MaCuDE
Management Curriculum for the Digital Era

Management and Human Resources Management Task Force

Phase I Report of the MaCuDE project[1]

Attention to Digital Transformation in Courses and Programs in Management and Human Resources Management

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June 11, 2021

[1] The MaCuDE project is sponsored by AACSB International and led by Stevens Institute of Technology.

Executive Summary

Digital technologies are quickly transforming the way the business world operates. Although the change has been under way for several decades, its pace seems to keep increasing. This report describes a study done to assess the extent to which business schools have transitioned into instruction that prepares students well for digital work. It focuses on the disciplines of management and human resources management. It is based on reviewing course titles and descriptions from 164 business schools globally, scanning for use of any of a list of 51 terms related to digitalization. The major findings are:

- Two main areas of coverage are emerging, People Analytics and Managing Digital Transformation
- Four additional areas are human capital, technology management, social networks, and ethics
- People Analytics is business analytics applied to workforce data while Managing Digital Transformation involves the impact of digitalization on work and the workplace
- Usage is not widespread: Among the 3728 course titles collected, “digital” was used in 21 course titles while , a rate of .0056 percent. Courses in have begun to appear. We found 24 courses with ‘people analytics’ or related ones in the title
- Programs that explicitly focus on digitalization are sparse
- Digital terms are found across undergraduate, MSc, and MBA degrees
- Top 10 schools for each degree show greater usage than schools further down the rankings
- The use of digital terms is most frequent among European MSc programs and North American MBAs
- Challenges to greater integration of digital material into business school education include established, hard-to-change curricula, untrained academics, and scarce resources
- Recommendations for moving forward include consulting with industry on its needs, incentives to change academic resistance, and making resources availability a priority

Introduction: Digital Transformation in Business

Digital technologies have permeated business life such that companies not taking full advantage of them are in danger of losing competitiveness. The management of people in organizations is in the process of transformation in response to digitalization. Most directly, the introduction and expansion of analytics into management has altered the availability of information in profound ways. Data used to be limited, expensive to acquire, difficult to analyze based on limited computer capabilities, require a lengthy period of time to extract useful information, move slowly up the chain of command in hierarchical organizations, and therefore often be obsolete by the time it was carefully considered. Companies needed to combine periodic reports from managers, often in far-flung locations, manually construct text and tables from the data, and review it at multiple levels before it reached the executives overseeing it. Sales data, for example, often took weeks after sales had occurred to come to the attention of the executives in charge of making major decisions about it. For example, by the time executives in clothing manufacture got word about how well a new line of fashion was moving, the season was over and they were already shipping the next season's line.

Jump to today, sales rung up in an outlet anywhere in the world are immediately registered at the home office so that executives have access to end-of-day, or even more frequent, results on how each item fared that day, permitting them to immediately adjust production, pricing, distribution, and marketing.

Digitization is the conversion of a specific activity to digital format to gain advantages that medium enables. Digitalization is the overall, large-scale movement of industry from static analogic functioning to dynamic digital operations as hosts of specific activities are digitized, considerably changing the way in which business is conducted. We are interested in determining whether the education business schools are providing will optimally prepare our students for the digital world they will enter upon graduation. Our focus is on the human side of business as represented by the domain of general management and the specific function of human resources management.

The Focus of this Report on Management and Human Resources Management

Digital technologies range across a broad spectrum of activities and functions from those we use without a second thought, like the internet itself, software, and GPS to more recent advances in complex tools like artificial intelligence, business analytics, and robotics. They may fall on a parallel spectrum that indicates the level of specialist knowledge needed to use them and range from modest for the everyday group to substantial for advanced tools. They may fall on a similar spectrum on pervasiveness in business from widespread for the first group to specialized and limited for the second. These spectra are relevant because we believe that the digital skills of general managers tend to fall on the lower end while functional specialist skills fall on the higher end.

Our concern is with managerial skills, represented in the past by dimensions such as Mintzberg's ten management roles (e.g., figurehead, liaison, disturbance handler, and resource allocator) and those that fall within the domain of organizational behavior (e.g., leading, motivating, and change management). These behaviorally-based dimensions have not historically included digital skills. An examination of coursework in management and organizational behavior will indicate how relevant university instructors perceive them to their subject matter. (Although many would include strategy within the management field, a separate group is focusing on that area, so we excluded it from our

work.) We posit that general management functions have not lent themselves as easily to digitalization as have specialist skills related to functions such as marketing, finance, and accounting. We anticipate that the data will indicate that sparser attention has been given to them than in these other functions.

Human resources management includes responsibility for areas like recruitment and selection, training and development, compensation and benefits, and performance management and incentive systems. These functions involve specialist knowledge that can be subjected to digital manipulation, for example, applicant tracking software that weeds out unqualified job applicants and digital tools that provide online learning at the click of a mouse. Although the digitization of tools for HR are far advanced, we anticipate that lower visibility and priority has slowed their adoption compared with other functions.

Digital Terms as an Indicator of the Perceived Relevance of Digitalization

We sought to get a broad sense of the use of digital tools across a wide range of university business schools. Surveys of schools and/or instructors have encountered low response rates that inhibit their ability to capture a comprehensive state of the field under study or to generalize from their findings. We looked for a different method to develop a sense of the relative centrality of digital topics to management and HRM courses. We therefore decided to obtain course titles and descriptions on these disciplines from business school websites, which we could then cut-and-paste into a spreadsheet. We believed that this approach offered possibilities for a higher "response rate" relevant to the topics at hand.

We also sought to identify degree programs directed toward digitalization on the topics under study. The presence of a significant number of such programs versus relatively few serves as another indicator of perceived relevance. The fact was not lost on us that we would be using digital tools to assess the degree to which digital tools are being used as elements of coursework and programs.

Our primary measure was simply the extent to which digital topics are referenced in course titles and descriptions. To undertake such an examination, we examined media and consulted with colleagues to develop a list of 51 terms, presented in Appendix 1, commonly associated with digital technologies. Our intent was to search for use of these terms in course titles and course descriptions. In the process, we also could make note of programs directed toward digital topics.

The first step was to examine instances in which digital terms were present in titles or course descriptions. The second step was to count the number of times each digital term appeared. We concentrate on step 1 in the following section before moving to step 2.

When we visited websites, we almost always found accessible lists of courses. For some schools, we could not access course descriptions. Some required a sign-in by school personnel while others simply presented a list of courses or offered no explanation for their absence. Overall, we identified 3728 course titles on websites visited, of which 3197 (85.8%) were accompanied by course descriptions. A small number of course descriptions contained 20-30 words, the largest number contained 75-100, while a sizable number had 300-500 or more words. We will explain more about school identification when discussing step 2.

Classification of Courses and Programs Using Digital Terminology

Courses

Two primary types of courses, People Analytics and the Management of Digital Transformation, lead the list while four additional ones Human Capital, Managing Technology, Social Networks, and the Ethics of People Analytics/Digital Transformation have received attention. The first of the two primary types deals with HRM, the second with management.

People/HR/Workforce Analytics. On the HRM side, the predominant focus of attention is on a course usually called People Analytics, sometimes titled HR or Workforce Analytics. It applies business analytics methodologies to data on employees with the intent to discover underlying phenomena like the effects of a training program on salesperson productivity, the efficiency of applicant filtering tools in reducing time-to-hire, and the relationship between types of compensation and retention. Usually technical in orientation, it is most often taught by someone in the field of business analytics who adopts HRM for attention. It supports the "human resources" rather than "personnel" approach to the function.

Widely accepted as the dominant school of thought, the human resources approach posits that to exert influence HR needs to become "strategic partners" with other functions. The VP of HR should not just hold a seat at the senior executive table but also should be an important contributor. To maximize their contribution, HR people need "talk the language" of finance, operations, and even engineering. Advocates welcome people analytics as an opportunity to demonstrate quantitative competence, though the more often used tactic thus far is to employ people from technical backgrounds who learn about HRM rather than HRM practitioners who become expert in data management and analysis.

Although several HR functions use digital tools, they have not yet made it into HR-related course descriptions in significant numbers. People Analytics courses have begun to appear across the undergraduate, Master's, and MBA levels. Most, such as undergraduate versions offered by schools like City University of Hong Kong, Purdue, and McGill, are simply called **People Analytics** while variations exist like **Strategic Human Resource Metrics & Analysis** (Cornell) and **Data Analytics for HRM** (Leeds Beckett and ISCTE).

At the Master's level, schools like Rotterdam, Mannheim, and National University of Singapore offer the simply-titled course while variations include **Talent Development and Analytics** (Vrije), **Talent Analytics: Data and Tools** (Higher School of Economics), and **HRM Technology, Analytics, and Digital Innovation** (University College Dublin). Most of the top MBA programs offer the course, starting with Harvard, Wharton, and Stanford. Beyond the top 10, however, coverage drops off quickly.

Management of Digital Transformation. On the management side, courses have emerged to explore the ways in which digital technologies have changed the managerial landscape. They cover technologies like artificial intelligence, machine learning, and automation but do not delve far into their technical aspects. Instead, taking an overview perspective, they help managers understand their effects on the strategic and operational sides of business practice. Perhaps because of this broader view, few undergraduate programs offer a targeted course, with the few including **Digital Transformation** (ESSEC), **Digital Literacy** (Grenoble ESC), and **Digital Technology for Business** (Thammasat).

The topic receives the most coverage among Master's programs, with some seeking to lead the way on all things digital. Most of the courses include **Digital Transformation** in their titles (e.g., Copenhagen, ESADE, Indian Institute of Management – Calcutta), with some pursuing variations like

Theories of Digital Business (Amsterdam), **Modern Ways of Working in the Digital Age** (ESCP), and **E-HR** (National Taiwan University). The list of MBA programs with digital transformation courses is modest , exemplified by Dartmouth's **Digital Change Strategies**, Sasin's **Digital Transformation: Emerging Technologies and Strategies**, and Hong Kong UST's **Digital Leadership and Teamwork**.

Human Capital. Human capital is a concept receiving substantial recent attention. It refers to the qualities that go into forming high performing employees, such as their skills, knowledge, training, experience, commitment, and dependability. Since knowledge-based companies rely primarily on the quality of their workforce to succeed, the concept presents a way for them to evaluate how prepared their employees are to tackle the competitive challenges they face. Although strictly speaking it is not directly emblematic of digital technologies, it predominantly appears in conjunction with them and is presented in quantitative terminology that connects it directly to p**eople analytics,** which often is presented as a means to gain the insights that will allow a company to increase its human capital.

Courses in human capital have not emerged widely, but some schools have jumped in with both feet. Undergraduate offerings include **Human Capital Management** (IE), **Leveraging Human Capital and Performance** (Sussex), and **Introduction to Managing Human Capital** (Michigan). A handful of programs have instituted Master's degree courses, including **Teams, Technology, and Human Capital** (Purdue) and **Managing Human Capital in Projects** (Indian Institute of Management – Ahmedabad). MBA courses on the topic are offered mainly by highly respected schools such as Harvard (**Managing Human Capital**), Darden (**Human Capital Consulting**), and Chicago (**Leadership Capital**).

Managing Technology. A fourth area positions digitalization as the dominant current form of technology. Use of it predates the academic focus on analytics and digital technologies and historically it has received more attention from business schools affiliated with technological universities. Frequently used as an accompaniment to digital, as in "digital technologies," its inclusion in this list is warranted. Undergraduate courses include **Technology and Organization** (Nottingham) and **Organizing in the Digital Age: Power, Technology, and Society** (Lancaster). Master's courses include **Global and Distributed Teams** (Carnegie Mellon) and **Managing Science and Scientists** (Grenoble). The limited but varied MBA offerings include **Managing New Technologies** (York), **Women Leading in Technology** (Cornell Tech), and **Business Implications of Emerging Technologies** (RPI).

Social Networks. Analysis of complex networks has only been made possible by the computational power that accompanies digitalization. Among the small number of courses offered in it are the undergraduate **Digital Society: Your Place in a Networked World** (Alliance Manchester), Master's **Social Network Analysis** (National Sun Yat Sen), and MBA's **Managing Social Networks in Organizations** (Stanford).

Ethics of People Analytics/Ethics of Digital Transformation. Finally, we include the topic of ethics not because it has a strong presence – it does not – but rather because we see a strong need for ethics courses in both the People Analytics and Digital Transformation domains. In our sampling of 3728 courses, we found an undergraduate course by Cornell's School of Industrial and Labor Relations on the **Ethics of Data Analysis** and a Master's course each from the Indian Institute of Management – Calcutta on **AI and Ethics** and the International University of Japan on the **Ethics & CSR of Digital Business**.

Programs

With few exceptions, courses in the six areas described above are electives, which signals that there have been few programs created to serve the themes. To take them in the same order as the courses, there are programs in the following domains:

People/HR/Workforce Analytics. The Higher School of Economics, Moscow, delivered one of the three programs we found in the use of digital technologies in HR, a Master's in Management and Analytics for Business, with courses dedicated to HR functions, in particular **Talent Analytics: Data and Tools**, **People Analytics: Prediction of Performance and Prescription of Policy**, **Staffing Analytics Overview**, and **Performance Evaluation: Data and Tools**. Grenoble ESC addressed elements of both HR and management in its Master's in International HRM in the Digital Age, through courses like **People Analytics**, **Digital Transformation for HR Professionals**, and an annual exercise in "**Gamification & Creation of a Serious Game for HR."**

Management of Digital Transformation. One of three programs we found in this area, at the International University of Japan, is a Master's in Digital Transformation with courses in **Management for Digital Transformation**, **Ethics and CSR of Digital Business**, and **Digital HRM**. A second program, an MSc in Business, Innovation, and Management offered by the Lancaster University Management School, includes the courses **Core & Emerging Technologies, Technology Futures, Analysis, & Design,** and **Management & Organizations in a Digital World**. We will describe the Lancaster and Grenoble MScs further in Appendices 2 and 3.

Human Capital. The three prominent Singaporean universities dominate the field of human capital. Singapore Management University offers an undergraduate major in OB/HRM with courses such as **Human Capital Management**, **Human Capital Analytics**, and **Human Capital Strategy,** as well as a Master's in Human Capital Leadership with courses in **Human Resource Analytics** and **Research Management Insights**, **Human Capital and Global Business Strategy**, and a capstone project on **Solving a Human Capital Challenge**. National University of Singapore has a Master's in Human Capital and Analytics while Nanyang Business School includes a concentration in Human Capital Management as an option in its MBA program.

Managing Technology. Several schools offer techno-MBA programs (e.g., KAIST, the University of Washington, RPI). Grenoble ESC covers the theme in its Master's in Management, with courses that include **Psychology at the Intersection of Technology and Human Behavior**, **Calling BS in an Age of Big Data**, **Legal Aspects of New Technology Management**, and the **Business of Knowledge: Managing Science and Scientists**.

We found no programmatic efforts in business schools in the **Social Networks** or **Ethics** arenas.

Levels of Use of Digital Technology in Courses

Step 1 involved the identification of courses in digital topics. For step 2, we sought to test the integration of digital content into courses in the management and human resources management disciplines. As part of our approach, we wanted to learn whether grouping schools by common elements would reveal differences across the groupings. We targeted three sets of groupings. For the first, we continued to separate undergraduate, MSc, and MBA levels. For the second, we studied whether the resources available to schools affected their ability to innovate in the digital area. Revisions to courses and programs require the capacity to support faculty members as they work to develop material in a new field. Some schools have much greater access to these types of resources. As a proxy for resource availability, we used standing in respected school and program rankings, specifically those developed by the Financial Times for MBA programs globally and by QS World University Rankings for MSc and undergraduate programs. The third grouping was geographic, distinguishing between schools from North America, Europe, and Asia.

We gathered data from 117 school web sites for the UG, 112 for the MSc, and 110 for the MBA. The total number of sites visited was 164, 67 from Europe, 57 from North America, and 40 from Asia. We began with lists of 40 schools for each degree level. Eventually, we concluded that it was much more efficient to gather data from a school on multiple degrees where possible, for example, in visiting the website for a school on the undergraduate program list, we also checked into the school's MSc and MBA programs. [See the schools included in the data collection in Appendix 4.]

As the numbers of schools visited indicates, we gathered data on the most schools in Europe, then in North America, and the fewest in Asia. The MSc and undergraduate rankings were skewed toward European schools and the MBA toward North American schools. We tried to achieve greater balance by adding more schools from the less represented regions but had limited success. To some extent in Europe, but to a much greater extent in Asia, courses were delivered primarily if not exclusively in their native language. While Western European schools offer many of their programs in English, in Asia, with the exception of Singapore, Hong Kong, and India, a special, limited set of courses is delivered in English intended primarily for exchange students. In addition, we sometimes found it difficult to maneuver on Asia schools' websites.

Since there is no global ranking of undergraduate programs, we relied on the QS ranking for Business & Management. For the Master's, the QS ranking of Master's in Management programs was our touchpoint. The FT global ranking of MBA programs served that group. For each of the three degrees, we sought information on the top 10 schools, the middle 10 – ranked between 46 and 55 – and schools ranked 91 to 100. We also used a representation of schools beyond the top 100, which we limited to schools ranked 101-150, randomly selecting ten schools from each degree program's list. The two QS lists served this purpose for their respective programs, but since the FT ranking does not extend beyond 100, we used the QS ranking of MBA programs for this segment.

Of the 51 terms associated with digitalization, only 19 received one or more mentions in the data, thus eliminating 32 terms from further consideration in an initial pass. In a second pass, using a cut-off point of less than ten mentions to narrow the field further, we settled on a final group of eight terms. Terms like automation, blockchain, and machine learning did not make the cut. We returned afterward to the expanded list but did not find any term that saw a surge in number of usages.

We then summed the number of times each term was used in course titles and within course descriptions in groupings of schools by degree, with similar rankings, and across the three geographies. Tables 1a, b, and c present the results for the counts. [See the tables at the end of the text.] The first result to note is the modest number of times digital terms were used at each level. For the left side of each table, the totals result from inclusion of 40 schools by ranking group in the counts for each degree. Essentially, all three degree levels showed almost identical overall numbers, averaging 2.3 uses per school. For all degrees, the top 10 schools had the highest totals. The imbalance was greatest for the MBAs, where even adding the other three groupings together still left them far short of the top 10's totals. Beyond that, the groups of 10 showed little discernible pattern. Since our primary reason for the splits was to see whether greater resources gave top schools more leeway to initiate initiatives in digital education, we see evidence to support that interpretation.

For the geographies, we included all schools in the database from each region. Looking at the results, our main conclusion is that the concept of digital/digitalization received more use among schools in Europe. Technology got more attention in Europe for both the undergrad and MSc degrees while it received more from MBA programs in North America. Among MSc programs, Europe dominated for every digital term that got much attention except human capital. For that term, North America and Asia showed higher usage overall than Europe, with similar numbers for both regions. The current

major topics of artificial intelligence and big data received very modest numbers of mentions, which aligns with the fact that other terms in the same bucket like machine learning and blockchain did not make the cut when we narrowed the number of terms. North American MBA programs led the way on all terms that received much attention except digital. In combined use of all terms, the differences for undergraduate courses were not vast, especially when compared with the domination shown by European MSc programs and North American MBA programs.

The differences across geographies reveal the extent to which MSc programs are a focus of attention in Europe versus the centrality of MBA programs in North America. While MSc programs have been a major focus of attention for several decades in Europe, North American schools have begun to increase these offerings only in the last decade. Most MSc programs consist of 10-15 courses taken in one year. In many European countries, student move directly into an MSc from their undergraduate studies. Their format and the ready pool of students enables significant experimentation. Even for MBA programs that offer multiple concentrations, the generalist curriculum constrains the introduction of new courses, which are delivered primarily as electives if at all.

Overall, this document reports the results of an intensive survey of course titles and descriptions to sense the extent to which digital terms have penetrated academic thinking. Our conclusion is that they have not gone far. Among the 3728 course titles collected, "digital" was used in 30, a rate of .0080 percent, while "people/HR/workforce analytics" was used in 24, equal to .0064 percent. Nine of the latter were offered by schools ranked among the top 10 global MBA programs.

Assessment of Use of Digital Technology in Courses

Earlier in this report, we listed two primary types of courses that emphasize digital transformation, People Analytics and Management of Digital Transformation, and four additional ones that also have received attention, Human Capital, Managing Technology, Social Networks, and the Ethics of People Analytics/Digital Transformation. In visiting websites of 164 schools, we did not come near the 901 accredited by AACSB as of this writing. Undoubtedly, we missed relevant courses and programs offered by schools not included. However, in focusing attention on groupings of the top 150 schools in their respective rankings, we believe we reached a substantial number of high quality institutions that, given the intense competition among business schools, are likely to be keenly on the lookout for emerging trends. Considering the evidence from our examination of courses and programs dealing with digital transformation and the quantitative measures we collected on the most commonly-used digital terms, we offer observations on the state of coverage found thus far in management and human resources management courses and programs.

People Analytics. Of the 24 courses we found on People/HR/Workforce Analytics, ten were undergraduate, five MSc, and nine MBA. Most were electives, most were not part of a major/concentration/specialization in HR, and most HR majors/concentrations/specializations did not require a People Analytics course. Very few HR courses of any type, for example, training & development, compensation & benefits, recruitment & selection, indicated in their course descriptions that they focused strongly on digitalization or even mentioned the digital realm at all. Ideally, HR education would lead the way in preparing students to use the digital tools that are becoming increasingly necessary. However, the discipline does not seem to be keeping up with the rapid dissemination of digital tools in HR departments. Digitalization may not be paradigm shifting, but application of its methods creates HR functions that are very different from pre-digital days in their ability to manage data and pursue greater efficiency. Employees travelling long distances to attend training sessions, staying for several days in hotels, and putting their day-to-day jobs on hold while they

studied have a far different experience than if they take on-line training as their schedule allows, at the pace they choose, and sometimes even deciding which modules to study.

Management of Digital Transformation. The 120 schools in the top, middle, lower, and outside the top 100 tiers for the three degrees combined used **"**digital" 77 times, seven in undergraduate programs, 35 in MScs, and 35 in MBAs, an average of 0.64 per school. Of the 30 courses that had "digital" in their titles, 15 were MSc. Most were electives, though in a few instances they was part of a program, for example, ESCP's MSc in Digital Transformation Management and Leadership.

As with People Analytics, the data show a pronounced lag between the attention to digital technologies in companies versus the world of business school education. Courses tend to focus on the managerial implications of adopting digital technologies like artificial intelligence, blockchain, and analytics rather than teach their technical features. This approach is essential in that not every manager needs to know how to construct algorithms, but many need to know their implications for their own responsibilities.

Human Capital. Comparisons of the groups of rankings indicated the term was used 21 times at the undergraduate level, four at the MSc, and nine among MBAs. Six courses in the data base have "human capital" in their titles, five for undergraduates and one for MBAs. The Chinese University of Hong Kong has an undergraduate concentration in HRM that offers three of the six. As the larger data base shows, the term is gaining traction, often used in conjunction with people analytics.

Managing Technology. The term "technology" has the longest presence of any in the study and continues to be highly used. It is the most frequently used term in our data base, receiving 96 mentions in the rankings groupings, far outpacing "digital," the second most often used at 52. It appears 40 times with undergraduates, 35 with MScs, and 21 with MBAs. The increasing number of schools pursuing STEM classification for their MBAs have given it greater use, though my own school has offered an MBA in Technology Management since the 1980s. Strictly speaking, technology does not have to refer to digital, as research on the relationship between an organization and its technology dates most prominently to the 1960s. But the term is now used predominantly in conjunction with digital, as in "digital technologies."

Social Networks. The last two topics receive scant attention in the relevant literatures. The recent emphasis on flat hierarchies has directed some attention toward social networks as a way to provide meaningful analysis of the impact of informal ties on behavior. As attention to human capital increases, a significant source of human capital is an individual's ability to tap into social capital.

Ethics of People Analytics/Ethics of Digital Transformation. We were underwhelmed by the number of courses in management and human resources management addressing ethical topics related to digitalization. Undoubtedly, at least some courses on business ethics include ethical issues raised by digital technologies. However, given the significant attention directed toward the implications of technologies like artificial intelligence, the potential misuses of algorithms, questions about the degree of digital monitoring versus invasion of privacy, the ways digital media promulgate unidimensional thinking and "fake news," and the profound effects of genetics, the total of three courses on ethical digital issues we located indicates a distinct and worrisome lack of attention to the topic.

Challenges Incorporating Use of Digital Technology into the Curriculum

Any effort to increase students' exposure to digital tools in management and HRM faces formidable obstacles. Some of the main ones are:

Academic curricula. The task is to bring academic curricula in management and HRM into line with the rapid spread of digital technologies in industry. Attempts to change business school curricula bring an immediate groan from any group of academics, who have a vested interest in protecting their turf, that is, the courses they teach, and resist incursions that threaten it. Introducing new coursework is a daunting challenge. For example, it seems clear that HR majors will need familiarity with people analytics for future work in HR. In a finite, limited set of courses in HR concentrations, already heavily constrained by demands from other worthy areas, introducing a new course implies the need to remove an existing one. The scene is set for a struggle over which course draws the short straw.

The task of changing existing course material is not as daunting but still significant. Textbooks, cases, readings, exercises, and other material that have worked well up to the present are not easily pushed aside. Alternative material on digital topics may not exist or may still be in development. Anyone developing new material will first need to develop the material, then develop instructions/teaching notes to guide new users in how to implement it.

Academic preparation. In discussing curricular matters, we have skirted the question of academic receptivity to learning about a new domain. An immediate concern will be the increased need for quantitative skills among management and HR instructors, since they are essential to teaching courses on digital HR like people analytics but frequently are not a strong suit for instructors in these disciplines.

The use of digital tools requires more preparation than simply reading over some notes. As the business world becomes more thoroughly digital, academics will need to prepare to think digitally. In management and organizational behavior, many managers may not need in-depth knowledge and skill in the technical aspects of incorporating digital technologies. However, they will need to develop enough familiarity to understand what the technology can do and how it will affect employees. To convey that familiarity, instructors will need to become conversant with the implications of digitalization for managerial work. HR instructors will need to become familiar with relevant digital tools.

Fit between skills and proclivities. Our primary task is to provide students the skills and knowledge to function effectively in their careers. Some students are drawn to majors in HR and management specifically because they are not comfortable with, and perhaps not skilled in, the quantitative analysis required in many other business disciplines. HR and management may never require the levels of quantitative analysis of supply chain management or finance, for example, but students and faculty will not be able to escape its reach as readily as they may have in the past.

A second skill set in short supply extends well beyond management and HR but is important in these disciplines as well. Many students get caught up in the use of the technologies themselves. When asked to explain the results of work they have done on a data set, they draw a blank. The key is not to learn digital tools on their own but rather how to apply them to underlying problems.

Scarce resources. In this constrained economic environment, many universities lack the resources to fund new initiatives. For management and HR faculty to become familiar with digitalization, they need training. To generate new material incorporating digital technologies or even to revise existing courses to offer exposure to these technologies, they need time. In the past, new initiatives often have been accompanied by resources to temporarily reduce teaching loads so that faculty can concentrate on the new domain. At present at many schools, that is a big ask.

By contrast, the top schools hold the necessary funds and already provide lower teaching loads that facilitate the development of new material. In Tables 1a to c, the top 10 consistently outpaced the other deciles in word counts, with the largest disparity in MBA programs. The lesser gaps for UG and MSc programs may arise partially from the fact that the elite of the elite are largely missing. Eight of the schools with top ten MBA programs do not offer undergraduate business degrees and most offer a paucity of MSc programs. Only HEC Paris and London Business School, both European schools with a more inbuilt set of MScs, appear on both MBA and MSc top 10 lists while only MIT and Wharton are on both the MBA and undergraduate lists.

Recommendations: Toward Digital Transformation

Our recommendations spring from the topics discussed in this report. They are not meant to be comprehensive but rather to initiate a conversation about the way forward. Some are relatively straightforward and doable. Others are more complicated.

Consult with people from industry. This report assumes that digitalization in the business sector has outpaced our ability to educate our students on the necessary skill sets. To be more conclusive, we need to know more about the state of digitalization among businesses. The next phase of the MaCuDE project is intended to find out directly from executives, managers, and professionals about their experience of digital transformation. If such a transformation is in process, what are its contours? Which areas of business are the most advanced and which are behind? How well prepared do practitioners feel to cope with the changes? What critical skills will new graduates need to be effective? Curricular revisions must be informed by the critical needs of industry.

Curricular. The knowledge gained from interaction with people in industry can feed into needed curricular revisions, which are significant but not revolutionary. Although they do not require a new paradigm, they present a very different context within which business decisions are made. Credits and debits still need to be reconciled, investment decisions made, marketing campaigns designed and conducted, but the mechanisms for undertaking these activities and the larger context within which they take place has shifted. Software can now perform automatic reconciliations, algorithms increasingly dominate investment decisions, marketing campaigns have shifted their channels from mass media toward social media. Some key skills are technical and refer directly to the functions concerned. In the case of human resources, for example, new hires may not need to know instantly how to use the specific applicant tracking software a company uses to screen job candidates, but they must be familiar with the process of automated applicant screening. They may not need to know the programs used to deliver online training, but they need to understand the uses of different training approaches and how e-training fits into them.

An important consideration relates to the scope of changes needed. In the past, to integrate new material into a curriculum – ethics and internationalization are two that come to mind – an early question was whether to offer a discrete course or to add material to existing courses. Faculty objected that they did not know enough about the subject to cover it within their courses and had no room to fit in yet another topic. The usual path was to start with a course, first as an elective but then migrating into a requirement. As the concept became further entrenched, however, a shift occurred toward expecting the topic to be covered across multiple courses. In the above examples, eventually ethics and international business needed to be integrate into several courses across the curriculum.

Each of our twin foci, management and HRM, may need different a approach. For management/organizational behavior, the main questions relate to adding new, largely conceptual material to existing topics. How does remote working affect employee motivation or small group dynamics within a work unit? What effect does instant availability of data on performance metrics like sales have on centralization and control?

For HRM, on the other hand, as a discreet function, digital tools are becoming pervasive in their potential, if not actual, application to major HR responsibilities. Preparing students to handle functions like recruitment and selection, compensation and benefits, and training and development will require HR instructors to gain familiarity with actual tools used. It will not be enough to teach students about applicant tracking systems, they will need to see an ATS in action and handle a software package that does so.

Faculty receptivity and preparation. To teach digital material, faculty will need training to become familiar with vital concepts and tools. In the 1980s, accounting firm Arthur Andersen, recognizing the gap between desired versus actual levels of faculty familiarity with ethics, responded by holding week-long, tuition-free sessions at their corporate training facilities in Chicago. Faculty who attended received intensive instruction on incorporating ethics into their courses and were then expected upon returning to their schools to facilitate their colleagues' incorporation of business ethics into their courses. The program significantly quickened the integration of ethics into curricula. The firm generated substantial goodwill and recognition for its efforts.

Absent a benefactor, an opportunity is available for an organization like AACSB, another professional association, or even an industrious executive education program, to offer the requisite workshops. Unlike topics such as ethics and internationalization which gradually built momentum, digital transformation is regularly in our faces. It seems hard for faculty members to deny its long-term importance and their need to become conversant with it. Familiarization may not require a paradigm shift, but it will require a shift in mindset that starts with the recognizing how much our lives have become digital and its increasingly pervasive presence at work.

Resources. Business school deans in particular are familiar with the faculty refrain that any proposed new initiative is impossible to implement without financial support. Resources required to prepare faculty to educate on digital effects include the costs of training, buy outs of release time so that faculty can develop new or significantly altered courses, cases, exercises, readings, and support materials. HR faculty may need funds to purchase software licenses for themselves and their students as well as obtain training on how to use the software. As discussed earlier, these funds will be more readily available at elite institutions, but they also are necessary among less prestigious schools. Top schools tend to develop material that works well in conveying experience at executive levels but does

not as easily apply at lower ranks. The view from middle or lower levels is applicable to many more students than the view from the top.

Additional thoughts. A few final thoughts to consider related to the effects of digital transformation on business education include:

- The technical ability to teach courses in people analytics is most readily found among specialists on business analytics, but few programs on the topic include people analytics in their curricula
- We must keep foremost in students' minds that digital tools are only tools and using them well requires understanding the larger context and critical issues they help to address
- Many practitioners highlight the importance of being able to tell a story about results they are presenting
- The ethics of the use of digital tools is an increasing point of emphasis by knowledgeable observers. At the very least, business ethics courses need to cover ethical questions emanating from technologies like artificial intelligence, digital monitoring, the effects of automation on job elimination, and biases built into algorithms. Even better, much material exists to support courses devoted to the ethics of emerging technologies
- We can anticipate that "human capital" will gain significant emphasis in the future as a construct that closely aligns with digitalization. The notion of humans as capital will contribute further to the quantification of human resources

Conclusion

To say that digital transformation is not revolutionary does not mean it lacks far-reaching effects. Evolution implies slow-moving phenomena, but there is nothing slow about the integration of digital technologies into business. A phrase used by advocates of organizational change is that people who question its need should get out of the way or get run over. Business educators in management and HRM so far have largely stood off to the side in teaching about digitalization. Without adaptation in the near future, it seems increasingly likely that we will get run over.

Table 1a. Terms That Appear in Course Descriptions for UG Programs

Terms	*Top 10*	*45-55*	*91-100*	*100+*	*Total*	*NA*	*EUR*	*AP*	*Total*
Technology	13	7	10	10	40	30	45	20	95
Analytics: People, HR, Workforce	4	7	0	4	15	17	3	10	30
Analytics: Anything Else	1	0	1	0	2	8	3	0	11
Digital, digitization, digitalization	2	1	2	2	7	3	26	8	37
Big data	0	0	0	0	0	1	2	0	3
Software applications	1	0	1	0	2	1	7	3	11
Artificial intelligence	2	1	0	1	4	3	4	1	8
Human capital	7	10	1	3	21	18	3	21	42
Total	**30**	**26**	**15**	**20**	**91**	**81**	**93**	**63**	**237**

Table 1b. Terms That Appear in Course Descriptions for MSc Programs

Terms	*Top 10*	*45-55*	*91-100*	*100+*	*Total*	*NA*	*EUR*	*AP*	*Total*
Technology	13	7	10	5	35	20	60	11	91
Analytics: People, HR, Workforce	0	0	6	2	8	4	21	6	31
Analytics: Anything Else	0	1	1	2	4	4	2	1	7
Digital, digitization, digitalization	19	6	9	1	35	4	59	9	72
Big data	0	0	1	0	1	1	5	1	7
Software applications	1	0	0	0	1	2	1	1	4
Artificial intelligence	2	1	0	0	3	1	7	4	12
Human capital	0	0	0	4	4	13	8	13	34
Total	**35**	**15**	**27**	**14**	**91**	**49**	**163**	**46**	**258**

Table 1c. Terms That Appear in Course Descriptions for MBA Programs

Terms	*Top 10*	*45-55*	*91-100*	*100+*	*Total*	*NA*	*EUR*	*AP*	*Total*
Technology	11	4	4	2	21	36	13	18	67
Analytics: People, HR, Workforce	10	2	0	1	13	15	6	2	23
Analytics: Anything Else	9	0	0	0	9	9	7	1	17
Digital, digitization, digitalization	19	6	9	1	35	7	17	8	32
Big data	2	0	0	0	2	2	3	1	6
Software applications	2	0	0	0	2	2	2	0	4
Artificial intelligence	1	0	0	0	1	3	2	1	6
Human capital	3	2	2	2	9	24	4	22	50
Total	**57**	**14**	**15**	**6**	**92**	**98**	**54**	**53**	**205**

Appendix 1. Terms Related to Digitalization

Advanced manufacturing
Analytics
Social network analysis
Sentiment analysis
Artificial intelligence
Algorithms
Automation
Autonomous vehicles and drones
Big data
Blockchain
Blogs
Cloud computing
IaaS: Infrastructure as a service
PaaS: Platform as a service
SaaS: Software as a service
XaaS: Everything as a service
Cryptocurrencies like Bitcoin
Cybersecurity
Digital, digitization, digitalization
Email and Netiquette
Genetics
Fintech
GPS
Information systems
Internet
Internet of things (IoT)
Intranet
Machine learning
Nanotech
Neural networks
Privacy/digital monitoring
Programming
Python
R
Remote employees
Robotics
Smart phones and mobile apps
Social media like Facebook, Twitter, Instagram
Software applications
Solar power – digitally enabled
Tableau
Tablets/iPads
Technology
Telecommuting
3D printing
Videoconferencing
Virtual and augmented reality
Virtual teams
Wikis
Wireless internet access – 4G & 5G (WiFi)
WWW/Worldwide web

Appendix 2. An Example of a Program Oriented toward Digital HR

To put flesh on the discussion of courses and programs, in this appendix, we present an example of a program oriented toward digital HR, **the MSc in International HRM in the Digital Age** offered by Grenoble Ecole de Management. The program, "prepares students for future giving them a deep understanding of global HR management and an insight into the impact and challenges of digital transformation on HR today, giving them the tools to work anywhere in the world, in any company."

The program has four sections. The first introduces a set of core HR skills, e.g., **Personality Tests & Talent Acquisition**, **Compensation Practices & Policies**, and **Talent Management**, in which instructors are required to present at least one technical tool for each course. The second section locates HR within an international business environment and the third takes on the challenges of digitalization with courses in **Digital Transformation for HR Professionals**, **Managing Knowledge to Develop Core Competencies**, and **People Analytics**. The program supports learning with personal and professional development workshops, a field trip, and a group consulting project for a company. A unique feature is its use of an intensive week-long seminar in Gamification in which students create their own "serious game" through a virtual simulation on an HR topic, then present it to a panel of HR experts from companies. The final section involves a 15,000 word project written during the second year while the student is in full-time employment and potentially using a topic based on their work experience.

Below we briefly describe four of the program's courses:

Digital Transformation for HR Professionals. This course explores the specifications, development, implementation, and maintenance of human resources technologies to identify how they support organizations, decision-making, and strategy. By the end of the course, students will be able to understand the characteristics of emerging digital technologies and assess their impact on human resources functions and professionals.

People Analytics. Instruction is presented on how data and sophisticated analysis is brought to bear on people-related issues, such as recruiting, performance evaluation, leadership, hiring and promotion, job design, compensation, and collaboration. By the end of the course, students will understand how and when to use hard data to make soft-skill decisions about hiring and talent development, so that they can position themselves as strategic partners in their company's talent management decisions.

Managing Knowledge to Develop Core Competencies. This course examines the existence, nature, and classification of organisational knowledge, including the key techniques and tools used within KM, the role of HR in developing effective KM processes, and the relationship between organisational culture, structure, processes, and successful KM with a focus on the role of human resources development.

New Organizations & Well Being at Work. Organizations are looking for new ways of organizing and managing their processes, activities, and thus their human resources. This raises deep questions about the role of HRM in corporations. In this course, we will seek to understand how the roles of HR managers will be reshaped as a result of these transformations.

Appendix 3. An Example of a Program Oriented toward Digital Management

Some non-degree executive education programs have begun to offer workshops or certificates on the the management of digital transformation, focusing mainly on educating middle- and upper-level managers about how digital technologies are affecting their companies and their own roles. There are few degree programs oriented toward the topic. In this appendix, we present an example of a program oriented toward digital management, **the MSc in Business, Innovation, and Management** offered by the Lancaster University Management School. The program, "offers a range of opportunities to help you understand how to harness technology, manage its effects to gain competitive advantage, open up new business markets, and streamline core organisational processes."

The program is a new one built on previously delivered MScs in E-Business and Innovation and in Information Technology, Management and Organisational Change. Given its origins, it emphasizes information technology with a lesser but still significant emphasis on management. Delivered in three terms, the first two for coursework and the third for a consultancy project or dissertation, it conveys a future-oriented approach through two courses in particular in term 1, **Core & Emerging Technologies** and **Technology Futures, Analysis, and Design**. In addition to a course combining professional and research skills, the remaining three courses address the effects of digitalization on separate domains, marketing, IT, and management. Term 2 continues with the skills training and **Technology Futures** courses and requires a course on **Information Technology Consulting and Project Management**. Students are given a choice of two from a list of four optional courses: **Enterprise Systems and Business Analysis**, **Managing IT Architecture**, and two in management, **Rethinking Leadership** and **The Management of Organisational Change: Challenges and Debates**.

Below we briefly describe three of the program's required courses:

Core & Emerging Technologies. Holistically, the course can be thought of as covering an introduction to the technologies and services that are utilised for modern digital business applications. It is concerned with recent, emerging and still evolving technologies and services that enable digital business processes to be accomplished and that enable different types of innovations to take a place in technology-driven organisations.

Technology Futures, Analysis, and Design. The aim of this module is to provide students with an understanding of ways to think about the role of technology in creating futures for companies and society, including the techniques that can be used to analyse and design futures. It looks at the role played by different ideas about the relationship between technologies and the future, as well as practical methods that are used in organisational contexts to attempt to anticipate the futures that technologies might enact.

Management and Organizations in a Digital World. Organisations receive a constant and increasing flow of information as a result of being more globally connected through digital processes. This necessitates new and more flexible management practices than the past. Understanding how information, technology and organisation interrelate is fundamental for developing these management practices. This module introduces the challenges and opportunities that accompany these management practices in a digital world.

Appendix 4a. Schools Used for the UG Tables

Aalto
Aliance Manchester
Amsterdam
Aston
Audencia
Bath
Bocconi University
Boston Univ (Questrom)
British Columbia
UCSD Rady
Carleton
Carnegie Mellon University
Case Western
Chulalongkorn
City University of Hong Kong
CUHK Business School
City, University of London: Cass
Copenhagen Business School
Cornell (Dyson & ILR)
Durham University Business School
Edinburgh Business School
EMLyon Business School
ESADE
ESCP Business School - Paris
ESSEC Business School
Exeter
Florida (Hough)
Florida Int'l
Frankfurt School of Finance & Mgt
Fudan University
Georgia: Terry
Georgia Tech: Scheller
Georgia State (Robinson)
Gothenberg
Grenoble Ecole de Management
Henley
Higher School of Econ - Russia
Hong Kong Polytechnic University
Hong Kong UST
ICN
IE Business School
ICN
ISCTE - IUL
Kansas
Koc University
Korea University
KU Leuven
Lancaster School of Management
Leeds Beckett
Lehigh
London School of Econ
Loughborough
Mahidol International
Mannheim
McGill University: Desautels
Miami Herbert Business School
MIT
Michigan Ann Arbor
Michigan State University
Montreal
Nanyang Business School
National Sun Yat-sen University
National Taiwan
National University of Singapore
Navarra
NYU
Notre Dame (Mendoza)
Nottingham
Oxford Brookes University
Peking University
Politecnico di Milano
PSL
Purdue University Krannert
Raboud
Renmin
RPI
Rotterdam
St. Gallen
Salamanca
Seoul National University
Shanghai Jiao Tong
Shanghai Univ of Fin and Econ
Sheffield
Singapore Management University
SMU (Cox)
South Denmark
Southampton
USC
Stevens

Stockholm School of Economics
Strathclyde
Sungkyunkwan University
Sussex
TUM
UT Austin
UT Dallas
Texas A&M
Thammasat
Thunderbird
Toronto Rotman
Trinity College Dublin
Tsinghua University
University College Dublin
University College London Bus Sch
Vienna Univ of Econ and Bus (WE)
Virginia (McIntire)
Virginia Tech
Vrije
Warwick
Washington: Foster
Washington State
Western University - Ivey
Wharton
Wisconsin School of Business
Yonsei
York
Zhejiang

Appendix 4b. Schools Used for the MSc Tables

Aalto
Aliance Manchester
Amsterdam
Arizona State (Carey)
Audencia
BI Norwegian Business School
Bocconi University
Boston Univ (Questrom)
Carleton
Carnegie Mellon
Case Western
Chulalongkorn
City University of Hong Kong
CUHK Business School
Concordia (John Molson)
Copenhagen Business School
Cornell Dyson
Duke (Fuqua)
Durham University Business School
EADA Business School
Edinburgh Business School
EMLyon Business School
ESADE
ESCP Business School - Paris
ESMT
ESSEC Business School
Exeter
Florida (Hough)
Florida Int'l
Fordham (Gabelli)
Frankfurt School of Finance & Mgt
George Washington
Georgia State (Robinson)
Gothenberg
Grenoble Ecole de Management
HEC Montreal
HEC Paris
Henley
HHL Leipzig Grad School of Management
Higher School of Economics - Russia
HKUST
ICN
IE Business School
IESE
IIM Ahmedabad
IIM Bangalore
IIM Calcutta
IIM Udaipur
Imperial College Business School
ISCTE - IUL
International University of Japan
KAIST
Kansas

Koc University
Korea University
KU Leuven
Lancaster School of Management
Leeds Beckett
Lehigh
LBS
London School of Econ
Loughborough
Mahidol International
Mannheim
Miami Herbert Business School
Michigan Ann Arbor
Montpellier Business School
Nanyang Business School
National Chengchi University
National Sun Yat-sen University
National Taiwan
National University of Singapore
NEOMA Business School
Newcastle University Business School
Notre Dame (Mendoza)
Nottingham
Peking University
Porto
Purdue University Krannert
Renmin
RPI
Rotterdam
St. Gallen
Shanghai Jiao Tong
Sheffield
Singapore Management University
SMU (Cox)
Solvay (Brussels)
South Denmark
Southampton
SP Jain Insitiute of Management
Stanford (MSx program)
Stevens
Strathclyde
Sungkyunkwan University GSB
Sussex
TUM
UT Dallas
Thammasat
Thunderbird
Tokyo
Tongji Univ Sch of Econ and Mgt
Toronto Rotman
Trinity College Dublin
Tsinghua Univ Sch of Econ and Mgt
University College Dublin: Smurfit
University College London Business Sch
Virginia (McIntire)
Virginia Tech
Vrije
Wake Forest
Warwick
Washington: Foster (6 MS, none OB/HR)
Western University - Ivey
Yonsei
York

Appendix 4c. Schools Used for the MBA

Alliance Manchester
Amsterdam
Audencia
Bocconi University
Boston Univ (Questrom)
UCSD Rady
Carleton
Carnegie Mellon
Case Western
Chicago Booth
Chulalongkorn
Chulalongkorn - Sasin
City University of Hong Kong
CUHK Business School
City, University of London: Cass
Columbia
Cornell Johnson
Dartmouth
Durham University Business School
Edinburgh Business School
EMLyon Business School

Emory University
ESADE
ESCP Business School - Paris
ESMT
ESSEC Business School
Exeter
Florida (Hough)
Florida Int'l
Frankfurt School of Finance & Mgt
Fudan
Georgia: Terry
Georgia Tech: Scheller
Georgia State (Robinson)
Gothenberg
Grenoble Ecole de Management
Harvard
HEC PARIS
Hong Kong UST
IE Business School
IESE
IIM Ahmedabad
IIM Calcutta
IIM Udaipur
Imperial College Business School
Indian School of Business
INSEAD
Iowa
ISCTE - IUL
International University of Japan
KAIST
Kansas
Koc University
Korea University
KU Leuven
Lancaster School of Management
Leeds Beckett
Lehigh
LBS
Loughborough
Mahidol International
Mannheim
McGill University: Desautels
Miami Herbert Business School
MIT
Michigan Ann Arbor
Nanyang Business School
National Sun Yat-Sen University
National Taiwan University
National University of Singapore
NYU
Notre Dame (Mendoza)
Nottingham
Oklahoma
Purdue University Krannert
Raboud
Renmin
RPI
Rotterdam
St. Gallen
Salamanca
Shanghai Jiao Tong
Shanghai Univ of Fin and Econ
Sheffield
Singapore Management University
SMU (Cox)
Sorbonne
Southampton
Stanford
Stevens
Strathclyde
Sungkyunkwan University GSB
Sussex
UT Dallas
Tokyo
Toronto Rotman
Trinity College Dublin
University College Dublin: Smurfit
Vanderbilt University: Owen
Virginia (Darden)
Virginia Tech
Vrije
Warwick
Waseda Business School
Washington: Foster
Washington State
Western University - Ivey
Wharton
Wisconsin School of Business
Yonsei
York
Zhejiang