level issues and the integration of domain expertise and computing than any other computing degree type (such as Computer Engineering (CE), Computer Science (CS), Information Technology (IT), or Software Engineering (SE)). CE and CS are clearly focused on computing only, SE introduces concerns of human behavior typically at a project level, and IT is primarily concerned about humans as users and sources of security threats. Although all disciplines recognize the importance of requirements specified by humans, IS degrees (particularly at the master's level) are specifically focused on supporting human goals at individual, organizational, and societal levels. Information Science is related to both IS and CS, and it shares areas of interest with both. It is, however, not one of the computing disciplines identified as such by, for example, CC2005.

Finally, it is also important to recognize that there is no one single model of a master's degree program in IS. As discussed in Section 6, the structure and content of these programs vary significantly depending on the region and the country. Still, many of the general reasons underlying the usefulness of these programs are the same: everywhere in the world, organizations and individuals are working to determine how to best use digital technology to advance their goals.

3 Assumptions Underlying the MSIS Degree

The revision of the MSIS model curriculum is based on the following assumptions regarding the MSIS degree:

1. MSIS is a **professional practice master's degree** that focuses on the development of specialized competences in IS. In addition, an MSIS degree can provide a foundational preparation for academic research; the programs choosing this emphasis typically require a research thesis. An MSIS degree focuses on the development of competences **that are aligned with a specific domain of practice** (such as business, health care, law, government, education, etc.).

3.1 Degree entry conditions and pre-program leveling experiences

2. An MSIS degree is **based on a completed undergraduate degree** that provides a foundation in the core IS topics, as defined in IS 2010. The length of the prior undergraduate degree in IS may vary depending on the national or regional educational system (for example, in many European countries an undergraduate degree can be three-year degree, leading to a two-year master's).
3. It is possible for those without an undergraduate degree as specified in #2 above to enter an MSIS degree program. This will, however, require additional coursework **that provides the equivalent of an undergraduate background in the IS topics specified below**. These courses are often called bridge courses, foundations courses, or pre-program leveling courses. The topic areas are as follows (together with the references to IS 2010):
    a. Foundations of Information Systems (IS 2010.1)
    b. Data and Information Management (IS 2010.2)
    c. IT Infrastructure (IS 2010.5)
    d. Systems Analysis & Design (IS 2010.6)
4. An MSIS degree **requires foundational studies in its specified domain of practice as a program prerequisite**.

The most common domain of practice is currently business, but the core concept of integration between technology understanding and domain expertise can be implemented in many other domains, too. Examples of such domains include government and public administration, non-governmental organizations, education, law, healthcare, banking and financial services, telecommunications, and services in general.

For example, if the domain of practice is business, a student entering the program is required to have prior coursework in core business disciplines. The specific combination may vary, but a typical combination consists of at least three courses covering topics such as accounting, finance, organizational behavior, strategy, marketing, operations management, and economics. In a health care focused MSIS program, incoming students would need to have an equivalent background covering relevant domain content. If an incoming student does not have a necessary background, the student will have to take appropriate bridge courses.

5. A student entering an MSIS degree program is required to have **at least one university level course in statistics or analytics**.
6. An MSIS degree program has **no expectations regarding prior professional experience**. Therefore, no outcome expectations for graduates can be built based on prior professional experience. It often is, however, valuable for students to have relevant professional experience as it could help overcome shortcomings in domain knowledge and/or an undergraduate degree (if, for example, the professional experience is in a computing field).

3.2   Key degree characteristics

7. An MSIS degree provides competences in four areas:
   a. computing/information technology (IT),
   b. domain of practice (see discussion above in #4),
   c. management and organizational practices related to the structure and operation of computing/IT, and
   d. individual foundational competences (such as written and oral communication, critical thinking, ethical analysis, teamwork, leadership, etc.)
8. The emphasis on or balance of these competences varies depending on the program. All of them should, however, be included in every MSIS degree program.
9. Universities around the world are offering an increasing number of highly specialized master's degrees in IS, focusing on a specific competence area, such as analytics and security. Whether or not such degrees can be considered MSIS degrees depends on the dominance of the specialized content. Any MSIS degree should support the development of competences in all of the four areas discussed above. **If the specialty dominates the degree so significantly that the core competence areas are not covered, a degree will not fit under the MSIS umbrella**.
10. An MSIS degree consists of **at least 30 semester hours (USA) / 60 ECTS credits (Europe) requiring at least eleven months of full-time study** (or an equivalent amount of part-time work). Possible bridge courses in IS and/or the domain of practice should not be included in this total.
11. When evaluating the required competences at the time when a student graduates from an MSIS program, it is essential to take into account not only the MSIS program components but also the graduates' competences accumulated before they enter the degree program. This sounds trivial, but is easy to ignore in practice.
12. When determining the expected graduate competences for an MSIS program, it will be very useful to utilize professional competence models developed during the recent years by multiple regional or national governmental organizations (such as the European e-CF

competence framework) or industry organizations (such as UK-based SFIA). Through conversations with the authoring organizations and users of these frameworks, the task force is planning to incorporate key elements of them into the outcome expectation model.

3.3   Post-Experience Degrees

There are many master's degree programs in IS that require students to have experience as IS professional before and/or during the graduate program and depend on this experience as an essential element of the program. These programs can be highly valuable and lead to excellent outcomes. Master's degree programs that are highly individualized, address just-in-time professional needs, and consist of components collected over a long period of time could become a very popular or even a dominant program model in the future. It would, however, be very difficult to build a curriculum recommendation for these programs, given the significant differences between students' backgrounds and program expectations regarding these backgrounds. Programs targeted primarily to pre-experience students may, naturally, let a student with relevant professional experience adjust her/his curriculum so that it better fits the student's existing competences. For example, an experienced network/systems administrator may have capabilities that allow her to take an advanced elective instead of an intermediate course in IT infrastructure.

It is likely that the IS community would benefit from a mechanism that allows IS professionals to acquire and collect educational experiences over their professional careers and build recognized credentials based on them. We do, however, recommend that this type of a degree be built separately with an identity that is different from that of an MSIS (it could, for example, be an executive master's consisting of multiple certificates). This type of separation would be likely to benefit both the pre-IS experience MSIS and the post-experience degree. The task force will articulate a way to separate a post-experience master's degree program, certificate programs, and commercial certifications. All of these are mechanisms through which IS professionals acquire new competences or strengthen existing ones as part of their lifelong learning process. Offering them can, however, be an important part of a university's mission, but it is clearer if a separate degree type is specified for them.

In addition, we recognize the existence of MBA concentrations in IS as a separate entity from master's degrees in IS. An MBA is a generalist degree designed to focus primarily on the development of managerial capabilities, and an MBA concentration seldom provides the type of technical depth expected from a specialized master's in IS.

4   Proposed Major MSIS 2016 Changes Compared to MSIS 2006

The MSIS 2016 Task Force is proposing the following key architectural changes compared to MSIS 2006:

1. **Specifying the MSIS as a pre-experience degree** targeted to either fresh graduates of undergraduate programs or career changes without IS/IT experience.
2. Explicitly articulating the expected graduate competences related to the four areas discussed above: **domain of practice, computing/IT, IS/IT management, and individual foundational competences.**
3. Recognizing that **business is not the only possible domain of practice.**

4. **Building support for a variety of national and regional curriculum models around the world**
    a. We need to design a curriculum structure that supports the required flexibility.
    b. It is particularly important to consider the fact that in many parts of the world a master's degree includes a significant research component (such as a master's thesis).
5. **Articulating the expected graduate competences at a more detailed level than in MSIS 2006.** Some of the changes will be based on the following external phenomena:
    a. Changes in computing technology and the environments to which it is applied
    b. Changing balance between management and technology
    c. Improved understanding of the general competence requirements for IS/IT professionals and the work on IT competences that has taken place around the world and particularly in Europe during the past few years.
6. **Addressing specific concerns and opportunities related to the highly specialized MSIS-style degrees, such as those focused on analytics and security.**
7. **Articulating post-experience degree programs and analyzing the opportunities they offer separate from the primarily pre-experience MSIS degree.**
8. Recognizing the need to address **delivery channel issues, such as**
    a. The impact of on-line delivery for graduate degrees
    b. MOOCs and other forms of ongoing just-in-time learning may require that particularly in post-experience degrees the components can be integrated into structures that can be certified as learning experiences.
    c. What is the relationship between commercial and academic providers?

5   What is a Model Curriculum?

5.1   Continuous Improvement

Model curricula and the corresponding development process provide a number of useful and important roles to the IS community. A model curriculum development process fosters collaboration, requires careful introspection on what constitutes the core knowledge and capabilities of the discipline, and assists in understanding content and delivery innovations affecting the future direction of the discipline. In addition, the tangible artifacts associated with the completed model curriculum reflect a consensus of the IS community, provide a mechanism to communicate to relevant stakeholders the core capabilities obtained in graduate IS education, and serves as a resource for benchmarking, comparison and innovation of existing IS programs.

When viewed as a process of continuous improvement, measurement and periodic revision of the model curriculum form a feedback loop whereby the needs of the IS community are continually being met. Figure 1 illustrates the process of continuous improvement used for the development of the 2016 IS model curriculum.