Final Report on Computer & Information Sciences at Regis University

November 25, 2013

Strategic Planning Solution Group on Computer & Information Sciences

Version History

Revision	Date	Author(s)	Annotations
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Version 1.0	November 15, 2013	Jim Seibert, Chris Meyers, Karl Dakin, Shari Plantz-Masters, Trisha Litz, Chris Fleming, Tom Reynolds, Jagan Gudur	Added findings and context to Executive Summary. Refined finding and recommendation pertaining to Jesuit values education. Added details in Long-term Opportunities. Categorized Critical Success Factors into 3 groups. Added introduction to the Opportunities section. Rewrote 2.1.3. Added text to ensure all aspects and implications of expanding doctoral education at Regis are considered.

First full version. |
| Version 1.1 | November 15, 2013 | Jagan Gudur | Final report submitted to the president and the cabinet.

Document placed under change control. |
| Version 1.2 | November 22, 2013 | Shari Plantz-Masters, Doug Hart, Stamos Karamouzis, Jagan Gudur | Minor corrections for accuracy. |
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Executive Summary and Recommendations

With its unwavering focus on providing a values-centered education grounded in Jesuit principles that shapes every aspect of students' and graduates' lives, Regis University represents a beacon whose guiding light is experienced even long after one's association with the institution begins. The principles that form the foundation of this education have withstood the vicissitudes of time and culture. Yet, for newer adopters to make sense of the principles, their story needs to be told (and their value communicated) in a manner that is relevant to the context and times in which such new adopters live.

The U.S. GDP has grown from a low of $14.36B in 2Q2009 to $15.79B in 3Q2013. The National Bureau of Economic Research determined that the most recent recession, which began in December 2007, ended in June 2009. The term "sluggish recovery" has often been used to describe the state of the U.S. economy ever since. Have we truly "recovered"? Many believe our economy has undergone an irreversible change. Although the unemployment rate has slowly improved to 7.6%, the rate of participation in the labor force has dropped from 67.3% in 2000 to 63.4% in May 2013, the lowest in 34 years [Appendix U].

Students and families increasingly look for evidence that investing in a college education will provide career and financial success [Appendix N]. Even if we limit the discussion on the value of higher education to economic terms, research shows that the earnings and well-being of individuals who invest in it has never been higher. Paradoxically, students, families, and society at large have been increasingly vociferous in questioning the value – the ROI – of higher education. While 86% of institutions believe their graduates are sufficiently prepared for jobs, only half of the employers and graduates feel the same way [Appendix D].

The socio-economic forces at work will likely lead to a decline in national productivity, unless the U.S. is successful in increasing productivity by at least 30%, which will then help maintain the growth rate in per capita GDP that we've been accustomed to in recent times. In an unsponsored study conducted by the McKinsey Global Institute, five catalysts are identified "that can spur productivity", grow GDP, and generate jobs. Each of these areas has the potential to positively impact GDP by over $150B [Appendix U].

Regis University has the definite opportunity to directly contribute to at least two of these "game changers" – computer science education (specifically, data analytics) and human capital development. The National Science Foundation's statistics show that Regis is one of the biggest producers of bachelor's and master's degrees in computing. However, we can be an even bigger contributor. The current Computer & Information Sciences (CIS) programs at Regis can be summarized as follows:

	CPS SCIS	RC Physics & CS	RHCHP HSA
Programs	4 Bachelor's 6 Master's Several Certificates	1 Bachelor's	1 Bachelor's (HIM) 1 Master's (HIIM) 2 Certificates
Students	1,800	40 (Majors + Minors)	160
Faculty	9.5 F-T, 160 P-T	1 Tenured, 1 Term, 1 P-T, 1 Occasional	2 F-T (1 doctorally prepared and 1 in progress)
Accreditation	ABET Only accredited programs 100% online	None	CAHIIM (HIM)
Recognition	Online programs sometimes ranked in top 10. DoHS / NSA CoE		Only RHIA program in CO
Partnerships	DoHS / NSA, National Defense University, National University of Ireland – Galway, University of Technology Jamaica, Deltak, Oracle, IBM, SAP, Microsoft		Community Colleges – Colorado Region

Table 1. CIS at Regis "As-is"

According to the Bureau of Labor Statistics (BLS), computer and information technology occupations are projected to add over 800,000 jobs 2010-2020. Computer Systems Design and Related Services jobs are projected to grow at 3.9% annually through 2020. Of the 22 occupations that are projected to add 50,000 or more jobs in that decade and require a bachelor's degree, 6 are CIS occupations; 8 of the 22 had a 2010 median pay of $75,000 or higher – 5 of these are CIS occupations [Appendix B, C]. The U.S. President's Council of Advisors on Science and Technology (PCAST), in a report submitted to President Obama, counsel that Computer Science will remain a dominant factor in America's science and technology employment and that supply will fall short of the demand for qualified people by large margins. PCAST goes on to predict that while there will be variations, prospects for computer science occupations in the U.S. are strong and other science and technology fields pale in comparison [Appendix Q].

An October 2011 report of a study conducted by Georgetown University's Center on Education and the Workforce states that "STEM" (science, technology, engineering, and math), of which Computer Occupations is the biggest subgroup in their definition (51%), will remain crucial to the vitality and development of the U.S. economy well into the future. They project 2.4M STEM job openings by 2018 and forecast that our schools will be stretched even further as STEM demand grows.

Spring 2013 surveys of CPS's graduate students and alumni indicate a high level of interest in doctoral programs, with about 73% of students and 68% of alumni responding as "very interested" or "somewhat interested". About 21% of students were interested in a doctoral program in computer science. Interest in doctoral-level computing programs has figured consistently in outreach discussions with industry and government.

Based on data from Google Trends, the "search interest" in big data related terms has been on a growth path since about 2007-2008 and seems to be peaking in 2013. The score for business analytics has been growing since 2005 and is close to the maximum possible score in 2013. The scores for predictive analytics, health analytics, and healthcare analytics have also been steadily growing since 2009-2010 [Appendix I].

Job trends (tracked using keywords) from Indeed.com [Appendix I, J, and K], a major employment Web site that tracks millions of job postings on the Internet, indicate that:

- Three of the top ten job trends pertain to technologies used in data analytics and have risen consistently from 2009-2010.
- Data science and related areas have consistently accounted for over 3% of all job postings tracked since mid-2009 and have experienced a growth rate of over 70% since 2010.
- Health analytics and healthcare analytics jobs have been rising since 2007 and in 2012-2013 accounted for about 0.5% of all postings tracked, while healthcare analytics and healthcare informatics together accounted for about 0.25%.
- Every year from 2006 onwards, over 4% of all job postings tracked have been in information assurance and security related areas.

Data in digital form is projected to grow at 40% annually and reach 40,000 exabytes by 2020 (from less than 3,000 EB in 2012). The shortfall for positions requiring deep data analysis skills is expected to reach 140,000-190,000 and the need for data-savvy managers and analysts is projected to reach 1.5M+ in this decade [Appendix V]. The productivity gains and cost savings from extensive use of big data analytics in four sectors alone – retail, manufacturing, health care, and government – is estimated to be $610B annually.

Clearly, the present and the foreseeable future of the field of CIS offer plentiful opportunities for our students, both traditional and post-traditional. The real question is not whether Regis should invest in CIS, but rather it is: to which areas of CIS should Regis bring its precious resources to bear and what are the necessary attributes and changes needed for the University to be a bigger player in this field?

For Regis to successfully pursue opportunities in CIS, it needs to ensure that several cultural, institutional, operational, marketing, and financial aspects are addressed. These are described in Critical Success Factors and summarized below:

- Increased awareness and promotion of Jesuit values
- Speed, student-centricity, and responsiveness to learner needs
- Increased collaboration across all Regis units, academic and administrative
- Academic quality and learning assurance to ensure student success
- Differentiation both at institution and program level
- Flexibility and openness to different revenue models, tuition/financial aid structures, and compensation
- Measurement and feedback loops to inform continuous improvement
- Opportunity for students and faculty to interact with other Regis schools and colleges as needed

Currently, the School of Computer & Information Sciences (SCIS) in CPS ensures education on Jesuit values by including at least one course on ethics in every undergraduate program. Graduate students now must take

HU366, Leading Lives that Matter; in addition, CS and CIS undergraduate courses include modules on ethical issues. Faculty are also trained to include ethics within each program. Student performance in the CIS 318 (Information Technology Ethics) is reviewed against intended learning outcomes. The offerings are assessed and revised as necessary in accordance with SCIS's Learning Assurance process, which may serve as a model to other programs/schools at Regis.

Based on its findings, analysis, and conclusions, the Strategic Planning Solution Group for Computer and Information Sciences makes the following recommendations to Regis University.

Recommendation #1: Invest in Computer and Information Sciences.

Regis should invest in and pursue the following opportunities in the field of Computer and Information Sciences. Collectively, they represent a significant potential revenue stream (approx. $16M per year) and surplus opportunity (approx. $8M per year).

- Expansion of existing graduate programs in Information Assurance and Computer Security
- A new graduate degree in Data Science / Predictive Analytics
- Expanded offerings for traditional-aged students
- A new doctoral program in Computer Science
- Expansion of existing graduate-degree program in Healthcare Informatics

Strong and unified undergraduate programs in computer science are crucial for the success of these proposed investment areas. They will provide a foundational layer for CIS at Regis overall. In addition to providing a structured path of progress to students entering the field of CIS, they will provide a path to graduate studies for all students.

Recommendation #2: Promote and inculcate Jesuit values relentlessly.

Together, Jesuit values, learning assurance, experiential learning, and distinctive course offerings form the essence of Regis University's differentiating advantage in higher education. While the latter three pertain more to knowledge and skill and are therefore subject to change, the values part of the education we have to offer is timeless and immutable. Regis should accentuate Jesuit values to an even greater extent in its programs and ensure that students internalize these values.

Based upon consensus that the superior education of Jesuit values is one of the most important means for Regis University to differentiate itself in competition with other institutions of higher education, the CIS Solution Group recommends that Regis further enhance the infusion of Jesuit values within the CIS curricula. The group recommends:

- Increasing faculty development in application of Jesuit values to CS/CIS curriculum areas in consultation with the Office of University Mission, with particular attention to incorporating the Ignatian Pedagogical Paradigm into course design and activities

- Incorporating the Jesuit learning themes of CPS new humanities course, "Leading Lives that Matter," into undergraduate capstone courses as well as graduate capstone, practicum experiences and research projects
- Identifying added opportunities to incorporate these Jesuit themes into other courses in CIS graduate programs
- Developing new assessment measures to determine student understanding of Jesuit values and their potential application within their course assignments and work situations. Inviting participation of Office of Mission and comparable Jesuit institutional colleagues in reviewing these results

Recommendation #3: Ensure student learning and success through learning assurance.

Measuring the effectiveness of our programs is pivotal to our success --the only way an institution of higher learning can remain current and relevant. A rigorous practice of quantification, validation/verification, and timely associated adjustments needs to permeate all academic endeavors under the aegis of CIS at Regis. This is as important in the area of Jesuit values education as it is in the areas of knowledge and skill.

Recommendation #4: Build strategic partnerships to further CIS growth at Regis.

We live in a world of interdependence and an age of market eco-systems. Nowhere can this be seen in a more pronounced way than in the field of technology. Regis' success in the CIS space will depend on the collaborative relationships it establishes and nurtures. We should actively pursue symbiotic partnerships with industry, government, and academia alike.

Recommendation #5: Explore and pursue additional opportunities in the field of CIS continually.

The growth in data/information and technology as well as the application of various types of computing to almost all aspects of human endeavor is an established trend for the foreseeable future. This solution group focused on opportunities that Regis could meaningfully pursue within the next few years, building on current strengths and trends. In addition to the ones identified in Recommendation #1, the group discussed other possible opportunities such as gaming & simulation, trans-disciplinary degrees, etc. Within Regis University, there are and will continue to be opportunities to offer dual or intersecting degrees in the healthcare disciplines such as informatics for pharmacists, nurses, physical therapists, family therapists, as well as certificates or concentrations in other degree programs offered in CIS.

Regis should continue such exploration and pursue additional opportunities beyond the next three years.

Recommendation #6: Create an independent college of CIS.

The University should create an independent College of Computer and Information Sciences as a priority strategic initiative. The school should include the existing School of Computer Information Sciences in CPS, the Computer Science major in Regis College, and the HIM and HIIM programs in RHCHP.

CIS needs to be a primary focus area for Regis, and its success will depend on:

- Speed and adaptability to market changes
- Responsiveness to learner needs and focus on ensuring a high quality of education
- Dedicated resources
- Hiring and retaining best-in-class talent
- Acceptance of innovative revenue models

The most expedient way of accomplishing this is through the establishment of an independent college of computer and information sciences. As the name of a college also plays an important role in attracting students, the CIS Solution Group suggests using either College of Computer & Information Sciences (preferred) or College of Computing & Information Sciences.

1　Background and Context

1.1　Solution Group and Charge

The charge assigned to the Computer and Information Sciences (CIS) Solution Group (SG) was as follows:

"Invest in computer and information sciences for continued excellence, growth, and national recognition, including a possible formation of a separate school/college that incorporates the degrees and faculties of both Regis College and the College for Professional Studies, maintaining our current organizational structure, combining with other degree areas at Regis University, exploring other organizational models, and developing distinctive new degree offerings that respond to student interests and workforce opportunities."

The CIS Solution Group consisted of the following members:

Jagan Gudur, Chief Information Officer (Chair)
Karl Dakin, Executive Director, Sullivan Endowed Chair for Free Enterprise
Stamos Karamouzis, Dean, SCIS, CPS
Shari Plantz-Masters, Assistant Professor, SCIS, CPS
Dan Likarish, Assistant Professor, SCIS, CPS
Chris Fleming, Associate Dean, Learning Design, CPS
Jim Seibert, Associate Professor, Mathematics, RC
Trisha Litz, Instructor, Computer Science, RC and CPS
^Robert Sjodin, Term Instructor, Computer Science, RC
+Doug Hart, Professor, SCIS, CPS
Sheila Carlon, Director, Health Services Administration, RHCHP
Kathleen Whalen, Associate Professor, Nursing, RHCHP
Jeff Getchell, Director, Learning Technologies, RHCHP
*Chris Tsouris, President, Strategic Computing and Member, Regis University CPS-SCIS Advisory Board
*Chris Meyers, Entrepreneur
Tom Reynolds, VP for Mission and Planning (Advisor & Special Invitee)

^Excused himself from the Solution Group after a few sessions.
+Added to the Solution Group mid-way through the process to augment effort to assess opportunities.
*Regis-external participant.

1.2　Context

CPS's School of Computer & Information Sciences (SCIS) offers curricula that lead to four bachelor's and six master's degrees in areas relating to computing and information sciences. According to statistics from the National Science Foundation (NSF), SCIS is one of the largest producers of bachelor's and master's degrees in computing throughout the nation. Currently, the School serves approximately 1,800 graduate and undergraduate students with 9.5 full-time and about 160 part-time faculty members.

SCIS is recognized for Accreditation Board for Engineering and Technology (ABET) accreditations in three programs of study, its designation by the National Security Agency (NSA) and the U.S. Department of Homeland Security as a National Center of Excellence in Information Assurance Education, its partnerships

with other academic institutions (National Defense University, University of Technology in Jamaica, community colleges, etc.) including a joint master's degree with the National University of Ireland, Galway, and its partnerships with industry (Oracle, SAP, IBM, etc.).

Additionally, the School's bachelor's and master's degree recipients have the highest median first-year earnings in Colorado, compared to their peers from all other state universities.

The following degrees are offered completely on campus as well as online:

• B.S. in Computer Science (ABET accredited) • B.S. in Computer Information Systems (ABET accredited) • B.S. in Computer Networking (ABET Accredited) • B.S. in Business Technology Management	• M.S. in Database Technologies • M.S. in Information Assurance • M.S. in Software Engineering (ranked nationally amongst the top 5 online degrees in SE) • M.S. in Systems Engineering • M.S. in Information Technology Management • M.S. in Software Engineering & Database Technologies (joint degree with the National University of Ireland – Galway)

Table 2. Regis University CPS SCIS – Current Degrees Offered

The School's success can be attributed to a number of strengths that include SCIS cloud infrastructure (ARN, virtual lab), quality assurance for both graduate and undergraduate programs that ensures continuous improvement and that each program meets student learning outcomes, an Industry Advisory Board, and an Executive Advisory Board.

The **Regis College (RC)** Department of Physics and Computational Science offers a bachelor of science degree in computer science based on the curriculum recommended by the Liberal Arts Computer Science Consortium. The computer science major is small, with about 40 students taking both majors and minors. Computer science is a valuable second major or a minor to add to a variety of majors across the College. The program has one tenured faculty member, one full-time term faculty (primarily responsible for the CS course required by the RC business major), one full-time term faculty shared 50/50 with the physics program, and occasionally has a course taught by an adjunct or tenure-track faculty from related programs.

The primary strength of the program is that it offers a solid, although limited, CS major in the context of a traditional, residential, Jesuit liberal arts college. The unusual combination of physics with computer science is a result of having two very small programs with some shared interest, and a physics professor who teaches in the CS program from time to time. The physics program has grown over time and could now stand on its own.

In the **Rueckert-Hartman College for Health Professions (RHCHP)**, two specific degree programs focus on technology: HIIM & HIM. The Health Information Management (HIM) program, an accredited bachelor's degree program, has been in existence at Regis University for more than 30 years. While it was a small niche program for many years, since its move to the online environment in 2010, it has more than doubled in size and has students from all across the U.S. It is recognized as a top HIM program by CAHIIM (Commission on Accreditation of Health Informatics and Information Management Education) second only to St. Scholastica, the first HIM Program in the U.S. (Duluth, MN). The graduate program in Healthcare Informatics and Information Management (HIIM) was developed in 2011 in collaboration with the College for Professional

Studies, combining three courses in CPS and allowing two courses from the undergraduate program to count towards the MS degree. HIIM has been an attractive option for students who graduate from HIM; they can continue seamlessly into a relevant graduate degree program. Because of the move to electronic records, collaborative care organizations and other federal initiatives, health care information technology (Health IT) is expected to continue its growth.

These two programs are currently housed in the Division of Health Services Administration which serves around 250 students. About half of these students are in the HIM and HIIM programs. It is expected that the undergraduate program also has room to expand and grow with the industry focus on electronic records, expanded delivery systems, and databases that use digital health information.

The landscape for higher education in general and computer science programs in particular, has become increasingly competitive. Web-based education and for-profit educational institutions pose challenges to pedagogical techniques and traditional institutions.

In the current environment, the CIS programs at Regis are not positioned to grow and respond to changes rapidly. They lack program branding, a sufficient Web presence, and have limited ability for STEM outreach in high schools and middle schools. To compound work overload, salaries that are not discipline-specific make it difficult to attract Ph.D. qualified faculty for computing positions. Finally, the current structure hampers SCIS's ability to keep curriculum current and relevant. The refresh cycle has improved in recent months. The pace at which learner needs and the market evolve dictates that Regis needs to shorten this cycle further.

1.3   Approach

After analyzing the charge given to it, the team went through a discovery process to understand the existing CIS and related programs at Regis. It then started discussing current and emerging trends. Potential opportunities and the conditions required to be successful in CIS started emerging and both of them needed drill-down. Two sub-teams were formed, one to focus on opportunities and build basic business cases for them, and the other to identify critical success factors. The team met on a weekly basis. To ensure that things moved in lockstep, proceedings started with a full-team meeting and then branched off into sub-team meetings. In addition to validating within the sub-team, each sub-team validated ideas and emerging themes with the other sub-team.
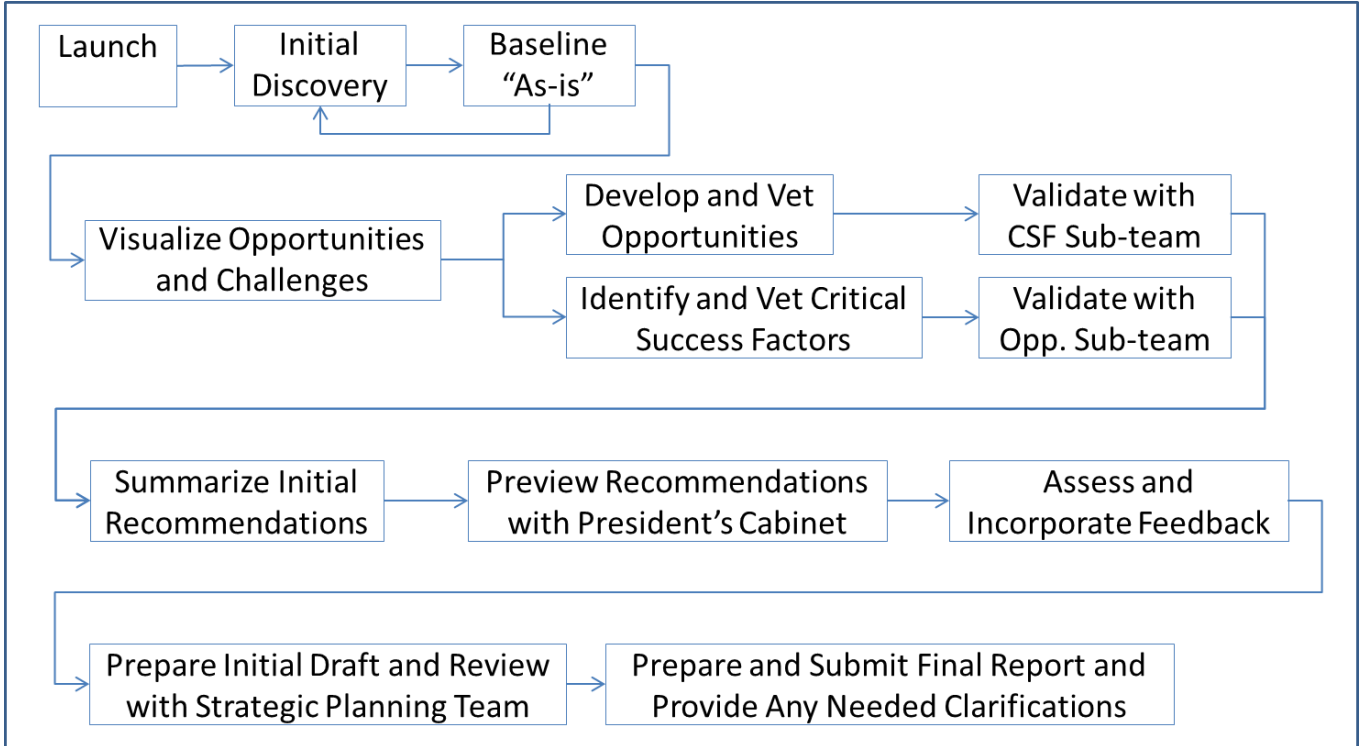
Figure 1. CIS SG's High-level Approach and Process Flow

2 Opportunities and Value Propositions

As the group engaged in discussions to identify opportunities for Regis in the field of CIS, members surfaced many worthy ideas. But it quickly became apparent that there were significantly more opportunities than Regis could pursue. Hence, the group decided to identify and delve into opportunities that satisfied the following considerations:

- Take into account input from students, recent graduates, and industry constituents.
- Seek to work from Regis' existing strengths, programs, and their success.
- Are based on analysis of ongoing trends observed in digital media.
- Require relatively lower levels of investment, vis-à-vis other potential opportunities in CIS.
- Have the advantage of existing relationships that can be leveraged further.
- Balance student needs, Regis mission, and revenue realities.

The opportunities described here are divided into short-term, medium-term, and long-term. Short-term opportunities need to be planned and their implementation needs to start within the next 6-12 months. The planning for the medium-term opportunities should probably start within the next 12 months and their implementation will likely take about 3 years from the time they start. Long-term opportunities look beyond the 3-5 year horizon and require substantial additional analysis.

2.1 Short-term (6-12 months)

2.1.1 Graduate Programs in Information Assurance and Computer Security

The School of Computer and Information Sciences has an existing Information Assurance (IA) program that offers a master of science degree. This degree also has two emphases: 1) cyber security and 2) information assurance policy management. The IA program has been quite successful and because of it, Regis University has been designated as a Center of Academic Excellence in Information Assurance Education by the U.S. Department of Homeland Security and the National Security Agency.

At present, the Information Assurance program has about 100 students. The formation of a new college for Computer & Information Sciences will allow a direct and focused effort to grow this program. Together with our marketing partner, Deltak, this program should be able to double in size within three years. The potential revenue, costs, and surplus estimates are shown in the table below.

Drivers	Trend analysis from digital media Feedback from government agencies Growth trend in recent years
Startup Cost	Expansion of existing program
Implementation Period	<3 Years from Start
Potential Annual Revenue Post-implementation	$2,375,000
Potential Annual Costs	$1,292,500
Potential Annual Surplus	$1,082,500

Table 3. Opportunity – Information Assurance and Computer Security

2.1.2 Graduate Degree in Data Science / Predictive Analytics

The terms "big data," "data analytics," "data science," and "predictive analytics" have all been trending upward in recent years, both with employers and with students. These and similar terms are used to describe the analysis of data, whether massive data from Google searches and Amazon sales, publicly available health data and private health institution data, or many other types. Business leaders then use such analyses to inform their decisions. The School of Computer & Information Sciences is already investing in the development of a graduate academic certificate in data science. This solution group recommends the expansion of that program into a new master of science in data science degree program.

The techniques taught in this program would be largely agnostic to the industry in which such data analysis might be used. Adjuring an industry focus will give us future opportunities to customize programs directed to specific target industries, such as health care or government/public sector data analytics.

Drivers	Trend analysis from digital media of interest among learners and employers
Startup Cost	$206,000
Implementation Period	~3 Years from Start
Potential Annual Revenue Post-implementation	$1,575,000

Potential Annual Costs	$716,500
Potential Annual Surplus	$859,500

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Table 4. Opportunity – Data Science / Predictive Analytics

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2.1.3   Expanded Offerings and Opportunities for Traditional-aged Students

The integration of undergraduate computer science programs from Regis College and CPS will provide many opportunities to both programs and can be accomplished with minimal monetary investment. The primary benefits from this merger would be:

- Traditional students at an advanced level will have the ability to take classes from other topical areas.
- It will enable Regis to develop both a bachelor of arts program in computer science with a more liberal arts focus as well as a bachelor of science program in computer science for traditional-age students.
- The current CPS SCIS programs in Computer Information Systems and Computer Networking would also offer traditional-age students an expanded array of courses, minors, and certificates. This would be particularly beneficial to students who want to pursue concentrations outside their major or inter-disciplinary opportunities.

2.2   Medium-term (12-36 months)

2.2.1   Doctoral Program in Computer Science

- Working adults in the field of computer science and information technology are showing growing interest in doctoral programs, and there are few options for them that don't require onsite coursework and long-term residential commitments.
- Many older adults nearing retirement may value the personal satisfaction of a terminal degree and may even be interested in college teaching; they may be interested in doctorates.
- Recent CPS surveys and interaction/outreach by SCIS leadership team suggests there is a strong market for PhDs in government, industry, and academia.

Drivers	Recent CPS surveys Industry outreach Government interaction
Startup Cost	$570,000
Implementation Period	2-3 Years from Start
Potential Annual Revenue Post-implementation	$8,400,000
Potential Annual Costs	$5,370,000
Potential Annual Surplus	$3,030,000

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Table 5. Opportunity – Doctoral Program in Computer Science

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Planning for such a program possibility needs to include a University-wide analysis of the impact of added doctoral students and programs on existing Carnegie and accreditation status, rankings, grant opportunities, faculty workloads, and other issues in doctoral education.

2.2.2   Graduate Degree in Healthcare Informatics

- Creating and expanding a program that bridges healthcare and information technology builds on two of our greatest strengths.

- The current graduate program in HIIM has students from a variety of health care and information technology disciplines which can be expanded with focused course development and marketing to include pharmacy, nursing, and other clinical informatics specializations which would complement the existing degree programs for RHCHP. These "intersecting degrees" would allow our healthcare-discipline students to stand out in the market with a solid technology and application foundation in either a certificate or dual degree option.
- Many of the existing technology programs in other areas in Regis (cyber security, etc.) could be rich sources of content for this program.
- Additionally, the undergraduate accredited program in Health Information Management will, in 2014, move to a more technologically focused curriculum mandated by the workforce and the accreditation organization, making the CIS move a sound one.

Drivers	Trend analysis from digital media Potential of existing HIIM program
Startup Cost	$205,000
Implementation Period	2-3 Years from Start
Potential Annual Revenue Post-implementation	$3,500,000
Potential Annual Costs	$350,000 - $400,000
Potential Annual Surplus	$3,150,000

Table 6. Opportunity – Healthcare Informatics

2.3   Long-term (> 36 months)

To balance the multitude of potential opportunities in the field of CIS with Regis' imperatives, the group focused on programs and initiatives that could mostly leverage existing infrastructure, faculty, and resources, require relatively more affordable investments, and could be adapted for the target market/customer envisioned by Regis over the next 3-5 year operational and planning horizon.

However, if additional resources are available, there are other opportunities that might prove more financially attractive or might better differentiate Regis from its ever-growing national and global competition, including the MOOC movement.

The following list is not ranked in any particular order, but is offered for future:

- Trans-disciplinary programs/curricula/courses that may be drawn from existing offerings currently offered at Regis University:
    - Tech/Cyber Assurance and IT Security Certification Product/Project Development Management Certification, partnering with industry and Product Development and Management Association (PDMA)
    - Data Analytics Analyst Certification that could lead to Data Artisan, Business Analyst, or Business Intelligence Engineer roles
    - Degrees and certificates that can intersect across multiple areas and give our graduates a differentiating edge in their respective fields (example: informatics and pharmacy, data science and business)
- Certificate and degree programs in the area of computer-based simulation that could spur innovation in a variety of fields, including education and healthcare. This could also be applied to address Regis' evolving needs in providing clinical training.

- Community outreach/marketing/culture
  - Build more partnerships, collaborations with other Jesuit universities and other institutions of higher education
  - Establish deeper outreach into Latino/Spanish/Latin America communities with some work/study/internship programs that can assist students with tuition, scholarship, etc. (for example, Mi Casa, Latin American Educational Foundation, Alumni of L.A. decent, etc.)
  - Collaborate with charitable, economic development, or other organizations that would benefit from an association with an institution of higher education: symposiums, continuing education certifications, workshops or professional certification events
- Establish centers of excellence and institutes on individual subjects within the general area of Computer and Information Sciences, such as:
  - Institute of Cyber Intelligence and IT Security, leveraging experts and IT up and down the Front Range
- New certification programs for employees of business partners to meet their needs/interests in areas of business/CIS with emphasis on building future CIOs, CTOs, CISOs, CSOs, and other C-suite executives
- An entrepreneur/leadership program that would combine the skills of computer and information science with the skills of running an organization resulting in future CEO and other C-Level executives. This program could be dovetailed into the Regis Entrepreneur Club. It may include use of data analytics dashboards, Google Analytics, Sales Force/CRMs, ERPs, MRPs, etc. and use other management tools that are highly dependent upon computer and information science.
- Lifelong learning programs for graduates that would start immediately upon graduation and continue until retirement. This form of continuing education could include certifications or continuing validation of competencies as exist in different professions.

3 Critical Success Factors

3.1 Jesuit Values Based, Cultural, and Institutional

- A heightened awareness and adherence to Jesuit principles and the promotion of an education that inculcates those values in students are fundamental to the success of the initiatives that stem from the CIS Solution Group's recommendations. Jesuit mission values should be embedded thoroughly in the experience of all students in the new college.

- Conscientiousness to both learning populations – traditional and post-traditional – is of utmost importance. Providing learning environments that are best suited to learner needs and outcomes are pivotal to student engagement and success. (It could also be one of our bigger differentiators as a player in the field of higher education.)

- Both academic and administrative units need to promote a more collaborative environment and culture in working with other units. For Regis to be successful, the tensions that are sometimes felt in the current setting between Colleges and between Colleges and administrative units need to wane.

- Responsiveness and speed are crucial for Regis's success. This needs to show in both our response to student needs and the actions we take to address STEEP changes in the industries and markets we serve. The field of CIS is closely connected with technology at large, which has been one of the bigger change agents in human life in the last 2-3 decades and likely to play an equally prominent role in

coming ones. A high rate of change characterizes this field, and we need to position Regis to respond rapidly and intentionally to changes.

- We need to sustain a high level of academic quality. While external measures such as ABET accreditation are extremely important, this also pertains to internal practices that consistently drive quality and learning outcomes.

- Regis needs to make a constant and concerted effort to differentiate itself both at the institutional and program levels. Insufficient differentiation could render Regis an "also ran" among thousands of universities. The group felt that the following should be the primary differentiators for CIS:

  o Jesuit values – ways to think and solve in any given situation . . . for life

  o Learning assurance – quantification, verification, and validation

  o Experiential learning – immersion, practicum

  o Distinctive courses that are not available at other universities, even though the other institutions may be offering programs with similar names

3.2 Administrative and Operational

- Regis's administrative and operational policies and processes need to become more student-centric and student-friendly. We need to provide students the flexibility to freely move between Colleges/Schools and take courses that are good for their education and a fit with their overall plan. Simplicity, adaptability, and flexibility must be the guiding principles in the design/redesign of such policies and processes. Our institution at large and CIS in particular need to demonstrate excellence in multi-mode delivery, as appropriate to learner needs.

- Openness to and acceptance of different revenue models will be needed for Regis to continue to be a force in higher education. (The flexibility needed to attract, engage, and graduate students – both traditional and post-traditional – who can lead lives that matter necessitates this acceptance.)

- The size and importance to Regis of the opportunities in the CIS space are such that they need dedicated resources (financial, staff, facilities . . .)

- As an institution of higher learning, it is vital for us to conduct performance measurement, validation, and establish feedback loops that will ensure quality and excellence in our programs. This is especially important in measuring the effectiveness of the values-based education part of our curricula.

- Traditional students should still experience the full Regis College core curriculum within the appropriate Regis College departments, and they should be able to easily take other Regis College courses or major/minor opportunities as they wish.

- Non-traditional students should continue to be provided learning formats, course offerings, and student support appropriate to their needs.

- HIM/HIIM students should continue to have contact with other RHCHP students and access to RHCHP resources.

- Students and faculty in all programs in the new school must have opportunities to interact with students and faculty in all other colleges/schools as needed, including the expectation that faculty in the new school must collaborate with colleagues in Regis College and RHCHP wherever their programs interface.

- All students should have access to co-curricular opportunities, resources and support suited to their age and needs.

3.3   Financial and Marketing

- Marketing efforts and messaging need to focus on specific programs and not just on the overall institution/Colleges. They need to be flexible and age-agnostic.

- To establish and run high-quality academic programs in CIS, it is essential to attract and retain high-caliber faculty. This will necessitate a suitable compensation structure that will be quite different from the prevailing ones at Regis. (A one-size-fits-all approach will be ineffective in addressing this critical success factor.)

- The University needs to design more flexible tuition/financial aid structures to allow the new college to work seamlessly with both traditional and post-traditional students.

4   Assumptions, Risks, and Mitigations

Assumptions

- In assessing and attempting to quantify the opportunities, the Solution Group assumed that Regis will allocate necessary funds to market and promote the proposed CIS programs.
- Regis has the financial wherewithal for the upfront investment and operating costs required during the implementation period for each of the opportunities.
- There will be a transition team appointed to further plan and implement the changes needed and recommended.
- The economy and market conditions will at least hold their current state/health and not worsen significantly.

Risks and Mitigations

- Continuing to operate in status quo will result in dilution of the reputation Regis has built in the field of CIS through years of sustained efforts. This will eventually lead to revenue erosion. Implementing the recommendations made in this report is the most effective mitigation against this risk.
- Insufficient funding or significant downward revisions to original allocations will compromise the initiatives stemming from this report's recommendations. Regis should approach the initiatives in a prioritized manner and minimize reprioritization of initiatives that are already underway.

- The opportunities in CIS are such that Regis needs to act upon them with a sense of urgency. Not doing so will minimize their value to Regis. Decisions pertaining to the recommendations in the CIS area should be made quickly. An implementation team must be formed immediately after the decisions are made. It should be given a charter with clear expectations and a firm time line.
- The possibility of changes in economic and market conditions (both in the education sector as well as other sectors that could impact the education sector, especially in the field of CIS) can never be ruled out. There is no way for Regis to completely insulate itself from adverse changes in these areas, but emphasis on responsiveness to market changes, measurement, and validation will dampen the adverse impact.
- As the proposed new college develops, its faculty may determine that changes to faculty assignments, undergraduate cores, and student outcomes are warranted. The leadership of the new college should establish processes that ensure review of such changes takes into account the spirit of the recommendations in this report.

Appendices

A. Regis' CIS Program Profiles
> An overview of all degrees and certificates offered by all three Colleges

B. BLS Employment Projections
> Bureau of Labor Statistics employment projections by major occupational groups for 2010-20

C. BLS Trends in Academic Demands
> Bureau of Labor Statistics trends and future predictions in educational majors and occupations

D. Voice of the Graduate – A McKinsey Report
> Results of 2012 survey of recent college graduates, expressing both concerns and hopes

E. CPS Doctorate Survey of Current Graduate Students
> Results of interest by current CPS grad students (all four Schools) in possible doctoral degrees

F. CPS Doctorate Survey of Alumni
> Results of interest by CPS alumni (all four Schools) in possible doctoral degrees

G. Monster – Where the Opportunity Is
> Analysis of real-time talent supply and demand to inform decisions regarding proposed CPS programs

H. Working with Big Data – BLS
> Article defining "big data" and its opportunities for career growth

I. Big Data
> Dr. Doug Hart's collection of information on big data from Google Trends, Indeed.com, and the McKinsey Global Institute

J. Healthcare Analytics and Informatics
> Dr. Doug Hart's collection of information on healthcare analytics and informatics from Google Trends and Indeed.com

K. Information Assurance – Cyber-security

Dr. Doug Hart's collection of information on information assurance/cyber-security from Google Trends and Indeed.com

L. Other Institutions with CIS Schools

A list of autonomous CS/IS academic units at the School or College level in U.S. institutions

M. NAPA SWOT April 2013

The Napa Group's analysis of Regis University's audience/s and its brand promise/s

N. Ten Trends in Private Higher Education

How marketplace conditions will influence private higher education enrollment; how colleges can respond

O. EMC Executive Summary Memo

Key findings based on an online survey by EMC Research of C-level executives and HR directors in varying industries

P. EMC Presentation

PowerPoint presentation of findings based on an online survey by EMC Research of C-level executives and HR directors in varying industries

Q. Careers in Growing Field of Information Technology Services

BLS article explaining what ITS includes and discussing probable future growth in ITS careers

R. Want a Great Scientific Career? Choose Computer Science

Also based on BLS research, explains that 62% of job growth in science will be in computer science

S. STEM

In-depth research from Georgetown's Center on Education and the Workforce on trends and projections for STEM fields and workers

T. BLS Top Job Growth Occupations 2010-2020

Table showing 22 bachelor's-level occupations expecting highest growth during decade of 2010 to 2020; 7 are computer-science related

U. McKinsey 5 US Game Changers July 2013

Report arguing that five big opportunities can accelerate U.S. growth by 2020; one is "the potential of big data analytics to raise productivity"

V. McKinsey Big Data: The Next Frontier June 2011

Study that "examines the potential value that big data can create for organizations and sectors of the economy and seeks to illustrate and quantify that value"