

THE CAPCO INSTITUTE
JOURNAL
OF FINANCIAL TRANSFORMATION

OPERATIONAL
ARTIFICIAL
INTELLIGENCE

OPERATIONAL

Is accounting keeping
pace with digitalization?

ALNOOR BHIMANI

**ARTIFICIAL
INTELLIGENCE**

#58 NOVEMBER 2023

a **wipro** company

THE CAPCO INSTITUTE

JOURNAL OF FINANCIAL TRANSFORMATION

RECIPIENT OF THE APEX AWARD FOR PUBLICATION EXCELLENCE

Editor

Shahin Shojai, Global Head, Capco Institute

Advisory Board

Michael Ethelston, Partner, Capco

Farzine Fazel, Partner, Capco

Anne-Marie Rowland, Partner, Capco

Editorial Board

Franklin Allen, Professor of Finance and Economics and Executive Director of the Brevan Howard Centre, Imperial College London and Professor Emeritus of Finance and Economics, the Wharton School, University of Pennsylvania

Philippe d'Arvisenet, Advisor and former Group Chief Economist, BNP Paribas

Rudi Bogni, former Chief Executive Officer, UBS Private Banking

Dan Breznitz, Munk Chair of Innovation Studies, University of Toronto

Elena Carletti, Professor of Finance and Dean for Research, Bocconi University, Non-Executive Director, Unicredit Spa

Lara Cathcart, Associate Professor of Finance, Imperial College Business School

Jean Dermine, Professor of Banking and Finance, INSEAD

Douglas W. Diamond, Merton H. Miller Distinguished Service Professor of Finance, University of Chicago

Elroy Dimson, Emeritus Professor of Finance, London Business School

Nicholas Economides, Professor of Economics, New York University

Michael Enthoven, Chairman, NL Financial Investments

José Luis Escrivá, President, The Independent Authority for Fiscal Responsibility (AIReF), Spain

George Feiger, Pro-Vice-Chancellor and Executive Dean, Aston Business School

Gregorio de Felice, Head of Research and Chief Economist, Intesa Sanpaolo

Maribel Fernandez, Professor of Computer Science, King's College London

Allen Ferrell, Greenfield Professor of Securities Law, Harvard Law School

Peter Gomber, Full Professor, Chair of e-Finance, Goethe University Frankfurt

Wilfried Hauck, Managing Director, Statera Financial Management GmbH

Pierre Hillion, The de Picciotto Professor of Alternative Investments, INSEAD

Andrei A. Kirilenko, Professor of Finance, Cambridge Judge Business School, University of Cambridge

Katja Langenbucher, Professor of Banking and Corporate Law, House of Finance, Goethe University Frankfurt

Mitchel Lenson, Former Group Chief Information Officer, Deutsche Bank

David T. Llewellyn, Professor Emeritus of Money and Banking, Loughborough University

Eva Lomnicka, Professor of Law, Dickson Poon School of Law, King's College London

Donald A. Marchand, Professor Emeritus of Strategy and Information Management, IMD

Colin Mayer, Peter Moores Professor of Management Studies, Oxford University

Francesca Medda, Professor of Applied Economics and Finance, and Director of UCL Institute of Finance & Technology, University College London

Pierpaolo Montana, Group Chief Risk Officer, Mediobanca

John Taysom, Visiting Professor of Computer Science, UCL

D. Sykes Wilford, W. Frank Hipp Distinguished Chair in Business, The Citadel

CONTENTS

TECHNOLOGICAL

08 Overview of artificial intelligence deployment options

Ali Hirsa, Professor of Professional Practice, Department of Industrial Engineering and Operations Research, Columbia University, and Chief Scientific Officer, ASK2.AI

Satyan Malhotra, Chief Executive Officer, ASK2.AI

24 Applied generative AI governance: A viable model through control automation

Gerhardt Scriven, Managing Principal

Marcel Braga, Principal Consultant

Diogo Santos, Principal Consultant

Diego Sarai, Managing Principal

34 AI and banks. In conversation with an AI intern

Jesús Lozano Belio, Senior Manager, Digital Regulation, Regulation and Internal Control, BBVA

44 Performance of using machine learning approaches for credit rating prediction: Random forest and boosting algorithms

W. Paul Chiou, Associate Teaching Professor of Finance, Northeastern University

Yuchen Dong, Senior Engineer, MathWorks

Sofia X. Ma, Senior Engineer, MathWorks

54 A smart token model for native digital assets

Ian Hunt, Buy-Side Industry Consultant and Adviser

OPERATIONAL

72 Networked business design in the context of innovative technologies: Digital transformation in financial business ecosystems

Dennis Vetterling, Doctoral candidate, Institute of Information Management, University of St. Gallen

Ulrike Baumöl, Executive Director of Executive Master of Business Administration in Business Engineering, and Senior Lecturer on Business Transformation, University of St. Gallen

82 Developers 3.0: Integration of generative AI in software development

Fayssal Merimi, Managing Principal, Capco

Julien Kokocinski, Partner, Capco

90 Digital transformation and artificial intelligence in organizations

Niran Subramaniam, Associate Professor in Financial Management & Systems, Henley Business School

98 Is accounting keeping pace with digitalization?

Alnoor Bhimani, Professor of Management Accounting and Director of the South Asia Centre, London School of Economics

104 Bank and fintech for transformation of financial services: What to keep and what is changing in the industry

Anna Omarini, Tenured Researcher, Department of Finance, Bocconi University

ORGANIZATIONAL

116 The truth behind artificial intelligence: Illustrated by designing an investment advice solution

Claude Diderich, Managing Director, innovate.d

126 Duty calls – but is industry picking up?

Jessica Taylor, Consultant, Capco

Ivo Vlaev, Professor of Behavioral Science, Warwick Business School

Antony Elliott OBE, Founder, The Fairbanking Foundation

138 Generative artificial intelligence assessed for asset management

Udo Milkau, Digital Counsellor

150 How can banks empower their customers to flag potential vulnerabilities?

Przemek de Skuba, Senior Consultant, Capco

Bianca Gabellini, Consultant, Capco

Jessica Taylor, Consultant, Capco

160 Assessing AI and data protection expertise in academia and the financial services sector: Insights and recommendations for AI skills development

Maria Moloney, Senior Researcher and Consultant, PrivacyEngine, Adjunct Research Fellow, School of Computer Science, University College Dublin

Ekaterina Svetlova, Associate Professor, University of Twente

Cal Muckley, Professor of Operational Risk in the Banking and Finance Area, UCD College of Business, and Fellow, UCD Geary Institute

Eleftheria G. Paschalidou, Ph.D. Candidate, School of Economics, Aristotle University of Thessaloniki

Ioana Coita, Consultant Researcher, Faculty of Economics, University of Oradea

Valerio Poti, Professor of Finance, Business School, University College Dublin, and Director, UCD Smurfit Centre for Doctoral Research



DEAR READER,

As the financial services industry continues to embrace transformation, advanced artificial intelligence models are already being utilized to drive superior customer experience, provide high-speed data analysis that generates meaningful insights, and to improve efficiency and cost-effectiveness.

Generative AI has made a significant early impact on the financial sector, and there is much more to come. The highly regulated nature of our industry, and the importance of data management mean that the huge potential of AI must be harnessed effectively – and safely. Solutions will need to address existing pain points – from knowledge management to software development and regulatory compliance – while also ensuring institutions can experiment and learn from GenAI.

This edition of the Capco Journal of Financial Transformation examines practical applications of AI across our industry, including banking and fintechs, asset management, investment advice, credit rating, software development and financial ecosystems. Contributions to this edition come from engineers, researchers, scientists, and business executives working at the leading edge of AI, as well as the subject matter experts here at Capco, who are developing innovative AI-powered solutions for our clients.

To realize the full benefits of artificial intelligence, business leaders need to have a robust AI governance model in place, that meets the needs of their organizations while mitigating the risks of new technology to trust, accuracy, fairness, inclusivity, and intellectual property. A new generation of software developers who place AI at the heart of their approach is also emerging. Both GenAI governance and these ‘Developers 3.0’ are examined in this edition.

This year Capco is celebrating its 25th anniversary, and our mission remains as clear today as a quarter century ago: to simplify complexity for our clients, leveraging disruptive thinking to deliver lasting change for our clients and their customers. By showcasing the very best industry expertise, independent thinking and strategic insight, our Journal is our commitment to bold transformation and looking beyond the status quo. I hope you find the latest edition to be timely and informative.

Thank you to all our contributors and readers.

A handwritten signature in black ink, appearing to read 'Lance Levy', with a stylized, flowing script.

Lance Levy, **Capco CEO**

IS ACCOUNTING KEEPING PACE WITH DIGITALIZATION?

ALNOOR BHIMANI | Professor of Management Accounting and Director of the South Asia Centre, London School of Economics¹

ABSTRACT

Digital transformations are taking place across enterprises in every industry. Becoming digital is both essential to compete and virtually unstoppable. All previous major technological disruptions have led to financial intelligence being altered to ensure more effective decision making in the face of change. This article considers issues that organizations going digital need to address in relation to accounting information provision. It discusses several points: accounting's need to move toward the delivery of predictive information rather than relying on extrapolations of historical data; the recognition that machines make more decisions that alter accounting information needs, structures, and contents; the importance of recognizing the "data-learning-action" loop that is emerging; the emergence of "strat-perational" information contexts; and the relevance of prioritizing qualitative insights in decision making.

1. INTRODUCTION

Three decades ago, new computer technologies changed how businesses manufactured products and delivered services. Accountants, as a result, altered the information they provided to managers to enable decisions to be made that were aligned with the new business environment. Digitalization today is not only transforming products and services but also the form and type of information enterprises must grapple with. Consequently, the interface evolving between digital technologies and financial information is likely to become the biggest shift ever seen in the history of business decision making. The beauty of digital is that it unfolds novel products, services, and value creation possibilities while also changing the nature of information managers can use to steer their organizations. The question remains: are enterprises deploying financial intelligence that is up to the mark? This article examines key financial information changes that digitalization necessitates to ensure decision makers are not retaining a mindset belonging to conventional analogue modes of operating.

2. THE LIMITS OF ACCOUNTING

Accountants take the view that there exists no business situation that accounting cannot report on. From cost determinations, to auditing, to taxation, to financial analyses, accounting information is considered to provide a sound basis for assessing financial performance and to make business decisions. However, accounting today is facing an unmitigated rupture – it needs to restructure itself from the core. While financial information within balance sheets and income statements will likely always matter at some level, accounting's sole focus on past economic transactions and business outcomes cannot remain. Several disruptive forces confront modern accounting expertise. To start, accounting information needs to address what will take place rather than simply reporting on what has transpired. The finance professional must veer toward delivering predictive insights based on a wider analysis of data as opposed to focusing on historical accounting reports perused by decision makers who must then extrapolate the implications. Going digital provides executives a bridge to tomorrow as data becomes more

¹ The ideas in this article are drawn from my books: Bhimani, A., 2021, *Accounting disrupted: how digitalization is changing finance*, AICPA/Wiley, and Bhimani, A., 2022, *Financial management for technology start-ups*, Kogan Page

predictive of financial outcomes to follow rather than ones that have already materialized. To achieve this, accountants must develop skill sets enabling them to assess more diverse organizational datasets.

Secondly, many firms are seeing a greater portion of executive action being taken through autopilots without human input. As such, accounting reports that used to guide such actions are becoming redundant because machines do not need to “read” reports formatted in a specific way. Machines act and operate simultaneously. In effect, the forms and intents of accounting information are changing because the agents requiring financial reports are changing. The notion that humans must make decisions based on information and only then act is inimical to the manner in which machines function, since information retrieval, analysis, decision making, and action are not dissociated processes.

A third key trend is that digital technologies increasingly enter products as ID tags and IoT devices, whereby information systems and data gathering mechanisms are baked into the products themselves that are being reported upon. Accountants have traditionally collected data about processes and products using information systems developed to capture data and convert these into useful information. They now need to focus on unraveling new insights from products that are themselves also information systems. Furthermore, it is not just a matter of products and information systems being intertwined but contexts where digital technologies structured on blockchain applications that record transactions in a manner that grounds the assurance of transactional legitimacy. In such organizational spaces, trust becomes integrated as part of information content, placing the traditional role of audits under question.

Accounting is without doubt becoming a whole lot more complex and digitalization is at the heart of the ongoing disruption. In altering what information sound decision making must rest on, digital technologies are crowding out conventional business philosophies, models, and thinking. Their capacity to self-transform further displaces the traditional role of accounting, premised on a linear sequence of data collection followed by conversion into financial information that accountants produce in a digestible form, allowing humans to base their actions upon. Business history knows no such pace or scale of change and there exists no U-turn to this technological transformation. Executives cannot afford their accounting information to stand still, as digitalization progresses without relent.

“
*...the interface evolving
 between digital technologies and
 financial information is likely
 to become the biggest shift
 ever seen in the history of
 business decision making.*”

What is of greatest relevance to business today is acknowledging the ramifications of going digital. It has been said that we have entered a new industrial revolution. Two hundred and fifty years have passed since mechanization emerged in industrial activities. A hundred years ago, we saw electrification and mass production taking shape, and electronics and automation started a third revolution around sixty years ago. The ongoing “fourth” industrial revolution has ushered in a convergence of our biological, physical, and virtual worlds. But, of note, is that during the first three revolutions, few people were cognizant of the magnitude of changes to come. Today, however, we are all too aware of the massive and unprecedented shifts that are ongoing in the way we produce, consume, move, communicate, and experience things. While the industrial changes surfacing during the first three industrial revolutions could perhaps not be foreseen by people, no one today can stand in denial of the all too evident and fast-paced changes this fourth one has unleashed. No excuse can be had for financial information to not react, or indeed proact, in this climate of extreme change for business.

3. UNKNOWNNS IN CORPORATE STRATEGY EXECUTION

Executives face an increasing array of unknownns. In the past, decision-makers pursuing major alterations in their operations fully appreciated what they were seeking. It could have been a novel marketing campaign to rebrand a product, implementing flexible work practices to make production more pliable, possibly facilitating customer service via new support systems, perhaps making capital investments to increase productivity and scope, or, possibly, to seek a merger for acquiring new knowledge and mobilize wider revenue streams. Decision-makers have had the luxury of reasoning and purposefulness in investments they made in pursuit of specific business

outcomes. Going digital, by contrast, implies operating within a limited vision of what the end state of executive action might be. There are no mechanisms available that can lend assurances that a specific digital transformation investment will culminate in specific enduring outcomes. Indeed, that is the point of digital: pursuits leading to outcomes that are more dispersed than the ones that were initially advanced, and which may even be unintended, can lead to strategic moves that are not only viable but extremely apt and which trigger the next move. To a degree, digitalization enables digitalization that sets off new trajectories, which alter processes, all the while enabling further action that is far from being anticipated at the outset. Speed of action has always been of relevance in business, but going digital powers fast iterative changes that executives may not fully fathom and, which, therefore, remain outside what competitors can envision. Digital paths of action can take enterprises to different destinations, where reaction and proaction are essential to effectively and continually address the status quo, whose half-life becomes more transient.

We turn now to how accounting must be re-thought.

4. WHAT NEEDS TO CHANGE

How data can assist managers is changing. Financial information systems capture data points about economic transactions that have occurred, converting them into information that is condensed, formatted, and made intelligible to decision-makers. Digital data is much broader than economic data points. We can think of conventional internal accounting reports as being intended for executives through the collection of economic transactions-based data and related quantitative and qualitative metrics to feed into their decision making (Figure 1).

Accountants within enterprises that are digitally transforming must have greater engagement in assessing cloud infrastructure benefits, as well as mobilizing process changes and containing their costs, assessing cybersecurity constraints, and exploring pathways to more flexibility, automation, and scalability. Their role is becoming increasingly complex in relation to dealing with more varied data sources and data volume and becoming more cross-functional with decisions having to be made on enhanced rules-based automation across organizational activities.

Figure 1: Accounting drives decisions



Figure 2: Structured and unstructured data counts

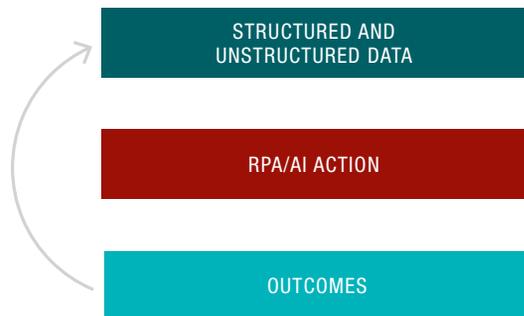
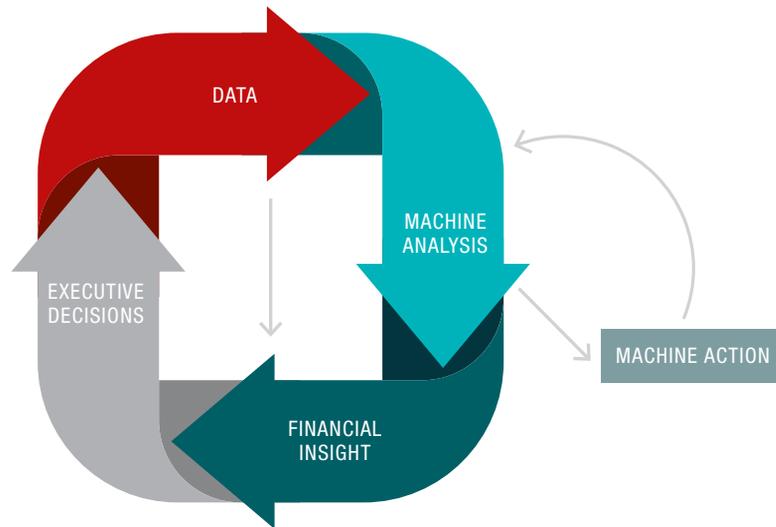


Figure 3: Executive action by humans and machines

Digital transformation offers a much wider realm of insights for executives to benefit from and accountants need to become adept in determining what maximizes the insights they can advance for the enterprise. Data that is external to the domain of economic transactions can enable the identification of trends that foretell economic exchanges and provide intelligence on novel possibilities for action and opportunities for growth. Executive action based on such data creates more such data that can be acted upon. Technologies such as robotic process automation (RPAs) are becoming increasingly sophisticated, with machines undertaking devolved action and continuously learning from those actions and refining information, yielding insights for assessment that executives can in turn harness (Figure 2). Financial information systems need to react to the possibilities that non-financial data has implications for consequent financial transactions. Beyond that, machine-based actions culminate in decisions that executives can undertake based on the growth of structured, financial, and non-financial, as well as unstructured, data (Figure 3).

With machine learning, machines can assist in taking and operationalizing certain actions reliant on data inputs and subsequently to refine these actions based on data outputs from prior actions. Concurrently, humans can focus on using information to guide actions they do not delegate to machines. Actions drawing on data insights from machine executions can become further integrated with human action related data outputs, producing a breadth of data that circularly

underpins yet more decisions and actions. Ultimately, data growth enables decision making that fosters more data, enabling greater and faster learning, which in turn unleashes enterprise action that propels yet more data (Figure 4). That looping of data-learning-action is among the most powerful impact that going digital can trigger, if effectively channeled into intelligent decisions and action, whether by humans or machines. In contexts where artificial intelligence (AI) agents find increased presence, data becomes a principal basis for ML systematized learning. Consequent action based on that learning unleashes more data faster, enforcing even greater and faster learning. This gives form to a virtuous loop with extreme data analysis, accelerating learning, and extensive action powering the looping. It is this in AI intense environments that enables extremes of growth, potentially leaving competitors in rear view. As firms implement AI systems, the interfacing of data, learning, and action makes accounting more complex than it has ever been, while also enabling it to become more strategically relevant for organizational growth and performance.

Conventionally, strategy is regarded by some executives as emerging over time, as intentions collide within their firms. But for most, strategy tends to be formulated to define and guide desired operations, taking account of wider business and environmental factors. As such, strategic information points executives to what should underpin their decisions in pursuit of targeted business activities, with such decisions having to

take account of marketing advances to be made, investment opportunities to be identified, branding efforts to be made, and so on. And, of course, operations should essentially tally with, and support, strategic intentions. Within digitally transforming organizations, it may well be that the past should not determine strategy.

Just as this article argues for accounting information to be predictive and focused on the present to point to what is to follow financially, strategic action can no longer be defined based on what has happened. But a further point must be made, which is that it is now inappropriate to see strategic intent as presuming a long-term time period, so the enterprise paves its protracted directional purpose. In rethinking alternative courses of action on a continuous basis, executives cannot adhere to a pre-digital conception of strategy. In fact, strategy and operations are intertwined in digital contexts, so much so that strategic action that is now of essence is one that recognizes the process of data capture, decision making, and action having become “strat-perational” (Figure 5). Strategy has moved to the “here and now”, directing organizations to consider whether operations need refining and also whether strategic intents need redefining in an interrelated realm. This implies that accountants should no longer lock-in expired rationales into digital contexts, because the information potential of operations intermeshed with strategic aims goes much beyond treating the two as separates, with long-term strategic intent guiding day-to-day operations.

Management thinkers have long held that enterprise controls should keep the strategic apart from the operational. The idea of short-term actions being informationally divorced from long-term aims is one to be questioned when going digital. In digital, the short-term and the long-term enjoy a close coupling that has not been present in conventional industrial businesses. Within digitally transforming contexts, a decision to pivot the firm in a certain direction will create data to be analyzed in real time. Aggregate data produce information that enters decisions concerning the next move or desired action. Under digital, broad business pursuits meet with continuous realignment. Operations can produce sufficient information to suggest the enterprise should steer toward entirely novel areas of activity or a new direction. The broad business hypothesis should be open to being questioned and altered in the face of information from operational activities. Small sets of data cannot be maintained as islands distanced from pointing out alternate organizational agendas. Managing in real time and quantifying short-term returns must naturally preserve relevance, while a recognition must be had also that longer term changes are interdependent, with ground level operational processes and business direction being flexible to pointers that are operational. What some view as an “agile business” in digitalizing enterprises, is in fact a rejection of demarcating operational activities as entirely separate from strategic moves. Digital transformation means the two are coupled with differentiation being an obstacle to sound management. This is not to suggest that thinking strategically

Figure 4: Data enables learning, which guides action

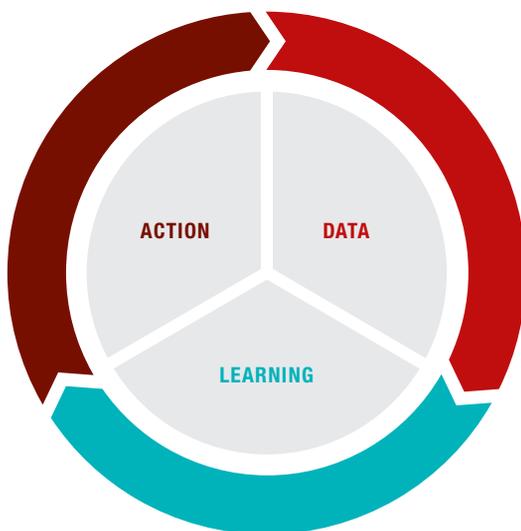
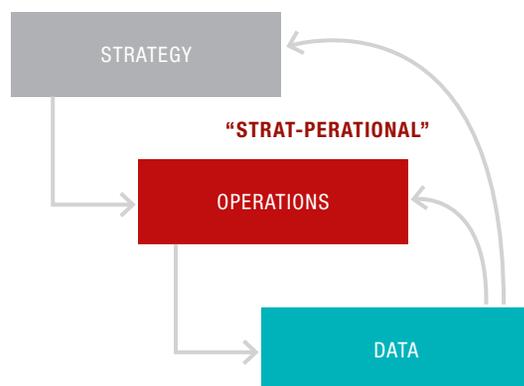


Figure 5: When strategy is truly coupled with operations



no longer has a place, but that distancing such thinking from the value of real time action and operational on-goings is to deny the production of insights that can be important to survival and growth.

5. CONCLUSION

Digitalization is bringing a multitude of changes and challenges that are impacting what executives need from their corporate finance function. The accountant must comprehend the significance of shifts evolving at the interface of digitalization, financial information, and enterprise action. Clearly, as organizations invest in digital technologies, hordes of new data types emerge, not all of which is financial in a conventional sense. This article has discussed several implications including, first, that accounting information must now steer toward being predictive rather than forcing decision-makers to try to visualize the future consequences of their actions based on reports of what has transpired. Second, it has been noted that machines are increasingly engaged in integrating data analyses with decisions and actions, such as to alter the information roles, content, and needs humans may have placed on accounting. Thirdly, it has been discussed that being cognizant of the “data-learning-action” loop is of high relevance, as this is what going digital rests upon. It has also

been argued that differentiating between long-term strategy and short-term operational activities can no longer be seen in clear-cut terms; “strat-perational” information contexts are fast emerging, which impact what accounting information should focus upon. In addition to these observations, one more point needs to be borne in mind, which is that the relevance of quantification in business decision making must not be overstated simply because digitalization is taking place. Data-driven management action is certainly desirable, though the implication cannot be that numbers should trump qualitative assessments. Going digital cannot pre-suppose that numbers-based analysis should monopolize enterprise decision making. In the face of information growth, senior executives rely on more, rather than less, qualitative input when businesses digitalize. The movement towards digitalization certainly increases the possibilities for numerical analyses, but this signifies more, rather than less, qualitative insight. Understanding what going digital means for their enterprise should be a priority for organizational leaders and this will involve unlearning at least some conventional managerial precepts that have been said to be fundamental, including the idea that managing by the numbers should be prioritized. Financially relevant information should not preclude that which is most capable of generating insights, and, as it turns out, much of that cannot be quantified.

© 2023 The Capital Markets Company (UK) Limited. All rights reserved.

This document was produced for information purposes only and is for the exclusive use of the recipient.

This publication has been prepared for general guidance purposes, and is indicative and subject to change. It does not constitute professional advice. You should not act upon the information contained in this publication without obtaining specific professional advice. No representation or warranty (whether express or implied) is given as to the accuracy or completeness of the information contained in this publication and The Capital Markets Company BVBA and its affiliated companies globally (collectively "Capco") does not, to the extent permissible by law, assume any liability or duty of care for any consequences of the acts or omissions of those relying on information contained in this publication, or for any decision taken based upon it.

ABOUT CAPCO

Capco, a Wipro company, is a global technology and management consultancy focused in the financial services industry. Capco operates at the intersection of business and technology by combining innovative thinking with unrivalled industry knowledge to fast-track digital initiatives for banking and payments, capital markets, wealth and asset management, insurance, and the energy sector. Capco's cutting-edge ingenuity is brought to life through its award-winning Be Yourself At Work culture and diverse talent.

To learn more, visit www.capco.com or follow us on Facebook, YouTube, LinkedIn and Instagram.

WORLDWIDE OFFICES

APAC

Bangalore – Electronic City
Bangalore – Sarjapur Road
Bangkok
Chennai
Dubai
Gurgaon
Hong Kong
Hyderabad
Kuala Lumpur
Mumbai
Pune
Singapore

EUROPE

Berlin
Bratislava
Brussels
Dusseldorf
Edinburgh
Frankfurt
Geneva
London
Milan
Munich
Paris
Vienna
Warsaw
Zurich

NORTH AMERICA

Charlotte
Chicago
Dallas
Hartford
Houston
New York
Orlando
Toronto
Washington, DC

SOUTH AMERICA

Alphaville
São Paulo

THE COVER IMAGE WAS CREATED USING JASPER AI, AN AI ART GENERATOR



WWW.CAPCO.COM



CAPCO 25
a wipro company