



Report of the ICDE Working Group on

The Present and Future of Alternative Digital Credentials (ADCs)

January 2019



Table of Contents

1. Executive Summary and Structure of the Report	3
2. Charge and Acknowledgements	6
3. Introduction	8
4. Definitions: What are ADCs?	9
5. Rationale: Why are ADCs an Institutional Imperative?	12
6. Employer Acceptance: Issues and Evidence	20
7. Criteria: What Guidelines Should be Used for the Issuance of ADCs?	24
8. Implementation: How Should an ADC be Implemented?	26
9. ADC Alternative Pathways for Adoption	31
10. Recommendations	32
11. Conclusion	34
12. Addendum: A Snapshot of Blockchain	35
13. References	40
14. Attachments	
1. Predictions	43
2. Glossary	44
3. Universities Experimenting with ADCs Across the Globe	46
4. Badge Examples	48
5. Current ADC Providers	50
6. Blockchain Pilot Projects by Institution	52
7. Institutions to First Adopt Blockchain	53
8. Blockchain Providers Across the Globe	54

Report of the ICDE Working Group on The Present and Future of Alternative Digital Credentials (ADCs)

Executive Summary and Structure of Report

Introduction.

Alternative Digital Credentials (ADCs) will significantly transform the relationship between ICDE member institutions and their students—and ultimately between higher education and society. By providing a digital, information-rich record of workplace-relevant skills and competencies, attributed to an individual, ADCs will challenge the relevance of traditional university transcripts. These alternative forms of verification will create a new and dynamic ecosystem for the evaluation of applied learning in the workplace. ADCs will “unbundle” learning acquisition, verification, and documentation which will disrupt higher education’s traditional advantage and allow non-higher education institutions to be active in the credentialing process. In addition, students, rather than institutions, will be the owners of learning certifications in the form of ADCs, breaking the lock institutions have had on the dissemination of certifications. By focusing on workforce needs, ADCs will help institutions create greater alignment between theory and practice in what they teach, and, at the same time, by providing separate certifications, help protect the traditional values of theory and inquiry in the teaching/learning process.

It is important to note that while ADCs and this report challenge the workplace efficacy of traditional transcripts, they do not challenge the value of earning of a degree for economic or personal advancement. Such challenges are coming from many directions, and while ICDE institutions may face disruptions from

these challenges, including from non-higher education providers, a treatment of these challenges is beyond the scope of this report.

Definitions.

Early in the emergence of any new technology or use, there is confusion of terms. The Working Group defined “alternative” as certifications rather than what institutions are already issuing, usually in the form of transcripts. “Digital” refers to the form of presentation, dissemination, and storage of certification using digital technology. “Credential” is a general term describing the attestation of learning or competency. ADCs are distinguished from other terms such as “badges,” a general term under which ADCs reside, and micro credentials which may or may not be digital. A major decision required of ICDE members has to do with distinguishing competency-based ADCs from learning-accomplishment ADCs, —an issue that is described in depth in the report. Another issue has to do with the digitization of transcripts and how that relates to the issuance of ADCs.

Rationale.

ICDE members should seriously consider implementing ADCs for many reasons. 1) ADCs and their non-university equivalents are already widely offered. 2) Traditional transcripts are not serving students and the workforce because they do not connect student’s capabilities with workforce needs. 3) Accrediting agencies and governments

are focusing on learning outcomes and what students are able to achieve after graduation. 4) Young adults are demanding shorter and more workplace relevant learning. 5) The large volume of open education available to people, including MOOCs, calls for some form of ADC-like certification. 6) Employer hiring practices are increasingly dependent on digital searches and ADCs more easily expose the relevant metadata for the purpose of discovery. 7) Finally, an ADC ecosystem is beginning to develop with governments and foundations creating repositories, standards, and new technology make ADCs more useful and accessible.

Employer Acceptance.

A common excuse for institutions not entering the ADC movement is that employers do not understand or recognize ADCs. The Working Group concludes that there is clear evidence that, while current employer recognition has been slow to develop, there is clear evidence that employers are using ADCs now in limited fashion and that recognition will increase rapidly. A number of corporations including Oracle and IBM issuing ADCs. Major governments, including New Zealand, Australia and Mexico, are creating policies that promote the use of ADCs in workforce training. Companies, including the CRM giant Salesforce, are collaborating with universities to issue ADCs. The lack of employer recognition should not be a factor in deciding whether to adopt ADCs—employer recognition will rapidly increase.

Criteria/Guidelines.

A central contribution of this report are proposed criteria and guidelines for the issuance of ADCs. Without such guidelines, an institution will not be able to determine outcomes that should be credentialed and those that should not, thereby confusing

the marketplace and devaluing ADCs. A critical distinction is between competency-based credentials and learning-achievement credentials. Institutions are likely to want to issue both kinds of ADCs but the distinction between them will create confusion. Ten separate criteria are proposed and frame the decisions ICDE members must make regarding what they will attest.

Implementation.

This report lists several elements in the implementation process that all ICDE members will face in moving forward with ADCs. The selection of an institutional set of icons is a deceptively difficult process, which brings into play many significant decisions. The amount and nature of the “metadata” (or explanatory content) of an ADC is also a significant decision, as is the option to include student work in the digital representation of the ADC. A generic implementation process is described in the implementation section.

Alternative Pathways.

Three (among many) alternatives are proposed for the way ICDE members might approach the ADC movement. First, delay implementation. The advantage is to not involve resources prematurely, wait until the technology and processes have become more refined. The main disadvantage is that the member may fall behind and lose a competitive advantage. Second, is the addition of ADC issuance to existing certification processes. This can be accomplished by choosing a badging utility and starting to issue ADCs. The disadvantage of this approach is that it tends to preserve the status quo, and, without due consideration, no change will result. The advantage is that the member “gets into the game” and may gain competitive advantage. Third, members should create a fully digitized transcript.

ADC issuing processes should cover all competency and learning assessment. The disadvantage is that this is a major enterprise-wide effort with high cost and some risk. The advantage is the possibility of gaining of a highly functional competitive advantage.

Recommendations.

Based on this report the ICDE Working group recommends the following. ICDE members should

1. Seriously consider the implications of an ADC infrastructure and set of services at your institution.
2. Secure support from the senior administration and academic leadership for the adoption of an ADC service system.
3. Assure uniform standards, administration, and oversight of ADC issuance.
4. Resolve basic early decisions about criteria for issuance, relationship to digital transcripts, competencies. Learning achievement, metadata content, icon design, and quality oversight.
5. Establish an implementation plan that includes sufficient resources (human and financial) to support the success of the plan.
6. Choose a third party vendor to supply the software and necessary supporting services.
7. Continuously evaluate the issuance and use of ADCs.
8. Be alert to blockchain applications.

Conclusion.

The report concludes with a call for action by ICDE members to embrace and implement ADCs soon or fall behind. ADCs are clearly going to be an important part of the higher education landscape for the future and will define the relationship between ICDE members and a wide range of their patrons—government, industry, students, and parents. ADCs will have an influence beyond certification at the heart of the institution—with the ability to teach and engage students in a meaningful learning process.

Blockchain Technology.

This report also includes an addendum that describes and discusses Blockchain technology and its application to ADCs. This rapidly evolving technology, upon which Bitcoin is based, is a highly secure and “unhackable” technology to verify and record transactions, including the issuance of ADCs. It remains one possible choice for ICDE members to consider. However, it is just now emerging and while it promises to be the underlying technology of ADCs, it is not yet refined enough for immediate use. However, ICDE members should be aware of its potential.

Report of the ICDE Working Group on The Present and Future of Alternative Digital Credentials (ADCs)

The Call to the Working Group: Charge and Acknowledgements

This report has been prepared at the request of the ICDE Executive Committee at its 22-23 January 2018 meeting. This request came from the ICDE Presidents as a result of a presentation on Alternative Digital Credentials (ADCs) by Gary W. Matkin, Ph.D. at the Presidents' Forum on 20 October 2017 in Toronto, Canada. The general purpose of the report was to "provide guidance for how universities could establish their own criteria for using alternative credentialing, and possible standards that could be used."

On March 9, 2018, The ICDE Working Group on the Present and Future of ADCs is called upon to inform ICDE members about, and

help them prepare for, the coming of ADCs. The Working Group will prepare analysis and summaries of the current and future of ADCs related to their adoption by institutions and their use by institutions, students, and employers. It will prepare reports on the current issues with regard to the implementing of ADCs by institutions, including reports on the vendors and system utilities available for adoption by institutions. Importantly, it will propose institutional standards for the issuance of ADCs—standards that will inform institutions as they determine their own individual standards to meet the particular needs of their constituencies.

Amendments to the Call and Defining Scope

As The Working Group considered its task, it amended the call to clarify terms, focus its scope, and achieve a reasonable time to completion. First, it was determined that time did not allow for any independent surveys or the original compilation and analysis of data. The investigation would be limited to a review of a sample of the considerable literature addressing ADCs. Second, instead of recommending "standards" for the issuance of ADCs, The Working Group would recommend "guidelines" for ICDE institutions to adopt. ICDE is not a standard-setting body and standard-setting would have to involve the agreement and review of a large segment of ICDE membership. We also

determined that discovering opportunities for the advocacy of ADCs was not appropriate for the report. ICDE may decide to be an advocate for ADCs, but that would involve further discussion and understanding after this report is considered. The rationale for the adoption of ADCs is so strong that it, in itself, is the basis for advocacy.

The Working Group will anticipate the future of the ADC movement and what impact the future might have on institutions. Finally, The Working Group will identify opportunities to influence public policies in favor of the adoption of ADCs.

Members of the Working Group

Gary W. Matkin, Ph.D. (Chair)

Dean, Continuing Education and Vice Provost, Career Pathways
University of California, Irvine
gmatkin@uci.edu

Stefania Aceto

Senior Researcher and Project Manager
Universidad Internacional de La Rioja (UNIR), Spain
stefania.aceto@unir.net

Deb Adair

Quality Matters
dadair@qualitymatters.org

Ansary Ahmed

Professor and President/CEO
Asia e-University
president@aeu.edu.mv

Mark Brown

Full Professor
Director, National Institute for Digital Learning Glasnevin Campus
Dublin City University
mark.brown@dcu.ie

Daniel Burgos

ICDE Chair in OER, UNESCO Chair on eLearning,
Vice Chancellor for Knowledge Transfer and Technology
Universidad Internacional de La Rioja (UNIR), Spain
Daniel.burgos@unir.net

Cheong Hee Kiat

President
Singapore University of Social Sciences
hklecheong@suss.edu.sg

Gabriela Geron, Ph.D.

Founder
Connecting Iberoamerica
gabriela.geron@connectingiberoamerica.com

Allyn Radford

Independent Consultant
Transforming Credentials
allyn.radford@transformingcredentials.com.au

Darien Rossiter

Principal Advisor to Deputy Vice Chancellor, Education and VP
Royal Melbourne Institute of Technology
darien.rossiter@rmit.edu.au

ICDE Working Group Report on the Present and Future of Alternative Digital Credentials

Introduction.

Alternative Digital Credentials (ADCs) will significantly transform the relationship between ICDE member institutions and their students—and ultimately between higher education and society. For instance, by providing a fully digital, information-rich record of workplace-relevant skills and competencies in the near future, the use of ADCs will seriously challenge the validity of traditional university transcripts making them obsolete and, in the long-term, irrelevant. While degree (diploma) completion will remain important to employers, alternative forms of verification of learning and competency will create a new and dynamic ecosystem for the evaluation of applied learning and workplace competence.

ICDE institutional members will be profoundly influenced by the shift in importance from traditional forms of learning attestation (transcripts) to the new forms embodied by ADCs.

Higher education institutions are being challenged in their role as the dominant credentialing player in society. The ecosystem for credentialing in our society is quickly changing with many new credential issuers joining the movement. This movement is being propelled by the fact that, in contrast to traditional and more formal credentialing, both learners and employers are becoming more comfortable with the valuing of shorter modules of learning. This new ecosystem has several characteristics that traditional forms of credentialing do not.

First, the demonstration of acquired skills and knowledge will be more important than where or how the learning occurred.

This “unbundling” of learning acquisition, verification, and documentation will break the long-held advantage that higher education institutions have enjoyed in the verification of a person’s education and will further enable non-higher education organizations (such as professional associations and corporations) to become active in providing learning opportunities and credentialing.

Second, students will be the owners of their ADCs and will have control over dissemination. Currently, institutions control the dissemination of academic transcripts and effectively limit public access through transcript fees and restrictions on the student data they are allowed (or willing) to release. The advent of secure, un-hackable authentication processes will make ADCs as, or even more secure, than traditional transcripts.

This movement toward ADCs has already begun to influence the traditional degree curricula to better serve workplace needs. In other words, what has been taught in formal curriculum either in classroom or online, will gradually evolve to better prepare students for employment. The failure to connect traditional higher education to workforce needs is an increasingly evident gap.

ICDE members will experience a slow decline in relevance and market position if they fail to adopt ADCs and remain unsympathetic to student employability concerns. They should add ADCs to their portfolio of services most importantly to fulfill their implicit promise to students and society.

Definitions: What are ADCs?

The vocabulary used to describe any emerging innovation is always an issue until the terms themselves take on specific and generally accepted meanings. This report seeks to contribute to the clarity of terms by defining the ADC as a specific form of certification issued by an institution of higher education that attests the competence and capability of an individual to perform productively in the workplace, and, to some extent, in society.

ADCs are portable, useful, transferable, and easily understood.

ADCs “can contain specific claims of competency and web-based evidence of those competencies. They can be curated, annotated, and distributed over digital networks under the earner’s control” (Hickey, 2017, pg. 18).

1. Alternative refers to credentials that are distinctive from a diploma, advanced diploma, associate degree, bachelor’s degree, graduate degree, master’s degree, doctoral degree, or other attestation to the completion of a course of academic study. The digitization of transcripts and degree credentials is also an important trend, but should be distinguished from ADCs. Alternative credentials attest to the gaining of competency, focusing on the practical application of the knowledge gained (competency) or unbundled academic achievement (evaluated learning). It can also include recognition of competencies or learning gained from other providers or from experience.
2. Digital refers to the form of presentation, curation, and storage using digital technology to store and transmit information, which in this case consists of the credentials and their embedded data. The credentials are stored in repositories and then are transmitted to recipients electronically (usually via the Internet). Digitization provides an efficient means of disseminating information about a person’s competence. This is extremely valuable for job-seekers, who have a way to demonstrate their competence in front of many prospective employers, who have a convenient way to compare the qualifications of many applicants. In the future it will become increasingly common for automated candidate matching for job roles using credential data. Digital technologies also promise highly secure authentications of achievement (see Blockchain Addendum, pg. 37).
3. Credential is a general term used to describe the product of a learning enterprise and represents the attestation by a respected third- party (often institutions of higher learning) that learning has been accomplished and that the credentialed individual is capable of applying that learning toward productive behavior.

Several points follow from the definitions above require specific discussion.

ADCs, in this report, are associated with higher education institutions. This makes sense because of the term “alternative” distinguishes them from what institutions would normally offer. However, while non-degree organizations, such as professional associations, do not have any primary

credentials for which alternatives are needed, the term ADC may also apply to their offerings in that they may not have any recognized and accepted credentials.

ADCs are related to competencies, capabilities, and learning relevant for the workforce. This qualification usefully narrows the scope of ADCs and focuses post-secondary institutions on workplace-relevant skills. In this definition, a learner would not receive an ADC for appreciating the operatic musical form or understanding the political situation in for instance, the Middle East.

A major issue in defining ADCs in higher education has to do with the difference between “competency” and “learning-achievement.” A testament to the competency of an individual indicates that an individual has not only learned (gained knowledge about) something, but is also able to apply that knowledge in a practical way. Competency is the result of learning and that learning can come from any source—formal courses, work experience, innate ability. Attesting to the learning-achievement of an individual opens extensive use of ADCs, is more consistent with traditional assessments (as a grade in a course), and therefore is easier to implement. Learning-achievement is usually associated with a specific learning treatment offered by the issuer of the ADC, such as a course.

However, opening the door to learning-achievement ADCs, presents some significant issues. It may lead to the confusing proliferation of ADCs of varying levels and extent of learner involvement. It also may erode the value of competency-based ADCs, particularly as those ADCs are used to distinguish learners in the marketplace. To place competency ADCs alongside learning-achievement, ADCs without making a clear distinction between the two, would clearly

be confusing. However problematic the combining of competencies and learning achievements is, the pressure to issue both types of ADCs is too great, and most universities will eventually issue both types.

Prediction: ICDE members will have to distinguish between competency and learning-achievement ADCs.

ADCs are sometimes confused with the digitizing of traditional transcripts, a practice that is becoming more widespread as a means of serving students and meeting their needs more completely. Part of this confusion is that the vendors and utilities used for digitizing both transcripts and ADCs can be the same. It might also arise when the objectives for engaging in ADCs have not been clearly considered or articulated. The portability of digitized official transcripts has a significant appeal for students and can be a cost-saving benefit to institutions. However, it is institutionally important that the traditional transcript and its dissemination be distinguished from ADCs—otherwise students and the public will be confused and there might be a possibility that the special nature and importance of transcripts would be eroded.

Prediction: ICDE members will have to distinguish between the digitation of transcripts and the offering of ADCs.

ADCs are related to other commonly used terms, of which the most frequently used is “badge.” Badges are digital recognitions of a wide variety of learning accomplishments, skills, abilities, and activities. Badges are issued by many organizations including professional associations, corporations, businesses, MOOC providers, and many others. ADCs are a form of badge and yet have the restrictions described above.

Many other terms are frequently used in connection with this growing badging trend. Major MOOC providers have coined their own terms for their offerings. For instance, MOOC course sequences covering general subject matter normally associated with traditional degrees, particularly at the master's level, have been named and even trademarked by Coursera (sequences, Master Track), EdX (micro-masters), and Udacity (nano-degrees).

For additional commonly used terms and their definitions in the context of this report, please refer to the (see attachment #2: Glossary).



Rationale: Why are ADCs an Institutional Imperative?

The use of the word “imperative” in the title of this section is not an exaggeration. The ADC movement represents the coming together of many forces that are influencing higher education today.

The ADC movement is developing at the pace of technology, leaving many, but not all, universities behind, mired in a characteristic inability to embrace change, even when that change clearly serves students and society. ICDE members must turn their attention to ADCs before nontraditional and tech-savvy organizations encroach on universities’ traditional spheres of influence. ICDE members need to respond to the massive shift in employment caused by technological change, the need for quick and regular reskilling, and the dissatisfaction of employers with ill-prepared graduates. The extensive listing and description of the influencing forces below make a strong argument for a quick adoption of ADCs.

1. ADCs (and their non-university equivalents) are already widely offered.

Many universities around the globe are experimenting with ADCs. Attachment #3 lists 27 institutions that are currently experimenting with ADCs. The movement is quickly evolving. In 2014, a study found that 30 percent of Americans hold some form of alternative credential (Marklein, 2014). Relatively few of these were issued by universities, underlining the fact that competition from non-higher education institutions is firmly in place.

Two years later, in June 2016, a study of 190 four-year institutions in the U.S. found that 94 percent of them were issuing some sort of alternative credential and 25 percent of them were offering

them digitally (Fong, J., Janzow, P., Peck, K., 2016). Among the institutions taking the lead are the Community College System of Colorado, which launched 17 ADCs in manufacturing; the University of Wisconsin, Madison, which created a system of ADCs for workforce development; and the Open University of the UK, which launched its Badged Open Courses (BOC) initiative in 2013.

ADCs are certainly compatible with traditional degrees. For instance, the University of California, Davis created one of the first ADC systems based on an undergraduate degree. According to a report published by Acclaim¹, “Open Badges for Higher Education,” UC Davis undergraduate students majoring in Sustainable Agriculture and Food Systems will receive ADCs such as “Systems Thinking,” “Experimental Inquiry,” and “Understanding Values.” In 2018, the Royal Melbourne Institute of Technology implemented a program to embed micro-credentials (with associated digital badges) in 51 programs serving 7,500 students.

Many universities around the globe are experimenting with ADCs. Attachment #3 lists 27 institutions that are experimenting with ADCs.

In 2014, another study found that 30 percent of Americans hold some form of alternative credential (Marklein, 2014). Relatively few of these credentials were issued by universities, underlining the fact that competition from non-higher educational institutions is already firmly in place.

¹ Acclaim is an open badge platform acquired from Pearson by Credly.

In March 2016, LinkedIn Learning², using Lynda.com courses, offered more than 50 “learning paths” related to certificates that could be posted on LinkedIn (Fong, et.al. 2016, pg.3). Despite the close connection between LinkedIn and Lynda.com, Coursera boasts that its MOOC designations are even more widely referenced on LinkedIn, which is not surprising since it has over 30 million users. As major MOOC providers sought to monetize their products, their main source of early revenue came from relatively inexpensive certifications of learning-achievement from free courses. These designations now number in the millions.

However, the Wall Street Journal noted in an article about MOOC providers, that digital credentials issued by them:

“colleges and universities are waking up to the power of digital credentials—not just for road markers, but as ways to create new roads. We’re starting to see digital credentials as building blocks of digital pathways that will shape the future of higher education” (Weber, 2015).

2. Traditional transcripts are not serving the workforce. The primary failure of traditional transcripts is that they do not connect verified competencies to jobs.

“For all practical purposes, a college transcript is a static, standalone document that fails most of the market-facing tests we have come to expect in the age of the Internet. The transcript is meant to be locked in a secure location and shown only to graduate school admissions

officers or HR hiring managers that are seeking to verify attendance, grades, or degrees. A transcript cannot capture what a student has learned or achieved outside of the classroom, and it certainly cannot communicate the aspirations that may signal long-term career success. A student cannot sign an email with a transcript, so it is not tied in any useful way to digital identity. Employers cannot validate important skills nor assess the relevance of a student project simply by looking at a transcript” (DeMilo, 2017).

The difference between the form and dissemination of a typical transcript and the needs of students entering the workforce is apparent. While transcripts remain useful for students continuing their formal degree education, they are basically useless in the workplace, except perhaps to a very diligent reviewer.

For instance, course names on transcripts are often abbreviated to an extent that makes them uninterpretable. The grading system used in transcripts rarely indicates any level of mastery, particularly when grade inflation³ is an established trend. Students with transcripts from multiple institutions face a particular problem in presenting a coherent story of their academic careers—a problem that the digitization of records would help to alleviate.

In contrast to traditional transcripts, ADCs clearly link competencies with workforce requirements by identifying and verifying the competencies needed for a job or skills for the future. Additionally, the digital nature of ADCs makes it easy for students

² LinkedIn Learning combines the industry content from Lynda.com with LinkedIn’s professional data and network.

³ Grade inflation is used in two senses: (1) grading leniency: the awarding of higher grades than students deserve, which yields a higher average grade given to students (2) the tendency to award progressively higher academic grades for work that would have received lower grades in the past.

to disseminate them independently of the issuing institution and place them at any digital location they choose.

The power of the rationale behind the convenience created by digitization is that institutions will have to digitize their traditional transcripts. They will also have to include meaningful certification of student capabilities and competencies in their programs, as well as, communicate to stakeholders that students can actually perform the relevant tasks to an established and generally recognized standard.

It is important to note that while this critique of traditional transcripts through the lens of workforce relevance is strong, it is not a critique of degree obtainment itself. Degrees will continue to be the primary credential in higher education across the world. While degrees are a normal ticket to meaningful careers, that ticket represents the ability of graduates to master a body of knowledge and integrate the knowledge and skills necessary for that mastery. Such mastery is not simply the combination of individually identifiable skills and competencies, but a much broader and more complex action of intellectual integration and meaning-making.

Prediction: ICDE members will be forced to digitize their traditional transcripts.

3. Accrediting agencies are beginning to focus on learning outcomes.

The universal pressure on higher education institutions to be accountable, especially in the face of rising tuitions and costs, has led governmental agencies in most countries to push accountability

measurements on colleges and universities.

U.S. regional accrediting bodies require that each degree program publish desired student outcomes for the program and then measure the program's effectiveness against the achievement of those outcomes. Universities are called upon to provide an education that is relevant to life after graduation and an education that results in meaningful careers for students. For instance, in May 2017, four U.S. senators introduced the College Transparency Act⁴ that would:

“patch up the big gaps in college data transparency and finally provide students, families, and policy makers with an accurate picture of how colleges are serving today's students” (Harris, 2017).

ADCs, either embedded in degree programs (such as the previously cited example from UC Davis or the RMIT University [Australia] initiative that embeds nano-credentials in its formal award programs), or those that are not connected to degrees but are offered through university continuing education organizations, can help universities build momentum toward a full-scale adoption of ADCs, while demonstrating responsiveness to societal demands. The data generated through the ADC issuance process will support this demonstration.

4. Young adults are demanding shorter and more workplace-relevant learning.

As millennials become an increasing part of the workforce, it is important

⁴ Sen. Orrin Hatch-Utah, Sen. Elizabeth Warren-Massachusetts, Sen. Bill Cassidy-Arizona, Sen. Sheldon Whitehouse-Rhode Island. The College Transparency Act seeks to lift the veil on postsecondary student outcomes and will empower students, college leaders, and policymakers with the information they need to make better-informed decisions.

to understand their preferences and attitudes toward education. Their impact has already been felt in the university continuing education context with a major shift toward short, focused, intense, and workplace-relevant courses.

As bachelor's degrees become the minimum requirement for jobs, these young adults seek ways to distinguish themselves in the marketplace through alternative credentials either in place of, or alongside, traditional degrees. This is especially the case as the marketplace moves toward the so called "gig" economy⁵ where individuals increasingly jump from job to job based on the skills and abilities they can demonstrate and verify. However, it is possible that the full scale adoption of ADCs will create such a valuable alternative to degrees that they will decline in importance.

A recent 2017 UCPEA study, "Increasing Millennial Interest in Alternative Credentialing," found that the majority of millennials (ages 21 to 35) exhibit a strong interest in earning certifications or badges in the future. Specifically, 72.4 percent of young millennials (ages 21 to 25), 65 percent of middle millennials (ages 26 to 30), and 66.4 percent of old millennials (ages 31 to 35) show moderate to strong interest in earning certifications and/or badges (Fong, 2017).

Parchment⁶, a provider of badging services, surveyed 1,015 students of varying educational levels and found that 71 percent want competency-based credentials that certify skills learned. And over 60 percent want sharable credentials

that they can post to professional networks such as LinkedIn that reveal details about academic experiences and are viewable on a mobile device (Hanson, 2017).

In June 2018, Strada Education Network^{SM7} partnered with Gallup to create the first national survey of education consumers called "From College to Life: Relevance and the Value of Higher Education." The survey includes responses from more than 250,000 students, from 3,000 different schools and programs, to assess their educational experiences after high school as they transitioned into work life. According to the report, relevance is a powerful theme that affects consumer perspectives on the value they place on their education (Strada and Gallup, 2018, pg. 2).

- "Relevance influences value and quality."
- "Relevance is related to well-being."
- "Relevance is a far more powerful predictor of consumer ratings of educational quality and cost value than other important demographic characteristics."
- "Relevance explains two and three times more variance in consumer ratings of quality and value, respectively, than public data widely used to create college and university rankings."

The recent rise in "bootcamps⁸," highly compressed training programs, mostly in the hard IT technical fields such as coding, also is relevant here. In a report

5 A gig economy is an environment in which temporary positions are common and organizations contract with independent workers for short-term engagements.

6 Parchment is a digital credential service that connects learners to P20 academic institutions and employers to issue, receive, and share credentials in simple and secure ways.

7 Strada Education NetworkSM is a national 501(c)(3) nonprofit dedicated to improving lives by catalyzing more direct and promising pathways between education and employment.

8 A coding bootcamp is a technical training program that teaches the programming skills that employers look for.

titled, “Growth of Coding Bootcamps 2017” indicates that such bootcamps have graduated over 23,000 students, with a sharp growth curve (Eggleston, 2017)

Since most of these programs are non-credit programs (i.e. do not carry college credit) the desirability of ADCs to verify and disseminate the highly relevant skill information about individuals is very compelling.

Higher education institutions are being challenged in their role as the dominant credentialing player in society. The ecosystem for credentialing in our society is quickly changing with many new credential issuers joining the movement. This movement is being propelled by the fact that, in contrast to traditional and more formal credentialing, both learners and employers are becoming more comfortable with the valuing of shorter modules of learning. This new ecosystem has several characteristics that traditional forms of credentialing do not.

ADCs are clearly in demand for this growing segment of the workforce; they reinforce and serve all of the market shifts described above. As shorter learning projects are defined, ADCs provide quick, detailed information about an individual’s competency that can be supported by specific information in the form of embedded ePortfolios of work previously undertaken by the job seeker

5. Open education demands ADCs.

The huge drive toward Open Educational Resources (OER) began in 2000 and has now expanded into repositories of millions of OER material. The early notion was that this free material could somehow be associated with formal education,

including academic degree credit.

The diversification of OER types, formats, platforms, and originators spurred the consideration that formal education could be achieved inexpensively and at scale. The promise was that OER could address the immense global demand for high quality, university-level education, with a special focus on developing countries.

In 2012, the arrival of MOOCs accelerated this concept as the main providers of MOOCs began “monetizing” their free products by charging for certifications of Perhaps a more direct testimony to the employer use of digital information comes from Hart Research Associates 2017 report, “Fulfilling the America Dream: Liberal Education and the Future of Work,” which conducted a study of 500 hiring executives across a spectrum of businesses and industries:

Coursera is offering now at least ten degrees with several institutional partners; EdX is offering courses that will be accepted by MIT and Harvard toward their degrees; and Udacity teamed with Georgia Tech to offer a MOOC-based inexpensive degree in computer science which quickly overenrolled. In 2013, Coursera created non-degree course sequences in order to increase retention rates, which is happening across MOOCs and OER.

The sheer volume of OER available, and the ease of access to it, exerts a gravitational pull toward ADCs as learners naturally seek external validation of what they accomplished through OER.

6. Hiring practices increasingly depend on digital searches.

Employers are using new tactics to identify qualified job candidates. The scarcity of professional skills in some areas and the highly specialized needs of employers are driving new hiring techniques based on an assessment of the candidate's digital footprint. The unreliability of traditional resume review for making hiring decisions was underlined recently in a study of over 5,500 resumes that found that over 80 percent had some discrepancies and 12 percent had false information (Williams, 2018). However slowly, employers are beginning to recognize the value of ADCs. In another study, when transcripts were placed side by side with digital badges, 86 percent of knowledgeable employers preferred a digital badge over an academic transcript when verifying a student's skills (Finkelstein, J., Perea, B., Tyszkowski, Y., Jona, K., 2018).

Perhaps a more direct testimony to the employer use of digital information comes from Hart Research Associates 2017 report, "Fulfilling the America Dream: Liberal Education and the Future of Work," which conducted a study of 500 hiring executives across a spectrum of businesses and industries:

"Business executives and hiring managers find electronic portfolios that summarize and demonstrate a candidate's accomplishments in key skill and knowledge areas more useful than college transcripts alone in evaluating recent graduates' potential to succeed in the workplace." (Hart Research Associates, 2017).

Prediction: The digital nature of ADCs combined with the automated ability employers have to examine large sets of candidate data

will accelerate the adoption and importance of ADCs.

7. An ADC ecosystem is developing.

One of the first implementations of a digital achievement system was developed by Microsoft for the Xbox 360's Gamescore⁹ system in 2005 (Nyren, 2018). In 2011, the Mozilla Foundation¹⁰ announced a plan to create a technical standard for issuing, collecting, and displaying qualifications earned online through the form of open badges (Nyren, 2018). From these initial efforts there has been a steady growth, refinement, and sophistication in the ambition and concept of badges issued across organizations.

These attempts first defined the technical structure of badges to conform to technical standards so that they could be stored and discovered according to established protocols. In 2013, the Open Badges Specification 1.0¹¹ sponsored by Mozilla, attempted to issue open badges that worked across current and future platforms. This effort was followed by the release of Open Badges Specifications 2.0¹² in December 2016, which was adopted by the IMS Global Learning Consortium¹³ in January 2017. The

9 The Xbox Gamescore system is a cumulative score of all the "Achievements" an individual has earned across any and all Xbox 360/Xbox One games. Each game has different challenges (some much harder than others), each worth a set number of points.

10 The Mozilla Foundation created open badges in 2011 with funding from the MacArthur Foundation and other partners to develop a new way to recognize learning where ever it happened-online and face to face formal education.

11 Version 1.0 was established as the official code repository for the Open Badges Specification.

12 Version 2.0 of the Open Badges specification makes new features available both in the badge class and assertion, as well as other, 'miscellaneous' features. For detailed specifications visit: <https://www.imsglobal.org/sites/default/files/Badges/OBv2p0/history/2.0.html>

13 IMS Global is the world-leading non-profit collaborative advancing edtech interoperability, innovation, and learning impact. IMS enables a plug-and-play-architecture and ecosystem that provides a foundation on which innovative

publishing of Open Badges has now been transferred from the Mozilla Foundation to IMS¹⁴, which is now enlisting the help of several major badge providers to refine the specifications (Nyren, 2018).

Perhaps the most ambitious effort to organize the storage and discovery of alternative credentials is being undertaken by the Credential Engine¹⁵, a program of the Credential Transparency Initiative¹⁶, in part by the Lumina Foundation¹⁷.

The Credential Engine is intended as:

A first-of-its-kind credential registry that will allow users to see every credential—from college degrees to industry certifications and micro-credentials—represented in terms of competencies, transfer value, assessment rigor, third-party approval status, labor market value, and much more (Gaston, 2017).

There are many other efforts to push badges, including ADCs, into some form

of organizing framework. The Pipeline Data Project¹⁸, the Connecting Credentials initiative¹⁹ and the Comprehensive Learner Records (CLR)²⁰ project are examples.

Individual organizations, especially those with large amounts of OER, have also designed their own storage and dissemination frameworks such as the Badged Open Course (BOC)²¹ initiative at the Open University of the UK. Further is the Making Informal Recognition Visible and Actionable (MIVRA) project, coordinated by Espace Mendes in France and involves eight partners from six EU countries. The project contemplates a universal recognition system whereby anyone can recognize attributes of anyone else with an emphasis on informal learning. MIRVA aims to study the conditions of an Informal Recognition environment by exploring:

- The potential benefits of Open Endorsement as proposed by the Open Badge 2.0 specification;
- The conditions (technical, educational, political, etc.) for the successful implementation of Open Endorsement;
- The services that could emerge from the information generated through

products can be rapidly deployed and work together seamlessly.

14 IMS Global is responsible for managing and advancing the Open Badges specification—a vital component of the digital credentials ecosystem. Open Badges is designed for compatibility and interoperability with the other IMS standards related to digital credentials: Comprehensive Learner Record and Competencies and Academic Standards Exchange (CASE)[®].

15 Credential Engine is a non-profit whose mission is to create credential transparency, reveal the credential marketplace, increase credential literacy, and empower everyone to make more informed decisions about credentials and their value.

16 Credential Transparency Initiative aims to create greater coherence, and transparency in the U.S. credentialing marketplace by: developing a common terminology for describing key features of credentials; creating a voluntary, web-based “registry” for sharing the resulting information; and testing practical “app” options to help produce searches that would benefit employers, students, educators and others.

17 Lumina Foundation is an independent, private foundation in Indianapolis that is committed to making opportunities for learning beyond high school available to all. We envision a system that is easy to navigate, delivers fair results, and meets the nation’s need for talent through a broad range of credentials. Our goal is to prepare people for informed citizenship and for success in a global economy.

18 The purpose of a data pipeline is to avail some data from its point of origin to some point of consumption.

19 In 2015, Lumina Foundation and Corporation for a Skilled Workforce (CSW) joined forces to establish the Connecting Credentials initiative and call for a national dialogue on how to build a well-functioning and sustainable credentialing system. Since that time, more than 100 organizations in the credentialing marketplace have agreed to co-sponsor the dialogue.

20 The CLRs seek to capture, record, and communicate learning when and where it happens in a student’s higher education experience. This includes learning outcomes from courses, program and degrees, as well as experience they have outside the classroom that help develop their career ready skills and abilities.

21 Badged open courses (BOCs) have been developed in response to the needs of informal learners who are seeking access to study skills and to have their learning recognized.

Open Endorsement;

- The mitigation of the risks of poor endorsements practices (e.g. LinkedIn);
- The conditions for creation of an effective continuum between informal and formal recognition.

ICDE members should remain aware of the resources available to connect their individual ADC implementation schemes to these initial standard-setting bodies. Most of the major vendors for issuing badges, including Badgr, Credly/Acclaim, and Parchment are already in touch with these standard setting initiatives, so if implementation of badging systems goes through the major vendors this should not be a major issue. However, the picture is not bright for the emergence of a comprehensive catalog or agreed upon technical or quality standards. The

number of issuing organizations is too broad and diverse, the number of possible credentials to be included in a data base is too large and fast changing, and the imposing of agreed upon standards of quality for entry into repositories is too difficult to agree upon.

It is more likely that initiatives of various types will align their digital credentials with existing, established standards or frameworks (qualification or industry skill frameworks, etc.) as a means to establish equivalence. Over time national, regional, and international cooperation efforts will establish key pathways for students and for those assessing the validity of badges.

Prediction: Efforts to set universal technical and quality standards for badges and to establish comprehensive repositories for credentials conforming to a single standard will not succeed.



Employer Acceptance: Issues and Evidence

A constant concern in determining whether an ICDE institution should enter the ADC badge movement is employer acceptance. It is still too early in the development of ADCs to affirm that ADCs will, in fact, be accepted and valued by employers. Many employers do not understand the potential of ADCs and badges in general, so that a portion of the market for ADCs has not yet been fully formed. However, it is clear that employer understanding of badges in general, and ADCs in particular, are beginning to penetrate the knowledge and practices of employers, and may even supplant more traditional ways of assessing potential candidates.

In a report, “Digital Badge Credentialing Value: From an Employer Perspective,” written by Dr. Constance D. Erickson, concluded that although traditional education remains a valued determinate of qualifications for many of the interviewees in this study and it appeared that acceptance for non-traditional credentialing may be at a crucial tipping point. Dr. Erickson goes on to say that employer acceptance of digital credentials hinges on the ability of universities to align education programming with business demands and the need to establish standards to safeguard quality and increase trust among employers (Erickson, 2015).

Recent events have set the stage for increased employer reliance on badges and ADCs. For instance, in a trend that is disturbing to higher education institutions, several large consulting firms (PWC, EY, Random House, KPMG, and Deloitte) have all removed their requirement for a degree to enter their workforces (Agnew, 2016). When this trend is accompanied by government efforts to foster apprenticeship programs where degree attainment is not a requirement

for a good paying job and the tying of degrees to apprenticeship programs (degrees by apprenticeship in the UK), there will be increased recognition of ADCs by employers.

The shift to acceptance of alternative pathways to qualification and credentialing is challenging the role of higher education institutions. If universities do not transform their business model and simply adopt a modular form of credentialing of their current qualification programs without changing their relationship with students and employers, they will place themselves at great risk.

There are some interesting drivers that contribute to employer acceptance of various forms of ADCs that fall within The Working Group’s definition of ADCs²². There is little doubt that the technology sector is leading the way in overall acceptance as evidenced by the examples below, but there is also evidence of other sectors moving to ADC models. These are sometimes being driven by industry regulators, associations, or the government. In New Zealand, for example, the Primary Industry Training Organization which is dedicated to grow primary industries, is introducing micro-credentials in key areas such as biosecurity.

Early adoption models are often still embedded with the need to complete a course, or other learning activities, as part of the process for an ADC to be earned. These cases tend to rely on relationships between different types of learning providers such as MOOC providers, existing institutions, or a combination of both. They may also be

²² Note: At times the terms relating to ADCs and Badges are used interchangeably in this section as a result of the terminology used by different organizations. The use of “badge” should be interpreted as an ADC issued by a different type of organization, often an employer and often in the context of certification.

supplemented by Open Education Resources (OER) of various kinds, or as indicated below, vendors within industry sectors. Early on, models such as these are less likely to include professional practice as part of their requirements or assessment and are less divergent from traditional models.

Employer usage of ADCs tends to fall into two categories: 1) using and promoting their own ADCs to their employees and partners, and 2) adoption of ADCs from other organizations. The adoption model (2) may be further broken down into adoption of domain specific ADCs for technical/functional skills and adoption of ADCs related to “soft skills” (also known as employability skills or 21st century skills etc).

Clearly, we are at the beginning of adoption cycles with employers when it comes to ADCs. While acceptance is patchy, some employers are surging ahead, and others will adopt them more slowly. Nonetheless, it is reasonable to assume that just as employers drove the value of degrees through their acceptance of them as an indicator of employability, the same will occur with ADCs as they build views of their organizational capacity through the inclusion of ADCs within their human resource management activities. As with most things digital so far, this may increase rapidly to scale.

Technology leads the way.

Adoption of technologically-oriented skills emerges from a history of vendor certifications that have long-standing acceptance from employers. It is common for employers to value third-party vendor certifications more highly than qualifications (degrees) in relation to particular job roles. For example, an employer will have greater certainty that a System Administrator, who has the appropriate vendor certification with or without a degree, is competent to

undertake the job functions than a degree graduate who does not have the relevant certification. This is true for certifications in any particular technology set (Networking, Databases, Security, etc). It also extends to other job functions such as Project Management, Enterprise Architecture, etc. As a result, the technology sector has become an early “proving ground” for ADC initiatives. These examples come from Oracle, IBM, and Google.

Oracle

Oracle’s interest in ADCs, evident in the referenced blog post, is indicative of the position being taken by large companies in the technology sector. It is an example of their messaging from within a global company that flows to their clients and practitioners and adds further momentum for employers to consider the importance of alternative credentials, and therefore, pushes towards greater employer acceptance (Barrington, 2017).

IBM

In 2017, IBM earned a top industry award for its innovation in technology certification programs using Open Badges (Leaser, 2017). The benefits related to their award were;

- Easier publication of certifications earned
- Improvements in employee engagement and progression
- Driving professional development activities
- Ability to create and use specialty credentials

Google

To address the shortage of IT support jobs,

Google created a five course certificate program, offered on Coursera as a MOOC, that enrolled 40,000 learners (1,200 completers) in the first five months. This version does not come with college credit. However, Google is now working with 25 community colleges in seven states to create a credit bearing program. Several four year universities, including Duke, may be working through Coursera to offer some form of credit. (Fain, 2018).

A further impact of ADCs that emerges from employer adoption leads to displacement of universities. *The Wall Street Journal* recently relating to large technology companies reaching into and recruiting from the Community College System to identify alternative sources of talent and bring into the company sooner (Mims, 2018).

Governments are involved.

Government initiatives are also being spawned to align education and employment. For instance, the New Zealand Government has formally launched several three pilots in micro-credentialing including:

- A nine-month course in self-driving cars.
- EduBits²³ that relate to the New Zealand Qualifications Authority (NZQA)²⁴.
- The Young Enterprise Scheme²⁵ aimed at school-age students and provides them with an opportunity to set-up and

23 Also known as data-rich micro-credentials, EduBits, also known as data-rich micro-credentials give students the opportunity to be assessed by Otago Polytechnic, one of New Zealand's leading tertiary education institutions in partnership with industry leaders. Once awarded an EduBit credential, the micro-credential will be issued for use on a student's CV, social sharing, LinkedIn or other online profiles. EduBits do not award academic credits towards qualifications.

24 NZQA administers the National Certificates of Educational Achievement (NCEAs) for secondary school students and is responsible for the quality assurance of non-university tertiary training providers.

25 The Young System enterprise programs use a combination of teachers and members of the business community to provide an authentic and relevant experience for students.

run a business as part of an experiential learning activity.

As a result of these pilots, the NZOA has now released a micro-credential system that aligns with their Qualification Framework.

In Australia there has been a push for ADCs through closer ties between industry/ employers and higher education. The greater frequency of such signals and the greater their strength, the more employers will shift to this more flexible approach to quantifying the capability of their workforce. The Australian Industry Group²⁶ released their report, "Developing the Workforce for a Digital Future: Addressing Critical Issues and Planning for Action," where it encouraged employers and higher education institutions to move towards micro-credentials as a means of improving the flexibility of workforce development and understanding capability.

Micro-credentials for engineering education to build capacity in the engineering workforce now attest to achievement requirements in a stratified manner.

Employers issue their own ADCs.

Employers themselves are issuing badges. A major indication that employers are beginning to recognize ADCs and badges is the fact that large employers themselves are issuing these credentials which are being recognized by other companies. We have already mentioned Oracle and IBM as being part of this category. They are joined by Cisco, which is now offering badges to those already holding certification status with them at the Associate, Professional, and Expert Level. In addition,

26 The Australian Industry Group (AI Group®) is a peak employer organization that represents traditional, innovative, and emerging industry sectors. The AI Group is a national organization that has been supporting businesses across Australia for more than 140 years.

Siemens created its own unique STEM skills program, and of course, the well-known Microsoft Exam and certification badges.

Company partnerships with universities.

Companies are forming partnerships with universities to offer ADCs. Salesforce, the giant Customer Relations Management (CRM) provider, has created the Salesforce Academic Alliance Program²⁷, offering a training program that leverages hands-on training in practical IT programming skills. With over 70 institutional members, this program started in 2012 and involves such institutions as the University of Massachusetts-Lowell, where students can earn ADCs in five courses.

The University of San Francisco is also a member of the alliance and has created graduate and undergraduate programs that build on the skills development within

²⁷ Salesforce's Academic Alliance program offers practical, hands-on training and certification to help students develop the skills they need to develop real world skills upon graduation.

the Salesforce program. Tecnologico de Monterrey and the Santander Bank are collaborating on an alliance to help the digital transformation of banking, producing “nano-degrees²⁸” for Tec students. Other examples of such partnerships are Bellevue University's partnership with Chipotle to map skills along a Chipotle created career path and Parsons School partnership with *Teen Vogue Magazine* to create a certificate in fashion industry essentials. RMIT has partnered with Bosch to create a suite of micro-credentials to promote advancements in key industries.

The Working Group concludes that, while still relatively low, employer understanding and use of badges and ADCs in identifying talent for employment and in advancing the skills in their own existing work force will increase rapidly. Therefore, the risk in delaying adoption of ADCs will increase rapidly, pushing non-acting ICDE members to a belated catch-up role if the delay is too long.

²⁸ A nanodegree is a course of study that can be completed in less than twelve months.



Criteria: What Guidelines Should Be Used for the Issuance of ADCs?

ICDE members have the responsibility for setting criteria to govern their own issuance of ADCs. ADCs will have meaning and credibility if they can be well understood and have quality standards built into their issuance criteria, determining how and what the ADC should be issued for.

“The criteria required to receive a badge are important to the overall design and success of a badge system because they make specific claims to learning. Criteria help set parameters that are useful to learners, evaluators, and those viewing the badge after it has been awarded. Establishing criteria of a badge provides a clear pathway to the learner and establishes a claim of learning with the person viewing the badge.” (Demillo, 2017).

This report, as indicated earlier, distinguishes between competency-based ADCs and learning accomplishment ADCs. While the criteria presented here applies to both types of ADCs, they should be distinguished with competencies being assessed in terms of how learning and experience can be applied in a practical and work-force relevant way, and learning-achievement ADCs attesting to the accomplishment of stated learning outcomes.

The following guidelines are presented for consideration by ICDE members.

1. An ADC will not duplicate or displace a certification that does or would normally exist on an official transcript of the institution. This honors the “alternative” element of the title of the ADC designation and eliminates the possibility that an institution could issue two different certifications for the same competency. It is allowable, however, that a traditionally transcribed course might contain more granular components for which ADCs could be issued.
2. ADCs will be issued only for competencies and learning achievements that are relevant to the workforce. Relevance is determined by examining the skills needed in specific jobs as determined from interactions with employers as indicated in job listings or employer surveys, or as predicted as relevant for the future of work.
3. The ADC will, at a minimum, indicate the competencies, and learning-achievements attained, and the steps, assessment, and evidence required to obtain them.
4. ADCs will not be issued for unevaluated learning accomplishments, such as the mere completing of a series of tasks or attendance at events, or for learning that has not been assessed. Competency and learning accomplishment evaluation is at the heart of the value of ADCs.
5. ADCs will not be issued for the attainment of trivial or irrelevant competencies or learning. The ADC should address something concrete and useful as defined by the workplace. This requires specific attention to the granularity of a competency or learning-achievement and the level at which it is assessed.
6. Each issued ADC will be issued in accordance with its own unique set of criteria (in rubric form) that is designed to measure the desired outcome for the

competency or learning achievement.

7. All ADC assessors or assessment processes must meet high, published standards of competency and workplace experience as set by the institution. The requirement of workforce relevance argues strongly for assessors who are experts in what the workplace demands in terms of skills and levels of competencies and learning achievement. This is the basis for the institutional involvement in the process. For the most part, some form of competency-based assessment or evaluation should be utilized in the process that requires a clear relationship between the assessment and the actual application of the competency or learning in the workplace.
8. Where ADCs are issued in the same subject area at two or more levels of competency, the levels must be clearly defined and available for public inspection.
9. The ADC issuing institution should retain a permanent record of all ADCs issued.

10. The verification used in the ADC issuance process must ensure that the earner's identity is authentic and that the communication about them and their competencies are secure and not subject to tampering.

These guidelines have been created at a certain level of detail to accommodate subsequent adjustments by institutions according to their needs, locations, and national educational systems. The ICDE Work Group encourages ongoing informal and formal discussion about their guidelines in light of experience and the fast changing landscape of ADCs.

This guidance has been created at levels that anticipate that local circumstances may well dictate adjustments to the guidelines described here. A major factor in implementation not addressed in this report, due to scope, is the influence of governmental bodies and institutional governance structures that are too numerous to list or even categorize.



Implementation: How Should an ADC System Be Implemented?

Many institutions have been successful in offering ADCs and the process for implementing an ADC system has been well-documented. This provides several sources of guidance that can aid ICDE member efforts.

The first and most difficult step (which we just surveyed) is to determine which guidelines to use for issuing ADCs. We discuss this decision in more depth in the “Criteria” section of this report. One approach is to explore “use cases” involving actual institutional ADCs, which would allow us to see how well those credentials conform to a set of potential guidelines. In addition, to deciding what (and what not to) issue ADCs for, there are several other decisions that must be made early in the process before implementation: choosing iconography, determining metadata configurations and features, and deciding specifically on an implementation pathway. This often involves choosing a vendor or utility to both offer the ADCs and maintain appropriate records.

1. **Governance.**

Perhaps the most important early step in implementing an ADC system is to establish the internal governance of the system. What university entities will administer the issuance of ADCs, establish guidelines for their issuance, control the number of issuing units, oversee the quality of the ADCs issued, assure that issuance criteria are being met, administer vendor contracts, fund the issuance of ADCs? Since the barriers to entry in badging are so low, it is foreseeable that many campus units could start issuing their own full-scale badges.

This is clearly a case where some central authority needs to exert itself to preserve the reputation of the institution.

2. **Iconography**

What may seem to be a rather unimportant early decision in the implementation process is the design of the “icon” (or badge) used to represent the achieved competency.

What words or images should be used to represent the competency? How should the “brand” of the issuing institution be represented? What shapes and colors should be used? Should there be differences between the shapes and colors of the icon to indicate different levels of competency or the duration of time involved in achieving competency? Should there be standard designs to follow? These are all important and difficult questions that must be answered

Existing ADC badges have taken many shapes and forms ranging from simple representations to more intricate and complex designs. See attachment #4 for a sampling of badges currently in use. These examples include various levels of detail that have varying descriptive powers. For instance, some institutions use different shapes to indicate different levels of competence. Others emphasize their institutional brands with existing logos, mascots, and institutional abbreviations.

From a review of many badges, we arrive at a set of guiding principles. An effective icon:

- Is readable at a glance and ubiquitous. It is important to avoid icons that are loaded up with distracting, unnecessary, and uninterpretable design features.
- Clearly indicates the competency achieved. In some cases, an icon might contain an abstract symbolic representation of the skill achieved, which then would require further interpretation. The use of colors to distinguish between ADC types is problematic in several dimensions, including compliance with disability accommodations.
- Indicates the issuing institution (and, if applicable, the appropriate unit within the institution—such as the School of Engineering). For the most part, this should be indicated in clear word form rather than exclusively through logos.

Meeting these simple criteria is not easy given the technical parameters imposed and the uncertainty of future directions for the use of the badges. However, setting early on, a clear design framework will avoid further confusion in the marketplace.

3. **Metadata (or Content)**

One of the most useful features of an ADC is its ability to provide the viewer with information about the nature and extent of the competency it represents. How did an ADC holder acquire the competency? What standards were used to assess the competency? What examples of the holder's work are available? The answers to each of these questions should be instantly retrievable by "clicking" on the badge.

A review of the literature indicates that the following elements should be included in the metadata of an ADC:

1. A full description of the competency represented by the ADC.
2. The specific outcomes needed to earn the ADC.
3. The evidence an ADC earner provided to demonstrate competency.
4. Verification of the ADC earner's identity, as well as relevant and secure communications about their qualifications, competencies, and skills.
5. The qualifications of the ADC issuer and information about where to obtain information about the standards or practices employed by the issuer to assure quality.
6. The relationship between the ADC and larger or related programs, competencies, or skill sets.
7. The specific date on which the ADC was earned.

Additional metadata, that are both desirable and useful, include how long the competency is valid (i.e. when the ADC expires), explicit reference to future changes in structures, (especially for behavioral skills), and how individuals seeing the ADC might acquire the badge themselves. This last item, plus back-end data usually available from ADC vendors, is important for marketing purposes because they can reveal how often (and where) a person shares an ADC along

with other information or trends related to badge usage. In addition, this data can provide researchers with information about how ADC earners are actually disseminating information about their skills and competencies.

The emerging standards for metadata, provided by badging utilities, are a natural measurement for the creation of the metadata to be included but they need to be evaluated by each institution.

4. Platform Selection

Another early and important implementation decision is the choice of an ADC (badging) platform. Earlier in the ADC movement it might have been logical for an institution to create a software variant of its own existing transcript system to handle ADCs. But today, it is clear that the technical requirements and complexity of these systems—not to mention the need to constantly evolve and add new features—makes in-house software development complex to maintain and much less attractive. However, the emerging use of blockchain technology may actually make it easier for institutions to do more on their own.

A major consideration is the articulation of the ADC platform with existing transcribing systems. This refers to the problem of distinguishing ADCs from traditional transcripts at exactly the time traditional transcripts need to be digitized.

It currently makes sense for ICDE members to partner with a third-party vendor that can offer high-quality services, as well as frequently introduce new capabilities to their platform. ADC standards allow for interoperability of ADCs between platforms, but institutions

should consider how this interoperability will provide value as technology changes. A word of caution: embarking on an implementation pathway requires significant resources, not only in terms of paying for third-party services and software, but also in terms of institutional costs including the salaries, time, and effort needed to create and maintain a new system.

There are many options for platform acquisition and it is beyond the scope of this report to evaluate all those that are now readily available to ICDE institutions. attachment #5 shows a comprehensive list of current vendors and attachment #3 is a sample list of institutions around the world who are using these vendors (Geron, 2018).

When selecting a platform partner, it is important to separate the educational concerns from the technological concerns and follow best practices in both domains. On the platform side, for example, due consideration should be given to the concerns of interoperability, integration, longevity, data migration, and other factors. On the education side, the criteria offered in this report are a starting point.

Planning for implementation can begin once a platform has been selected.

5. Implementation Process

Most vendors will provide their clients with a detailed implementation protocol. Key steps in such a protocol are listed and explained below based on recommendations from Credly's field guide, "Partnering with Employers to Create Workforce-Relevant Credentials" (Perea, 2017).

Step 1: Identify and address institutional barriers to success.

Common barriers include:

1. Resistance from faculty members who view ADCs as a step toward “vocalionalizing” university programs.
2. Lack of institutional flexibility and resistance to change.
3. Lack of resources to make the adoption successful.
4. Difficulty in identifying and quantifying indirect costs.
5. Lack of employer understanding of the value of ADCs.
6. Failure to define how ADCs will be used. This may result in a profusion of badges covering many different competencies that confuse both internal and external constituencies.
7. Lack of support from top administrators.
8. Failure to make the team effort required to implement ADCs.
9. Lack of sufficient marketing resources and skill to define the value of ADCs.
10. Lack of support from specialized accrediting agencies.

Step 2: Develop institutional buy-in and support.

For most institutions, making the decision to issue ADCs is an enterprise-wide undertaking that involves many units and individuals. Successful implementation begins with high-level management support for ADCs. This support is based on the understanding that ADCs will create relationships with local economies

and will serve students by making them more competitive in the marketplace. Here are several suggestions for a successful ADC implementation:

1. Identify a campus champion who can successfully implement the ADC system.
2. Control who is authorized to administer and award ADCs for the campus.
3. Provide comprehensive training for all staff involved in the implementation and on-going maintenance of the ADC system.
4. Control the volume of ADC awards to avoid “badge fatigue.”
5. Promote successful examples.
6. Associate ADCs with job placement.
7. Make ADCs rigorous, but applicable to specific workforce needs.
8. Calculate return on investment in ADCs, when possible.
9. Control badge images (icons) carefully, especially in large campus or multi-campus systems.
10. Associate the creation of ADCs with regional labor demand and make the information available to the public.

Step 3: Get the word out.

ADCs are relatively new and many ICDE staff members are unfamiliar with the ADC concept. The same is true for employers. Consequently, ADC implementation schemes must include explanations of the importance and use of ADCs.

Campus-related programs can explain and promote ADCs by demonstrating their relationship to degree courses and showing ADC holders how to use them on digital footprints and résumés.

On the employers' side, educational presentations can be made to employers, workforce development boards, professional associations, government councils, economic development boards, K-12 school systems, and two- or four-year feeder schools.

Needless to say, the promotion of a successful ADC application will significantly contribute toward fostering a positive response.

Step 4: Evaluate the results.

The process of offering ADCs does not end with the implementation of the system. Constantly evaluating the results and then making appropriate adjustments to the programs are important elements in the success of an ADC system.

Institutions should be prepared to answer: What was expected to happen? What actually occurred? What went well and why? What can be improved and how? Key measures of success are:

1. The number of ADCs issued.
2. The number of ADCs distributed to digital sources by earners.
3. The number of employers directly engaged in creating and using ADCs.
4. The use of ADCs for critical workforce skills needed locally.

More generally, though less easily measured, are 1) the number of ADC earners who profited from their ADCs and 2) the increase in an institution's reputation gained from providing skilled workers to the local workforce.



ADC Alternative Pathways for Adoption

Given these predictions and the foregoing discussion, The Working Group has identified several alternative pathways as ICDE members consider a decision regarding the adoption (or non-adoption) of ADCs.

Option #1: Do not engage in ADCs now.

Some institutions engaging in ADCs will not gain a competitive advantage and may not be in line with local economies or audiences. Another reason to wait is that it may be too early to get into the movement and a “wait and see” attitude is the best pathway now, as things settle out, particularly with regard to blockchain technology.

The advantages of this alternative are that 1) no expenditure of time or effort is immediately required, 2) “best practices” will emerge and clarify the pathway toward ADC adoption, 3) third-party vendors will be able to develop and debug comprehensive solutions to the inherent problems and difficulties of adopting ADCs.

The disadvantages are that 1) a competitive advantage may be lost if the wait is too long when the local context is ready for adoption, 2) local employers may quickly accept ADCs and the institution will be looked upon as being out of date, 3) the advantage of pushing program development more toward workforce and employer needs may be delayed.

Option #2: Add the ADC capability as a new standalone feature.

The institutions who heed the call for ADCs, by understanding their advantages, can engage a badging utility and begin the process of offering ADCs to better serve students and employers sooner rather than

later. Much of this report is geared to this alternative, but the emphasis is not meant to over sell this option. The advantages of this alternative are well described, while its disadvantages are the reverse of the advantages of the first option: too early in a somewhat disorganized landscape of possibilities, the need to suddenly shift technologies because of technological change, the cost of implementation, and the general disruption of systems and personnel.

Option #3: Introduce ADCs in parallel to the digitization of traditional transcripts.

This is a big step but certainly aligns with the general trend and predictions described in this report. The advantages of this alternative are that the distinction between courses and degree programs will have to be made clearly, there may be economies of scale and implementation that would not be present if the two digitization projects were not combined, and students would have a unified process that seamlessly combines the different types of attesting to learning/competencies.

The disadvantages are that this alternative would be expensive, disruptive, and would require integration with other systems and processes.

While these three alternatives have naturally emerged from our consideration, they are certainly not the only ones available to ICDE members who will have local circumstances to consider. Hopefully they provide a framework for a decision making around ADCs.

Recommendations

Extracting from the previous narrative the Working Group makes the following recommendations to ICDE members.

1. Seriously consider the implementation of an ADC infrastructure and set of services at your institution.

This report makes the institutional case for such a recommendation. ADCs are too important to the future of higher education institutions not to be considered. While any individual institution might decide to ignore ADCs for now, that should be an overt decision based on a careful institutional decision rather than ignorance of the importance of the movement.

2. Secure support from the senior administration and academic leadership for the adoption of an ADC service system.

Once decided to go ahead with an ADC implementation it is important to secure support from senior leaders of the institution. ADCs are best created as a unified, enterprise-wide initiative. They represent an important change in thinking and operations that requires support from the top

3. Assure uniform standards, administration and oversight of ADC issuance.

As word about ADCs and their value spread, it is possible that more than one unit on campus will be interested in issuing ADCs. Multiple campus issuers could create confusion and disputing and competitive dynamics within a single campus. Care should be taken that the

management of the issuance of ADCs is highly coordinated.

4. Resolve basic clearly decisions about criteria for issuance, relationships to digital transcripts, competency vs. learning achievement, metadata content, icon design, and quality oversight

Determining what and what not to “badge” is the most important early decision to be made (see “Criteria” in this report). Allied with this decision is the determining of the relationship between digitizing traditional transcripts and the ADC system. Restricting the issuance to competency-based criteria is more powerful than allowing ADCs to certify learning accomplishment, although the pressure to include learning competency will be intense. Determining metadata content, designing the icon, and establishing methods of assuring quality are also important early decisions.

5. Establish an implementation plan that includes sufficient resources (human and financial) to support the success of the plan.

A detailed plan of implementation is clearly necessary for the introduction of such a new service. Not only should the resources necessary for the implementation phase be designated, the ongoing cost of issuing ADCs should be considered and how that delivery phase

should be paid for.

6. Choose a third party vendor to supply the software and necessary supporting services.

At this point it is probably not possible for an institution to “go it alone” in creating an ADC infrastructure. A number of such vendors are in the market (see Attachment #%).

7. Continuously evaluate issuance and use of ADCs.

ADC service providers issue reports on the claiming and sharing of ADCs. This data should be used to evaluate the level and effectiveness of the ADC

initiative and provide feedback on the cost effectiveness of the institutive.

8. Be alert to blockchain applications.

Blockchain technology is likely to be the foundation of the ADC movement but it has not yet matured as the standard underlying technology. When it does mature, the barriers to entry to institutions may decrease and ADCs may become easier to issue and to protect. Developments in the use of blockchain in ADCs should be carefully monitored.



Conclusion

Every ICDE member institution will have to make decisions about ADCs soon, even if that decision is not to engage in ADCs now. ADCs are part of a trend in the credentialing ecosystem of our society and the response of ICDE member institutions, both individually and collectively, will have an impact on the continued and necessary relation of institutions to the relevance of the needs of the labor market and economic society. Failure to take progressive action in adopting ADCs by the university sector will erode our position in the market as non-higher education institutions create a confusing array and proliferation of digital credentials. In addition, individual institutions which fail to adopt ADCs will experience a slow decline in relevance and market position.

This report is intended to help guide ICDE members toward a common understanding of ADCs and how they might be part of the institution's offering. Decisions about ADCs should be based on the predictions embedded in this report and listed in attachment #1. They include the necessity of distinguishing competency ADCs from learning accomplishment ADCs, distinguishing between the digitization of traditional transcribed learning (which must also be accomplished by higher education institutions), and the new ADC-related objects for learning and competency verification.

There is no doubt that ADCs and micro-credentialing will be an important feature in the future of education in society so that, eventually, every ICDE member will have to engage in the offering of ADCs. However, it is unlikely, except in the technical realm of ADC issuance, that generally accepted common standards will be developed on a global basis. That is why this report is important—if ICDE members as a group can come to a common understanding of the ADC movement and its importance, agree on or begin to follow the criteria/guidelines listed in this report, there may be at least a framework for generally accepted standards.

The Working Group intends this report to be the starting point for an extended and comprehensive effort by ICDE members to exert a lasting impact on an important emerging trend. In such a rapidly changing area, elements of this report will be quickly out of date, but the underlying forces and market dynamics will remain and grow in strength. The ICDE organization and its members must respond, immediately. The Working Group, and its members, remain available and committed to further discussion to see this trend move toward to a favorable conclusion for all of higher education.

Addendum

A Snapshot on Blockchain: What is it and How Will it Influence ADCs?

As ICDE members evaluate implementing technology for the issuance of ADCs, they will need to consider blockchain. Blockchain²⁹ secures digital assets and allows for the secure transfer from one user to another. It is so secure that it is the underlying technology for cryptocurrencies such as Bitcoin³⁰. Blockchain has often been described as a “transformative technology.”

“Blockchain is a global, cross industry and disruptive technology, which is forecast to fuel the growth of the global economy for the next several decades.” (Grech, Camilleri, 2017, pg. 12).

1. How does blockchain work?

“Blockchain technology is forecast to disrupt any field of activity that is founded on time stamped record-keeping of titles of ownership. Within education, activities likely to be disrupted by blockchain technology include the award of qualifications, licensing and accreditation, management of student records, intellectual property management, and payments.” (Grech, Camilleri, 2017, pg.8).

The basic concept is that blockchain provides for the handling of digital asset transactions (money, stocks, intellectual property, ADCs) to be stored across millions of computers. Every ten minutes all of the transactions posted to the network are grouped into a block which is

then linked to the previous block, and the block before that, in a “chain” with each block time stamped. This makes it almost impossible for any single transaction to be “hacked” or altered without affecting the entire chain. Since there is no single repository for the transactions, which are distributed across millions of computers, there isn’t a single source that can be hacked.

What are the features of blockchain technology that make it so important? In 2017, the JRC Science for Policy Report “Blockchain in Education” sponsored by the European Union and authored by Gretch and Camilleri was issued. The report features an extensive array of facts and descriptions of how blockchain is, and can be, used in education. In addition, it outlines the special features of blockchain which, when combined, offer a compelling argument for its use in ADC implementation and for the claim of its transformative nature (Grech, Camilleri, 2017, pg. 8).

The report outlines the “Key Advantages of Blockchain Technology.”

Self-sovereignty i.e.; for users to identify themselves, while at the same time maintaining control over the storage and management of their personal data;

Trust i.e.; for a technical infrastructure that gives people enough confidence in its operations to carry through with transactions such as payments or the issue of certificates;

²⁹ Blockchain technology is a secure and transparent platform to create a global network for higher learning.

³⁰ Bitcoin (BTC) is a decentralized and anonymous peer-to-peer digital currency.

Transparency and Provenance i.e.; for users to conduct transactions in knowledge that each party has the capacity to enter into that transaction;

Immutability i.e.; for records to be written and stored permanently, without the possibility of modification;

Disintermediation i.e.; the removal of the need for a central controlling authority to manage transactions or keep records;

Collaboration i.e.; the ability of parties to transact directly with each other without the need for mediating third parties.

Blockchain prevents the ability to change data once recorded (for instance grades or assessments), to delete or lose data (through disasters or accidents), to prevent access (to learning assessments, or disputes over intellectual property), to place conditions on access (such as unpaid tuition or fees), and to use data in an unauthorized manner (Grech, Camilleri, 2018).

Prediction: Blockchain will disrupt the market in student information, of all types, and the systems in which the data are stored.

2. **How is blockchain being adapted for use with ADCs?**

A significant breakthrough in the adaptation of blockchain technology to ADCs began as a research project at the MIT Media Lab³¹ led by Philipp Schmidt and Juliana Nazare. They and many

others developed blockcerts³². In October 2016, blockcerts were officially announced and have been evolving ever since.

“Blockcerts provide a decentralized credentialing system. The Bitcoin blockchain acts as the provider of trust, and credentials are tamper-resistant and verifiable. Blockcerts can be used in the context of academic, professional, and workforce credentialing (Schmidt, 2016).

The components of blockcerts are:

Issuer—Universities create digital academic certificates that can contain a wide range of assertions about an individual’s skills, achievements, or characteristics, and register it on the bitcoin blockchain.

Certificate—Certificates are open badges compliant, which is important, because there is an entire community of open badges issuers that we want to support because open badges are becoming an IMS³³ standard.

Verifier—Anyone can, without having to rely on the issuer, verify that (1) a certificate has not been tampered with, that (2) it was issued by a particular institution, and (3) issued to a specific user.

Wallet—Individuals can safely store their certificates and share them with others, for example an employer. The iOS wallet is available already, and we are looking for partners to develop an Android version.

31 The MIT Media Lab transcends known boundaries and disciplines by actively promoting a unique, antisciplinary culture that emboldens unconventional mixing and matching of seemingly disparate research areas. The Lab creates disruptive technologies that happen at the edges, pioneering such areas as wearable computing, tangible interfaces, and affective computing.

32 Blockcerts is an open standard for creating, issuing, viewing, and verifying blockchain-based certificates. <http://blockcerts.org>

33 The IMS Global Learning Consortium is a nonprofit, member organization that enables the adoption and impact of innovative learning technology.

By far the most significant feature of blockcerts is that the technology is completely open and free for all to use.

Prediction: Blockchain technology, and blockcerts, will become the standard underlying technology for the issuance of ADCs.

Prediction: Current badging vendors who do not use blockchain technology will switch to it.

Prediction: Blockchain technology will accelerate the end of paper-based certification systems.

What are the additional possible uses of blockchain technology in higher education? In addition to issuing secure certificates, this new technology is being used or predicted for use in many other aspects of higher education, only some of which are related to ADCs. These include (Grech, Camilleri, 2017, pgs. 95-100):

The issuance of blockchains to verify multi-step accreditation (gathering an individual's multiple learning verifications under one record);

Facilitating the recognition and transfer of credits effectively creating a lifelong learning passport wallet;

Tracking intellectual property and rewarding the use or reuse of that property;

Receiving payments from students via blockchains;

Providing student funding (financial aid) through blockchain mediated vouchers and using verified student identification within the university.

3. **How is blockchain technology currently being used for ADCs?**

The adoption of blockchain in the credentialing progress is picking up steam even though it is still in its infancy. Governments are becoming involved as they see a way to standardize record keeping and dissemination across institutions and academic boundaries. In January 2017, the Republic of Malta, through its Ministry for Education and Employment, signed a memorandum of understanding with the Learning Management Group to adopt blockchain technology across its institutions of higher education. Malta seeks to become a "blockchain island." In January 2018, the European Commission launched the EU Blockchain Observatory and Forum³⁴, which highlighted the key developments of blockchain technology, promoted European users, and reinforced blockchain-related technology implementation. This launch grew out of the previously-mentioned Grech and Camilleri study, which includes an extensive list of blockchain issues and recommendations for governments and policy makers. In July 2018, through efforts of the Inter-American Development Bank, the first students gained block-chain based credentials under the Workforce Preparation Program.

A number of individual institutions are using blockchain technology to issue certifications. Attachment #9 lists institutions that are among the first to adopt blockchain as a supporting technology.

³⁴ The European Blockchain Observatory and Forum aims to accelerate blockchain innovation and the development of the blockchain ecosystem within the EU, and so help cement Europe's position as a global leader in this transformative new technology.

Prediction: ICDE members will use third-party vendors to help implement blockchain ADC systems.

4. What could delay or hinder the application of blockchain technology to ADCs?

The adoption of standards is the primary issue in the use of blockchain for education. Any innovation based on educational records requires widely agreed upon standards for digital meta-data. Standards need to be established for identifying students, recording student accomplishments, certifying institutions, and more. The creation of such standards can only be accomplished through a multi-country, multi-stakeholder approach to address all standards-related technical barriers (Grech, Camilleri, 2017, pg.107).

Note that this potential obstacle deals with technical standards, but the academic standards (herein called “guidelines”) are equally important. It is probably more difficult to agree on academic standards for ADCs than on technical standards for blockchain applications in education, primarily because of the autonomy of the institutional base of ICDE members. However, an EU effort at standardization as recommended by Grech and Camilleri might push institutions toward more uniform treatments.

5. How can ICDE members consider being involved in blockchain technology?

Utilization of blockchain technology can be adopted by institutions without the involvement of third-party vendors through blockcerts. It is most likely true that institutions deciding to use blockchain will engage the services of a third-party vendor. The number of these firms is increasing rapidly. Attachment #7 lists vendors and their university clients. A useful typography of several of the earlier firms is shown in attachment #8.

Among the earliest and most prominent are Learning Machine, Sony, Attores, Gradbase, Stampery, Civic, Uport, Indorse, Ledger, and Bernstein Technologies. Not all of these companies offer a full solution to the ADC movement, so selecting one from among them can be quite complicated.

6. What are the implications of blockchain technology for ICDE members as they consider implementing ADCs?

Clearly the use of blockchain technology in the issuance of ADCs will dominate in the near future. ICDE members have choices. They may use a current non-blockchain badging vendor, which are themselves heading toward a blockchain base, or may go directly to a blockchain approach using a third-party vendor. As third-party credentialing vendors switch to blockchain and as the field of higher education blockchain vendors begins to develop, the decision structure will change quickly.

Blockchain-Related Predictions

Prediction #1: Blockchain will disrupt the market in student information systems. The Working Group agrees that, while the adoption of blockchain technology in the attesting of competencies and learning outcomes is in its early stages, that blockchain will become the basic underlying ADC technology.

Prediction #2: Blockchain technology, and blockcerts, will become the standard underlying technology for the issuance of ADCs. This prediction follows from prediction #6, but adds the element of blockcerts, which have been developed by the MIT Media Lab for handling student certifications.

Prediction #3: Current badging vendors who do not use blockchain technology will soon switch to it. While blockchain technology will be available in a useable form for adopting universities, these vendors currently in the field will be following the blockchain path soon.

Prediction #4: Blockchain technology will accelerate the end of paper-based certification systems. Again, this is a prediction related to the digitization of traditional transcripts and the increased utility in disseminating certifications of an individual's skills to a broad audience.

Prediction #5: ICDE members will mostly use third-party vendors to help implement blockchain ADC systems. Blockchain, while being refined to be more user friendly, is likely to remain complicated enough to implement to cause ICDE institutions to use third-party implementers/ integrators.



References

Acclaim and Pearson. Open badges for higher education. Retrieved from <https://www.pearsoned.com/wp-content/uploads/Open-Badges-for-Higher-Education.pdf>.

Agnew, H. (2016). Big four look beyond academics. Financial Times. Retrieved from <https://www.ft.com/content/b8c66e50-beda-11e5-9fdb-87b8d15baec2>.

Australian Industry Group. Developing the workforce for a digital future: Addressing critical issues and planning for action. Retrieved from https://cdn.aigroup.com.au/Reports/2018/Developing_the_workforce_for_a_digital_future.pdf.

Barrington, B. (2017). Digital badges are now an essential tool for employees and candidates alike. Retrieved from <https://blogs.oracle.com/certification/digital-badges-are-now-an-essential-tool-for-employers-and-candidates-alike>.

DeMilo, R. (2017). This will go on your permanent record! How blockchains can transform colleges in a networked world. Evollution. Retrieved from <https://evollution.com/programming/credentials/this-will-go-on-your-permanent-record-how-blockchains-can-transform-colleges-in-a-networked-world/>.

Eggleston, L. (2017). The growth of coding bootcamps 2017. Retrieved from <https://www.coursereport.com/reports/2017-coding-bootcamp-market-size-research>.

Erickson, C. (2015). Digital badge credentialing value: From an employer perspective. Retrieved from <https://pubs.lib.umn.edu/index.php/mes/article/view/66/57>.

Fain, P. (2018). Inside Higher Ed Special Report. On-ramps and off-ramps. Alternative credentials and emerging pathways between education and work. Retrieved from https://www.insidehighered.com/sites/default/server_files/media/IHE-On-Ramps-and-Off-Ramps-Alternative-Credentials-Preview.pdf?utm_source=mailchimp&utm_campaign=0300c2c2e1f0&utm_medium=page.

Finkelstein, J., Perea, B., Tyszko, Y., Jona, K. (2018). Aligning employers and institutions with digital credentials. Credly Webinar. Retrieved from <https://www.slideshare.net/PatriciaDiaz80/credly-ihe-webinar>.

Fong, J. (2017). Increasing millennial interest in alternative credentials. UPCEA Center for Research and Marketing Strategy. Retrieved from <https://upcea.edu/increasing-millennial-interest-in-alternative-credentials/>.

Fong, J., Janzow, P., Peck, K. (2016). Demographic shifts in educational demand and the rise of alternative credentials. Pearson Education and UPCEA. Retrieved from <https://upcea.edu/wp-content/uploads/2017/05/Demographic-Shifts-in-Educational-Demand-and-the-Rise-of-Alternative-Credentials.pdf>.

Goss, D. (2016). Nation's top universities embrace a new credentialing system. Georgia Tech Blog. Retrieved from <https://pe.gatech.edu/blog/nation's-top-universities-embrace-new-credentialing-system>.

Grech, A, Camilleri, A. (2018). Blockchain in education. Usage scenarios in the European education area, European Commission, Brussels. Retrieved from <https://www.slideshare.net/anthonycamilleri/blockchain-in-education-87646636>.

Grech, A, Camilleri, A. (2017). Blockchain in education. JRC Science for Policy Report, 12,23,95-100. Retrieved from http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108255/jrc108255_blockchain_in_education%281%29.pdf.

Hanson, G. (2017). The comprehensive student record: what to include and why. Parchment Blog. Retrieved from <https://www.parchment.com/blog/comprehensive-student-record-include/>.

Harris, A. (2011). Federal lawmakers begin new push for student outcomes data. The Chronicle of Higher Education. Retrieved from https://www.google.com/search?rls=en&q=Federal+Lawmakers+Begin+New+Push+for+Student+Outcomes+data,%E2%80%9D+Chronicle+of+Higher+Education,+http://www.chronicle.com/blogs/tickler/federal-lawmakers-begin-nrw-push-for.&spell=1&sa=X&ved=0ahUKEwik543z387YAhWK3oMKHV1_CVIQBQgmKAA&biw=771&bih=688

Hart Research Associates (2018). Fulfilling the American dream: Liberal education and the future of work. Conduced on behalf of the Association of Colleges and Universities. Retrieved from <https://www.aacu.org/sites/default/files/files/LEAP/2018EmployerResearchReport.pdf>.

Hickey, D.T. (2017). How open e-credentials will transform higher education. The Chronicle of Higher Education, 18. Retrieved from <https://www.chronicle.com/article/How-Open-E-Credentials-Will/239709>.

Jesus, C. (2018). University of Basel becomes first Swiss university to issue blockchain-based diplomas. Coingeek. Retrieved from <https://coingeek.com/university-basel-becomes-first-swiss-university-issue-blockchain-based-diplomas/>.

Leaser, D. (2017). IBM wins top industry award for innovation in digital credentials. Retrieved from <https://www.ibm.com/blogs/ibm-training/ibm-wins-top-industry-award-for-innovation-in-digital-credentials/>.

Marklein, M.B. (2014). A cheaper, faster version of a college degree. USA Today. Retrieved from <https://www.usatoday.com/story/news/nation/2014/07/11/nanodegrees-alternative-credentials/11236811/>.

McSpadden, K. (2017). Ngee Ann Polytechnic to pilot blockchain diplomas, partners Attos. e27. Retrieved from <https://e27.co/ngee-ann-polytechnic-to-pilot-blockchain-diplomas-partners-attos-20170526/>.

Mims, C. (2018). Big tech's hot new talents incubator: Community college. The Wall Street Journal. Retrieved from <https://www.wsj.com/articles/big-techs-hot-new-talent-incubator-community-college-1530277200?lrs=83f4c68d-1ddb-4978-9743-360bcea3e37a>.

Nyren, H. (2018). The new face of higher ed: Mark Leuba of IMS Global shares how colleges are embracing alternative credentials. EdTech Times. Retrieved from <https://www.google.com/search?client=safari&rls=en&q=The+new+face+of+higher+ed:+Mark+Leuba+of+IMS+Global+shares+how+colleges+are+embracing+alternative+credentials&ie=UTF-8&oe=UTF-8>.

Orr, D., Ravet, S. (2018). Mirva: Open Recognition Framework Discussion Paper. Retrieved from <https://docs.google.com/document/d/1DyAkIMbhRE1S2RnjbvckUkyQ8skpseQXYaWrlTy5m9g/edit#heading=h.9wy235960618>.

Perea, B. (2017). Partnering with employers to create workforce-relevant credentials: A field guide. 2017 Credly, Inc. Retrieved from https://cdn2.hubspot.net/hubfs/2629051/Credly_Employer_Engagement_Field_Guide.pdf?submissionGuid=488094b5-e1aa-410b-a232-d1b2d8aea7c5&t=1527093785232.

Phillip, S. (2016). Blockcerts. An open infrastructure for academic credentials of the Blockchain. Retrieved from <https://medium.com/mit-media-lab/blockcerts-an-open-infrastructure-for-academic-credentials-on-the-blockchain-899a6b880b2f>.

PricewaterhouseCoopers and Australian Technology Network of Universities. (2018). Lifelong skills: Equipping Australians for the future of work. Retrieved from <https://www.atn.edu.au/siteassets/publications/lifelong-skills.pdf>.

Raine, L., Janna Anderson, J. (2017). The future of jobs and job training." Pew Research Center. Internet and Technology. Retrieve from <http://www.pewinternet.org/2017/05/03/the-future-of-jobs-and-jobs-training/>.

Strata Education Network and Gallup. (2018). From college to life: Relevance and the value of higher education. Retrieved from: <http://stradaeducation.gallup.com/reports/232583/from-college-to-life-part-2.aspx>.

The Learning Machine. (2018). Upward Mobility. Retrieved from <https://www.learningmachine.com/customer-story-malta/>.

Weber, L. (2015). Online skills are hot, but will they land you a job? The Wall Street Journal. Retrieved from <https://www.wsj.com/articles/online-skills-are-hot-but-will-they-land-you-a-job-1447806460>.

Williams, H. (2018). Blockchain may offer a resume you can trust. The Wall Street Journal. Retrieved from <https://www.wsj.com/articles/blockchain-may-offer-a-resume-you-can-trust-1520820121>.

World Economic Forum (2018). The future of jobs report 2018. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

Attachment #1: Predictions

1. Prediction: ICDE members will have to distinguish between competency and learning-achievement ADCs.
2. Prediction: ICDE members will have to distinguish between the digitation of transcripts and the offering of ADCs.
3. Prediction: ICDE members will be forced to digitize their traditional transcripts.
4. Prediction: The digital nature of ADCs combined with the automated ability employers have to examine large sets of candidate data will accelerate the adoption and importance of ADCs.
5. Prediction: Efforts to set universal technical and quality standards for badges and to establish comprehensive repositories for credentials conforming to a single standard will not succeed.
6. Prediction: Blockchain will disrupt the market in student information systems.
7. Prediction: Blockchain technology, and blockcerts, will become the standard underlying technology for the issuance of ADCs.
8. Prediction: Current badging vendors who do not use blockchain technology will switch to it.
9. Prediction: Blockchain technology will accelerate the end of paper-based certification systems.
10. Prediction: ICDE members will mostly use third party vendors to help implement blockchain ADC systems.

Attachment #2: Glossary

This glossary is created in the context of this report. Thus, the terms here may differ from more generally accepted definitions.

Alternative credential. A credential issued by a higher educational institution attesting to the skills, competencies, or know-how other than degrees, diplomas, or other learning attestations issued by an institution. Alternative credentials are more granular statements of capabilities and are relevant to workforce or professional needs.

Badge. A broad term used to describe a wide range of digital certifications related to skills, abilities, competencies, accomplishments, and experiences. Badges are issued by a wide range of organizations, not just universities.

Blockchain. A global, cross industry, and disruptive technology, likely to disrupt the awarding of qualifications, licensing and accreditation, management of student records, intellectual property management, and payments.

Blockcerts. Blockcerts provide a decentralized credentialing system which provides trust, verifiability, and tamper-resistance.

Capability. The sum of personal attributes that include skills, abilities, personal qualities and potential. Generally, capability is a looser, more inclusive term than competency.

Certificates. Credentials that are issued to students that have completed significant programs of study that do not result in a degree. However, the term also is used loosely to indicate any document issued by an institution for a wide variety of experiences.

Certification. A formal testament that an individual has the ability, knowledge, skills, and background to perform a function according to established standards.

Competence. The measured ability of an individual to perform a skill or action in a specified context according to a required standard.

Credential. A testament to a student's competence, capability, skill, or ability to do something relevant to the workplace that is issued by a higher education institution.

Digital credential. A credential issued by a higher education institution, in digital form, which implies that it is portable, useful, transferable, and easily understood. Digital credentials can be curated, annotated, and distributed over digital networks under the earner's control.

Issuer. The creator of digital academic certificates that can contain a wide variety of assertions about an individual's skills, achievements, or characteristics.

Learning Achievement. Learning achievement assessment determines if, and to what extent, a student (user) has achieved stated learning outcomes. Learning assessment is related to “evaluated learning” in the sense that, while learning can occur in many settings, the assessment component, necessary for verifying to third parties that learning has, in fact, occurred and is attested to by the issuer of the ADC. Learning achievement is distinguished from competency assessment by the fact that no test of the actual application of learning is formally done.

Master Track. A trademarked term by Coursera that indicates a sequence of courses that cover the material of a defined master’s degree that are offered at a less extensive and comprehensive way.

Micro-credential. A credential issued for a relatively small learning project that consists of several modules in a given subject. This term implies that there is a related credential of greater scope offered by the institution. In some cases, micro-credentials have been defined by the issuing institution. These are closely associated and sometimes used interchangeably with ADCs.

Micro-Masters. A term used by EdX to indicate a sequence of courses that cover the material of a defined master’s degree but are offered at a less extensive and comprehensive way.

Nano-degree. A term used by Udacity to indicate a sequence of courses that cover the material of a defined degree, but at a less extensive and comprehensive way.

Qualification. Capacity, knowledge, or skill that matched or suits an occasion or makes someone suitable for a duty, office, position, privilege, or status. Note that qualification does not necessarily imply competence.

Transcript. The official record of a student’s course work, grades, and degree completion issued by a higher education institution.

Verifier. Anyone who seeks to determine that a digital certificate has not been tampered with, that it has, indeed been issued by the specified issuer, and that it was issued to a specified user.

Wallet. In this context a repository created by an individual containing a description of each digital certificate associated with that individual.

Attachment #3: Universities Experimenting with ADCs Across the Globe

Institution	Country	ADC Implementation	Vendor
Beuth University	Germany	Beuth Bonus TIC Refugees.	ProfilPASS
Colorado Community College System	USA	Technical Math for Industry, Advanced Manufacturing Machining, Engineering Graphics, Faculty and Staff development, and Healthcare.	Credly
Deakin University	Australia	Professional Practice Credentials and MOOCs	Credly
EduOpen	Italy	Online free courses.	Open Badges
Emporia State University	USA	CBL, co-curricular implementation, enhanced job placement activities.	Credly
Georgia Tech	USA	MOOC-based degree with partner platforms Coursera, Udacity or EdX.	Badgr On the Open edX
High Schools	UK	High School Chemistry Laboratory.	Credly
Illinois State University	USA	Honors Program.	Credly
iMOOC Universidad Zaragoza and Universidad Politécnica de Madrid	Spain	Courses with a high level of personalization by the student.	Moodle
Instituto de Educación Secundaria de la Región de Murcia (Archena)	Spain	Music courses.	Classbadges
Lewis & Clark College	USA	Ensure graduates had the skills needed for the entry level roles at the company.	Portfolium
Madison College	USA	Skill sets, credit-bearing and non-credit courses.	
Miríadax	Ibero-America	MOOC courses offered by Ibero-American institutions.	Mozilla Open Badges
MIT	USA	MIT Media Lab.	Open Badges, Open edX
New York University School of Professional Studies (NYU SPS)	USA	Professional Development Badges can be earned in one specialty area or from a mix of courses in a variety of different industry verticals including real estate, marketing, hospitality, law, sports management, public relations, finance, global affairs, urban development, applied health, languages, or the humanities.	Basno
Otago Polytechnic	Australia	Micro-credentials for workforce upskilling	Credly
Penn State Digital Badges System	USA	For instructors and educators.	Penn State Badging Application

Institution	Country	ADC Implementation	Vendor
Physiopedia (outside academia)	UK	Physiopedia badges involvement	Mozilla Open Badges
RMIT University	Australia	Extensive portfolio of digital and micro-credentials, online short courses are available. These are currently mostly non-credit bearing but credit and RPL options are progressively available. Micro credentials also embedded into award bearing programs.	Credly
Southern California's Del Lago Academy	USA	Competency X program. Skills required to be a scientist for their internships and college applications, providing opportunities and academic and career readiness.	Portfolium
Spanish institutions	Spain	Finance Master.	Credly
Tec de Monterrey	Mexico	Pioneer in Latin America with 15 programs (courses, international and certification programs).	Acclaim
The Open University (OU)	UK	Free Badged Open Courses (BOCs) of informal learning recognition.	
The University System of Maryland (USM)	USA	Workplace readiness.	Portfolium
UNED Abierta	Spain	Online free courses.	Mozilla Open Badges
Universidad Peruana de Ciencias Aplicadas	Peru	Digital Learning, Faculty Top Ten ranking.	Credly
Universidad Politécnica de Madrid	Spain	Digital competences.	Insignias INTEF
Universidad Tecnológica de Graz	Austria	e-Learning and Law, Marking creativity design with children, The city of Graz, Open Educational Resources, Austria and the European Union, Social Media, Free Online Learning	Austrian MOOC-platform iMooX
University of California (Irvine, and Davis)	USA	Sustainable Agriculture & Food Systems.	Mozilla Open Badges
University of Washington	USA	Digital Badges for STEM Education, Canvas for Faculty	Canvas Badges, Mozilla Backpack

Attachment #4: Badge Examples



The Open University



Northeastern University

College of Professional Studies



Georgetown University



Cat·a·lyst

kad(ə)lɛst/
Noun

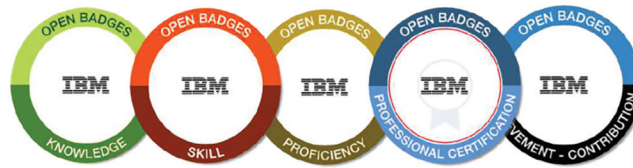
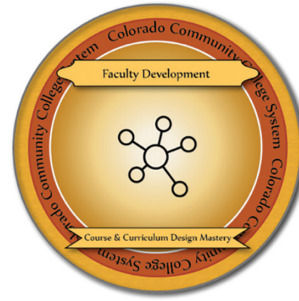
A person or thing that precipitates an event.

I ❤️  **STATS**



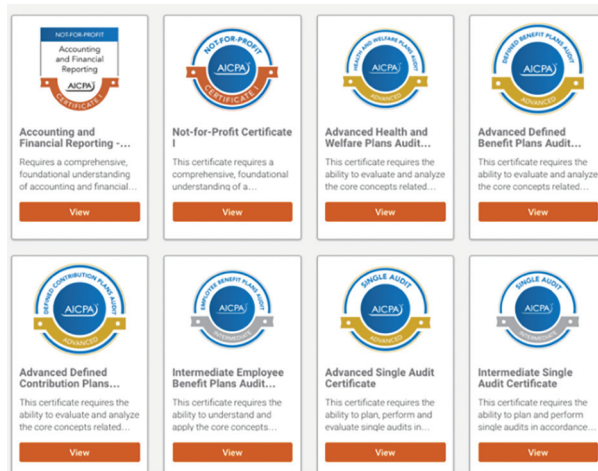
I "Heart" Stats: Learning to Love Statistics

Is your relationship with statistics dysfunctional? We can help: Get to know stats, build a healthy bond, and maybe even fall in love!



Knowledge | Skills | Proficiency | Certified | General

Badging is how we will measure **resume-worthy** IBM skills in the market



Attachment #5: Current ADC Providers

Provider	Country	Website	Notes
Acclaim	UK	https://www.youracclaim.com/	Previously part of Pearson, recently joining Credly.
Acreditta	Colombia	https://www.acreditta.com/	Partner of Credly for the Latin American market.
Badge Alliance	USA	http://www.badgealliance.org/	Part of IMS Global Learning Consortium.
Badgecraft	EU	https://www.badgecraft.eu/	
BadgeList	USA	https://www.badgelist.com/	
BadgeOS	USA	https://badgeos.org/	
Badgr	USA	https://info.badgr.io/	Open source, Integrated with Canvas, edX.
Badgr - Concentricsky	USA	https://www.concentricsky.com/work/detail/badgr	
Basno	USA	https://basno.com/about	Not sure if still exists.
Bestr	Italy	https://bestr.it/	
Blackboard	USA	https://help.blackboard.com/es-es/Moodlerooms/Teacher/Track_Progress/Badges	
Canvas	Australia	https://about.canva.com/create/badges/	
Classbadges		http://classbadges.com/	No longer actively supported.
Concentric Sky	USA	https://www.concentricsky.com/work/detail/badgr	Part of Badgr.
Core Learning Exchange	USA	http://www.corelearningexchange.com/	
Credly	USA	https://credly.com/	Acquired Pearson's badging business, Acclaim.
Degreed	USA	https://degreed.com/skill-certification	
Digitalme	UK	https://www.digitalme.co.uk/	
European Badge Alliance (EBA)	EU	http://ebawebsite.net/open-badges/	Policy recommendations.
ForAllRubrics	USA	https://badges.forallschools.com/	
Insignias Intef	Spain	https://insignias.educalab.es/	

Provider	Country	Website	Notes
Microstrategy	Spain	https://www.microstrategy.com/es/products/capabilities/digital-credentials	
MOOCIntef	Spain	http://mooc.educalab.es/	
Moodle Insignias	Spain	https://docs.moodle.org/all/es/Insignias	
Mozilla Backpack	USA	https://backpack.openbadges.org/backpack/welcome	
Open Badge Academy		https://www.openbadgeacademy.com/	
Open Badge Passport		https://openbadgepassport.com/	Free, Open Badge Factory property.
Open Badges Or		https://openbadges.org/	
Openbadges.me		https://www.openbadges.me/	
P2PU	USA	https://courses.p2pu.org/en/badges/	
Parchment	USA	https://www.parchment.com/	
Participate Platform	USA	https://www.participate.com/share-your-content	
Portfolium	USA	https://portfolium.com/solutions/badgelink	
RedCrittter	USA	https://www.redcritter.com/home.aspx	
Salesforce (Trailhead)	USA	https://trailhead.salesforce.com/en/home	
WIN Learning	USA	https://www.winlearning.com/ready-to-work-assessments.html	
WPBadger		https://wordpress.org/plugins/wpbadger/	
YouTopia		http://www.youtopia.com/info/	

Attachment #6: Blockchain Pilot Projects by Institution

Institution	Country	Blockchain implementation	Vendor
Central New Mexico Community College	USA	Student-owned digital diplomas.	Learning Machine
ESiLV	France		
Lipscomb University	USA	College of Pharmacy & Health Sciences.	Ethereum & Hashed Health
MIT	USA	Two cohorts of students at the MIT Media Lab (Media Arts and Sciences) and the Sloan School of Business.	Blockcerts, Learning Machine (LM)
Ngee Ann Polytechnic	Malaysia	Diploma certs.	Attores. Private Ethereum Blockchain software
Open University (OU)	UK	Badge all OU courses and notarise these on the blockchain.	Blockcerts
RMIT University	Australia	RMIT credentials (micro-credentials and online short coursed)	Ethereum
Southern New Hampshire University	USA	Certificates and Competencies.	Learning Machine
Tec de Monterrey	Mexico	Academic records.	Sony Goblal Education, IBM Blockchain
University College London	UK		
University of Basel	Switzerland	Diplomas.	Proxeus
University of Melbourne	Australia	Issue recipient-owned credentials on the blockchain.	Blockcerts
University of Nicosia (UNIC)	Cyprus	Bitcoin for tuition.	Blockcerts

Attachment #7: Institutions to First Adopt Blockchain

The following is a sample of institutions that were among the first to adopt blockchain as a supporting technology.

Open University (OU). The OU, in partnership with the Knowledge Media Institute (KMi)³⁵, has developed a prototype for assembling and issuing micro-credentials on blockchain (Grech, Camilleri, 2017, pg. 64).

University of Nicosia (UNIC). The UNIC claims a number of firsts in the use of blockchain and began issuing academic certificates onto the Bitcoin³⁶ blockchain, using its own in-house software platform in 2014 (Grech, Camilleri, 2017, pg. 68).

Massachusetts Institute of Technology (MIT). In 2015, the MIT Media Lab³⁷ began issuing digital certificates using blockcerts for a limited number of learners. Following in 2017, through the Learning Machine, a commercial entity using blockchain and blockcerts, began to issue diplomas to two cohorts of students at the MIT Media Lab and the Sloane School of Business (Grech, Camilleri, 2017, pg. 71).

Ngee Ann Polytechnic (Singapore). Ngee Ann Polytechnic, one of Singapore's tertiary polytechnic schools, is testing a program to issue diplomas via the blockchain. The pilot is being conducted with Attores, a digital certificate start-up, to white-label the service (McSpadden, K., 2017).

University of Basel. The University of Basel is the first Swiss university to issue blockchain-based diplomas. In partnership with Proxeus³⁸, blockchain innovator, the Center for Innovative Finance (CIF) will issue course certificates and register them on blockchain to drastically reduce the processing time for the documents (Jesus, C., 2018).

University of Melbourne. The University of Melbourne, using the Learning Machine³⁹ issuing system, became the first Asia-Pacific university to issue credentials on blockchain Retrieved from <http://newsroom.melbourne.edu/news/university-melbourne-issue-recipient-owned-blockchain-records>.

Georgia Tech. Georgia Tech is a leader in research in the use of blockchain technology in certification and has created a number of skill-related ADCs which are based on blockchain technology from Java Script to vegan cooking (Goss, 2016).

35 KMi is a multidisciplinary R&D lab that has been at the forefront of innovation for the past 20 years. We lead in a number of areas, including Semantic Technologies, Educational Media, Social Media Analysis, Big Data, Smart Cities, IoT and others.

36 Bitcoin (BTC) is a decentralized and anonymous peer-to-peer digital currency.

37 The MIT Media Lab was founded by MIT Professor Nicholas Negroponte and the late Jerome Wiesner (former science advisor to president John F. Kennedy and former president of MIT.) The Media Lab focuses on the study, invention, and creative use of digital technologies to enhance the ways that people think, express, communicate ideas, and explore new scientific frontiers.

38 By making blockchain accessible to the average user, Proxeus enables previously paper-bound, traditionalist businesses to easily digitize and adopt new blockchain-based business models.

39 Learning Machine Technologies, architect of the Blockcerts open standard with the MIT Media Lab, is the world leader in blockchain-based digital identity and credentials.

Attachment #8: Blockchain Providers Across the Globe

Provider	Country	Website
APPI	UK	https://appii.io/
Attores	Singapore	https://attores.com/
Blockcerts	USA	https://www.blockcerts.org/
Ethereum	Switzerland	https://www.ethereum.org/
Gradbase	UK	https://gradba.se/en/
IBM Hyperledger	USA	https://www.ibm.com/blockchain/hyperledger.html
Learning Machine	USA	https://www.learningmachine.com/
Microsoft Azure	USA	https://azure.microsoft.com/en-us/blog/multi-member-consortium-blockchain-networks-on-azure/
Proxeus	Liechtenstein	https://proxeus.com/
Sony Global Education	Japan	https://www.sonyged.com/2017/08/10/news/press-blockchain/
Stampery	Spain	https://stampery.com/
Trusted Key	USA	https://www.trustedkey.com/
Identity Solution Vendors		
Civic	USA	https://www.civic.com/
Uport	USA	https://www.uport.me/
Storing a Verified e-Portfolio		
Indorse	Singapore	https://www.indorse.io/
Managing Intellectual Property		
Binded	USA	https://binded.com/
Bernstein Technologies	Germany	https://www.bernstein.io/