–11:00 a.m.

6| LSC-T GRIT planning workshop @ LSC-T, facilitated by A&IR to LSC-T Strategy Groups on July 13, 2016, 9:00 a.m.–12:00 p.m.

Interviews

Face-to-face interviews of approximately an hour each were conducted with the leader of the Office of Analytics & Institutional Reporting, the president of LSC-T, and the vice president of instruction of LSC-T (currently the special assistant to the chancellor). The interviews were not recorded, but interviewers used their notes to write field reports. A report on each conversation was submitted to each interviewee within a week for feedback and approval of the accuracy of summarized content of the interviews. The interviews conducted are the following:

1| Chaney, M. (2017, September 29). Interview with Associate Vice Chancellor Marian Chaney, Office of Analytics & Institutional Reporting. (L. M. Llorance, Interviewer)

2| Nutt, L. A. (2017, September 26). Interview with President Lee Ann Nutt, LSC-T. (L. M. Llorance, Interviewer)

3| Wright, Q. (2017, October 16). Interview with Special Assistant to the Chancellor Quentin Wright. (L. M. Llorance, Interviewer)

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