Human & Technological Resource Management (HTRM)

A fast-forward into the future of human resource management and technology. Artificial intelligence, digital competencies, gig economy, digital reverse mentoring, employer branding and organisational design are the topics covered and highly relevant for the new world of HRM. A highly recommended read!

Miha Škerlavaj, Vice-Dean for Research and Professor,
University of Ljubljana and BI Norwegian Business School

A successful combination of two important topics: Industry 4.0 and Human Resource Management. Two sides of the same coin, which are usually only looked at from one perspective.

Professor Dr Alexander Brem
University of Stuttgart, Germany

The management of people in the time of Industry 4.0 is a critical issue for both practitioners and academics. This book provides much needed answers from a cohort of leading academics who pull together current knowledge about HRM and Industry 4.0 to shed light on this complex matter. Those who study HRM would profit from reading this book.

Yehuda Baruch, Professor of Management,
University of Southampton, UK

Human & Technological Resource Management (HTRM): New Insights into Revolution 4.0

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INVESTOR IN PEOPLE

To my sister Leena, who is my heart, and to my children Priya and Debashish, who are my soul

Payal Kumar

Anirudh would like to dedicate this book to his wife Abhilasha Gupta, his children Anushka and Ashwin, Dr Kai Hockerts, and Volume Contributors

Anirudh Agrawal

Pawan dedicates this book to his sisters – Shakuntala and Kamlesh and sisters-in-law – Indu, Deepa and Radhika

Pawan Budhwar

To all who have interest in learning about and embracing the HRM 4.0 revolution.

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Contents

Part II: HRM 4.0: Practice, Strategy and Policy

List of Figures

This page intentionally left blank

List of Tables

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Foreword: Managing People and Technological Change in Context

By

Professor Chris Rowley

Kellogg College, University of Oxford and
Cass Business School, City University of London

This new book edited by these three well-known and respected editors (Payal Kumar, Anirudh Agrawal and Pawan Budhwar) comes at the right time on a topic of great importance. It is fashionable for commentators and policy-makers to state we are at the beginning of a 'new' industrial revolution where technology is rapidly changing personal, work and professional lives and challenging existing models of work organisation with major implications for the economy, jobs and labour market.

In an attempt to distinguish this particular 'revolution' from earlier ones, commentators have given it the shorthand label of '4.0'. It is given the suffix of 'four' to signify its sequence in following on from the three prior industrial revolutions before it (Welsh Government, 2019). The first is seen to have been from the late eighteenth to the late nineteenth centuries when water, steam and mechanical equipment transformed production with mechanisation mainly focussed on agriculture, textiles, etc. The second was from the late nineteenth to mid-twentieth centuries when electricity, mechanisation and factory mass production created mass consumer markets and public services. The third was from the mid-twentieth to early twenty-first centuries with the growth of information technology, electronics, computing, the internet and the integration of corporate value chains which extended from manufacturing to service industries. Finally, the fourth is seen as developing from the early twenty-first century, driven by emerging and interlocking technological breakthroughs, such as in artificial intelligence (AI), robotics, data analytics, the internet of things, etc., giving rise to the digital transformation of business, public services and wider society.

I will side-step to what extent such a nomenclature is really the case in some sort of hard, measurable way with distinct boundaries. Indeed, this is similar to the arguments about globalisation – what is it, how 'new' is it, have there been previous 'waves' of it and how do we distinguish when it began (see World Systems Theory, such as Wallerstein (1976)) and ideas of deglobalisation.

Furthermore, I will avoid too much detailed comment and analysis around one of the main and longstanding interests and debates – which are polarised – regarding the impact of such industrial/technological revolutions on jobs.

This coin has two sides: the number and the nature of jobs. One the one side, there are too many eye-catching, lazy reports and headlines about the end of work, how 'robots will take all our jobs' or some other such predictions of work and employment Armageddon. These are naïve, overly-simplistic, inconsistent and debated due to their different methodologies, who is asked what and their focus is, etc. They also require balance in terms of not only exogenous but also endogenous factors. For example, there may well be the technology to replace humans, but it is only one factor – along with investment, innovation, government policy (such as on minimum wages, migration, etc.), etc – in shaping work and jobs. For some organisations it makes little business sense to use technology for many reasons, such as competitive advantage and strategy, ranging from access to cheap labour to the quality-cost decision and emphasising the 'hand-made' and value-added.

These scenarios reflect the much earlier and longstanding concerns about the impact of technologies on human jobs, which has always occurred (Jenkins & Sherman, 1979, 1981). A few examples are the displacement of artisan weavers by mechanised looms or all the myriad jobs around horses by other forms of transport and power to newer examples such as cashiers and tellers by self-service machines, etc. Behind this lies the so-called 'Luddite fallacy' linked to the 'lump of labour fallacy', basically that there is a finite amount of work available and technology does that work, then surely there can be no other work left for humans to do. Keynes in the 1930s popularising the phrase 'technological unemployment'. While the technological trend is labour substitution and hence job displacement, there are also compensation effects, including inter alia from the following. First, the technology itself: the labour needed to build, service and maintain it. Second, new investments: enabled by cost savings and increased profits. Third, wages: if boosted leading to increased income and spending in turn encouraging job creation. Forth, prices: lowering encouraging more demand and employment and helping offset wage cuts as cheaper goods increase buying power. Fifth, new products, services and markets: where innovation directly creates new jobs, both directly and indirectly and with 'new business models' leading to new products and services, etc.

The other side of the coin concerns the nature of jobs – such as skill requirements – stemming from technical change, again with polarised perspectives. Again, these ideas are not new. Examples range from Braverman (1974) on the innate deskilling in technology and the whole labour process field, including around control and surveillance via 'Just-In-Time' production and 'Total Quality Management' (Sewell & Wilkinson, 1992), or via tools for internal communication (Zuboff, 1988), as well as more comprehensively and surreptitiously as in so-called 'surveillance capitalism' of companies like Facebook and Google (Zuboff, 2019), expanding ideas of 'digital dispossession' (Harvey, 1990). Indeed, we can even see this at state level, as in China.

Some commentators see the most impact on routine jobs. However, but what is classed as 'routine' and 'high-skilled' is changeable – and even linked to gender – for example, the reclassification of retail bank clerks over time from skilled to unskilled as males were replaced by females. Also, technology is allowing

information capture from the minds of knowledge workers. This process of digital Taylorism – translating knowledge work into working knowledge, captured in digital software – is impacting on professional occupations such as accountants, lawyers, consultants and teachers (Welsh Government, 2019).

Technology can be used to re-design jobs, changing their content, character and context. Also, technology may transform the nature of the employment contract in allowing super connectivity that may then allow firms and people to arrange new types of employment and perhaps this may be incorporated into the nature of jobs. Likewise, we need to go beyond the analysis of people and technology issues separately as there will be interaction between them creating decision dilemmas and responsibility issues when we rely on AI or big data approaches in human resource management (HRM) issues, such as interviews, performance evaluation, etc. (I thank Professor Bae for these perceptive points).

So, how all technology is used and unfolds, we too often forget, is about human choices. It is not, to use the title of the great Bob Dylan song 'A Simple Twist of Fate'. Neither is it a zero-sum game. Yes, there will be challenges and job displacement, as there always have been with technological change, but there will be, again as previously, new opportunities such as fresh types of work, jobs requiring different or enhanced skills. How '4.0' is used and pans out has significance in terms of its impact on how work is experienced. It can be used to either to augment skills and improve job quality or to deskill and eliminate jobs. Like previous iterations of disruptive technology, at the start the metaphorical kaleidoscope is pointing at the light, ready and waiting – but there is only a limited space and time to shape matters and how it will be used before it comes settled.

Nevertheless, for the sake of simplicity, I will go along with the arguments that AI-based automation, software and bots, etc., can solve all manner of complex problems which once needed human intervention. I will narrow this down further to discuss and comment on the belief that some companies across certain industries are deploying technologies like AI and big data to HRM. For example, while there will be changes in the areas of work, it is not clear how change will take place, its job impacts in terms of numbers and training or practices such as recruiting, developing, rewarding and retaining people, both in the 'core' and the 'periphery' of the firm and dual labour market. In other words, is HRM 4.0 an opportunity, a phase or a threat?

This new book examines these areas and provides information and analysis in answering this question. How does it undertake this task? In broad terms this book is structured in two sequential parts. Part One covers the conceptual and historical frameworks in four chapters followed by another four chapters in Part Two covering HRM practice, strategy and policy areas. I will now note a little about each chapter before moving on to my own views.

Chapter 1 – 'Futuristic organisational design: The role of technological imperative in defining the changing nature of structure, coordination and people practices' analyses how the building blocks of digital organisational design shape managerial and employee behaviours, unleashing digital technologies potential. This is achieved by reflecting on the historical changes in organisational design practices that unfolded throughout different phases of industrialisation.

Chapter 2 – 'A polycentric network forming digital competencies for the future' details the process of creating a competency model via a multifunctional semantic informed by social system theory to enable dialogue in a polycentric network. This spread across a wide range of different small- and medium-sized enterprises, educational and training organisations, consultants, trade unions and industrial interest organisations. Chapter 3 – HRM 4.0 and the Shifting Landscape of Employer Branding focuses on HRM and the change in employer branding strategies due to rapid increase in digitalisation such as through analytics and big data. A conceptual framework is provided, that links this HRM with employer branding strategies. Chapter 4 – Opportunities and Barriers in the Practice of Human Resource Analytics argues HR Analytics can add value to organisational effectiveness, although barriers exist in realising this, such as low awareness. Facilitators include the right set of competencies with relationship building particularly important and discretionary effort.

Part two shifts to the level of HRM practice, strategy and policy. Chapter 5 – 'Gig Economy, 4IR and Artificial Intelligence: Rethinking Strategic HRM' begins by exploring the critical tenets of strategic HRM and then discusses what its study and practice needs to do in this new era. Chapter 6 – 'Digital Reverse Mentoring as a Strategic HRM Tool: Case Study of an Indian Firm' highlights the various design elements of digital reverse mentoring that contribute towards achieving digital transformation and rebuilding of mindsets in the company. Through the case study it also suggests that HRM needs to look beyond adoption of technological tools to actively participate in addressing the digital transformation in a company. Chapter 7 – 'Influence of Artificial Intellligence over Work, People and the Firm: A Multiindustry Perspective' examines the influence of AI over work, people and organisations. Its qualitative approach indicated the pervasiveness of AI, the emergence of new forms of work, the threat to some existing jobs and the emergence of new skill sets. Chapter 8 – 'Country-level comparison of Industry 4.0 in Germany, South Korea and the United States: Policy implications for India' compares the strategic actions taken by these countries by using a SWOT analysis. It uses Max Weber's ideal types as a positivist frame of analysis for the country-level data and then outlined policy recommendations for India.

I will now set this book, its contents and authors in context, both old and new and focus on the twin ones of lifelong learning and leadership.

First, lifelong learning. In terms of newer – or more correctly, now re-discovered and re-emphasised – areas, major ones concern 'adult education' to use a traditional term or its modern lexicon of 'lifelong learning'. As the Centenary Commission Report (2019) reminds us, adult education was seen as 'A Permanent National Necessity…' over 100 years ago! Another recent example is the work by Phil Brown, such as in the *Wales 4.0* report (2019). This argues that significant numbers of jobs will be displaced by automation and those effected will need access to good quality, relevant adult education to upskill and access higher-level roles that might emerge. Both reports acknowledge there are challenges in delivering such lifelong learning when funding cuts have reduced participation in adult education and the challenges of making such education accessible to the least mobile members of society. Furthermore, this is a classic 'rhetoric versus reality'

area. All politicians will publicly support such 'worthy' aims as adult education, but for such change to actually happen requires policy-maker commitment and actions and thus the political will – and funding.

Second, leadership. The ideas and implications of this latest revolution powered by AI will have implications and impacts on not only practices and their management, but also especially leadership, particularly effective leadership in uncertain times (Rowley & Oh, 2019; Rowley & Ulrich, 2012, 2019). It will require effective, agile leadership to both challenge the preconceived, easy, but intellectually lazy notions that somehow everything about and around technology is preconceived and fixed. It is not. It is about decisions and choices and the people who do this.

Of course, it is not only leadership, but new competencies of people becoming more important, requiring us to 'drill down' further. As I was reminded by Professor Bae, it may need us to redefine the nature and feature of people in the firm, even for the 'person' rather than a 'human resource' who can make their own decisions under new circumstances. The decisions and choices are related to the 'ideal society' we may conceive. We can avoid both 'technological pessimism' and 'technological optimism' and do not need to be afraid of technology, but we cannot disregard its influence, so we need to examine and analyse the nature of the new technologies of the '4.0'.

Given all this, I will end with a clarion call for not only further academic thought, research and publications in this area, but also for work of greater impact and engagement with policy-makers and practitioners. It is they who hold the code and key to how ever more technology is used in areas such as HRM for a brighter future for us all in our work and professional lives.

Acknowledgement

I would like to thank Professor Johngseok Bae of Korea University Business School for his perceptive points and improvements. All mistakes remain mine.

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Preface

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The book *Moneyball* by Michael Lewis (2003), which led to a film of the same name starring Brad Pitt, cinematically conveyed how data analysis could be used to promote people for organisational benefits. Since the book's publication and success of the film, the annual budget of analytics-based human resource allocation in sports teams has increased 20-fold. Now companies across industries are quickly deploying higher technologies like artificial intelligence (AI), the internet of things (IoT) and big data to hire and allocate human resources for greater competitiveness (Brunet-Thornton & Martinez, 2018). It is envisaged that AI-based automation will significantly restructure the industrial-organisational set-up (Agrawal, Schaefer, & Funke, 2018; Daugherty & Wilson, 2018). What is less certain is what kind of strategies will be adopted towards the digital transformation of organisations.

The recent socioeconomic trends and speeches by many global leaders have pointed to the uncertain socioeconomic effects of the movement of the economic and production systems from twentieth century practice, where the human was master of the machine, to a twenty-first century practice, where humans and machines work along-side each other as colleagues (Ross, 2017; Schwab, Davis, & Nadella, 2018; Susskind & Susskind, 2017). This trend is driven by recent advances in technology and constant innovation, outpacing even Moore's law (that the speed of our computers will keep increasing, as their cost keeps reducing). The developments in automation with the increased accuracy of predictive analytics, compounded with increased internet speed, cognitive machines incorporating lighter-inexpensive-nanoscopic sensors, and evolving platforms, have already evolved to the extent that technologies can mimick the human manager. People like Elon Musk and Stephen Hawking have prescribed a cautionary approach to the development of AI, pointing out that its relative autonomy might turn out to be problematic, and even beyond our control.

These trends force us to reflect on a multiple of critical questions. First, at the institutional and policy level, one is forced to reflect on how governments should develop strategies to ensure learning, socioeconomic balance and employment. Second, at the level of the corporation and production systems, one will have to rethink organisational structure, human resource skilling (and trimming), and

also human resource allocation while ensuring shareholder value creation and long-term competitiveness.

Further, following the digital transformation of organisations, there are deeper questions on re-skilling and redevelopment of the human resources while ensuring the ethical, sustainable and financial bottom line of the organisation. There remains uncertainty on the competitiveness of organisations investing (or not) in 'Industry 4.0'. We need to ask critical questions about the future of employees who fail to unlearn and adapt to the new normal. There are multiple critical questions on how the strategic human resource management (SHRM) will pan out in terms of attracting, developing, rewarding and retaining those employees who benefit the firm in these disruptive times. Will HR managers perceive IT as a supporting function or a *core* operational department?

This edited volume attempts to answers such questions. The book is divided into two sections. The first section primarily focuses on conceptual and historical frameworks. This section is more at the people and organisational-level and how organisations could re-think and re-design themselves to remain competitive. The second section focuses on the strategic and policy level and discusses how firms and countries should be strategic and policy-driven in managing employment, innovation and competitiveness. This volume primarily consists of qualitative and conceptual studies and calls for exploratory and confirmatory quantitative studies, especially in the domain of automation, re-skilling and national competitiveness.

The first chapter of the volume by Tomislav Hernaus, Aleša Saša Sitar and Ana Aleksić Mirić reflects on the organisational design practices which took place over different generations of industrialisation. They discuss from the organisational-level perspective the relevance of how change happens and how organisations could be in the age of digitalisation while ensuring competitiveness. They essentially deflate fears related to AI and Industry 4.0. The ability of small- and medium-size enterprises (SME) to unlearn and learn is difficult.

The second chapter by Margit Neisig and Uffe K. Hansen reflects on the 'polycentric network forming digital competencies' using social systems theory. The authors using this theory discuss the usefulness of sharing knowledge, information and competencies with individuals, organisations, SMEs connected in specialised groups and networks. The success of managing digital competencies lies in connecting (or grouping) these organisations in a unique socially cohesive networked system such that information exchange is symmetric, learning and change are implemented, and overall digital competitiveness is enhanced. SMEs should form clusters, networks and association sharing evolving knowledge and pursue socially collective business practices.

There are multiple empirical studies linking organisational performance to digitalisation. The chapter by Sujo Thomas, Sonal Kureshi, Susmita Suggala and Valerie Mendonca links the digital competency of the organisation to its employer branding strategies. More specifically, this chapter discusses the internal changes in the organisation due to the HRM 4.0 transformation and its perceived benefits on employer branding strategies. The study makes propositions about enhanced brand awareness (external implications) due to internal digital innovation.

The last chapter of the first section is by Tobias Rex, Sudeshna Bhattacharya, Kanimozhi Narayanan and Pawan Budhwar which discusses how the human

resource analytics adds value towards organisational effectiveness and competitiveness. While there is a strong empirical evidence of organisational competitiveness and digitalisation, investing for organisational digitalisation at the functional level (i.e. human resource analytics) requires overcoming organisational inertia. Internal leaders (and facilitators) within an organisation who have the vision and network may drive digitalisation at the departmental levels.

The doomsayers have presented an extremely dismal picture of Industry 4.0 where they have imagined the new normal with massive layoffs and capitalism without the middle class. The chapter by Ashish Malik, Pawan Budhwar and N. R. Srikanth addresses such fears. It discusses HRM in an exploratory study where the authors reflect on the organisational function of SHRM in the evolving context of automation, gig economy and how it can be re-designed such that organisational performance remains competitive. It is a policy level study, conceptualising SHRM policies in the developing dynamic environment of Industry 4.0 and how organisations at the intersection of gig economy can best strategize. Further, the doomsayers point that many organisations may actually find easier to layoff older staff than invest in their training.

The chapter by Nimruji Jammulamadaka is a case study that explores the various 'design elements of digital reverse mentoring' which have the potential to bring about organisational change. The research suggests that an employee-driven active engagement process has the potential to bring about digital transformation within a controlled environment at controlled costs and lead to high organisational agility. Utilising the potential of the newer and younger workforce for training the senior employees and helping them unlearn and learn newer technology will have positive social and financial ramification at the corporate level. Such a strategy will bring balance to the organisation and reduce fear of lay-offs.

The chapter by Richa Saxena and Yogesh Kumar takes a critical approach towards AI applications in workplaces and explores its consequences over the workplaces and associated people and their productivity. The authors point out the potential opportunities that the adoption of AI brings to the workforce and their organisations in terms of increased productivity and earnings. This chapter suggests to focus on re-skilling of existing employees in new digital applications and organisational design as a way of improving employee productivity and corporate bottom line. The technological competencies have mostly been held by global north, the global south has mostly remained a follower nation.

The chapter by Anirudh Agrawal, Payal Kumar and Ashish Tyagi is a country-level study of Industry 4.0 policies adopted in Germany, South Korea and the United States and its implication for India (and other emerging economies). This chapter uses SWOT analysis and Max Weber's ideal types to understand the Industry 4.0 policies of each of these countries. The study further finds that each country has had different positions on public policies, sustainability, human resource development, standards and protocols to influence its competitiveness and create ecosystems for their corporations.

The final chapter is an opinion piece by senior journalist and Chevening scholar Samrat Choudhary, who discusses whether the Covid 19 pandemic is bringing HRM 4.0 closer to all of us at a faster than expected rate. As this book moves

into print many of us all over the world are experiencing the reality of work from home and are tapping into technology for that. At the same time scientists and doctors are frantically working to draw on AI advances at a pace never seen before, for example, sophisticated drones in China are doing a mass surveillance of people and warning them to stay at home. In this chapter, the author looks at some examples of responses to the coronavirus in terms of work practices, at the barriers to adoption of these technologies and their inherent limitations, and at the implications of possible shift to wider adoption of remote work and work from home practices in years to come, for workers, managers, companies and at the broadest level, for industries and countries.

In all this edited volume presents both promise and a high degree of uncertainty. The apocalyptic movies like I-Robot, Blade Runner and the Terminator series have created an image where the world view for the future is such that technology would lead to mass lay-offs, with machines taking over humans and the world as we know it. Some chapters in this book convey that Revolution 4.0 poses a certain risk in terms of continuous employment, organisational competitiveness and country competitiveness. However, overall the theme of this volume is positive, discussing solutions and strategies that will ensure competitiveness of the people, organisations and countries in the 4.0 paradigm shift.

Research has only just begun on what impact the Industrial revolution 4.0 will have on employees and firms. This edited volume covers a whole gamut of interests, from practical effects on people and technology, to a more theoretical approach, to looking back and placing this revolution in a historical context. It is hoped that both researchers and practitioners alike will enjoy reading this and will gain new insights from the chapters written by authors from both emerging economies and developed countries. We thank the reviewers and the publisher for making this edited volume possible.

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Part I

Conceptual and Historical Frameworks

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Chapter 1

Futuristic Organisational Design: The Role of Technological Imperative in Defining the Changing Nature of Structure, Coordination and People Practices

Tomislav Hernaus, Aleša Saša Sitar and Ana Aleksić Mirić

Abstract

Technological development creates technological imperative for organisations. The most recent is dedicated to digital technologies with a strong influence on the way of managing and organising. To gain a better understanding of the latest business practice, the authors use a multilevel perspective and apply the historical analysis method. Specifically, this chapter explores organisational design (OD) of the future through the evolutionary perspective (spanning across the four industrial revolutions) and brings into focus how technological imperatives modified organisational structure, coordination mechanisms and people/job practices. By reflecting on the historical changes in OD practices that happened throughout different phases of industrialisation, the authors analyse how building blocks of digital OD shape managerial and employee behaviours, thus unleashing the performance potential of digital technologies.

Keywords: Organisational design; industrial revolutions; technological imperative; digital organisation; digital technologies; multilevel perspective

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Introduction

Technology – development and application of tools, machines, materials and processes that help in solving human problems (Reisman, 2006) – represents an umbrella term for innumerable advances introduced throughout the history of our civilisation. These developments have made an indelible mark both on society and organisations. Therefore, not surprisingly, technology has been recognised as an important contingency variable determining the level of structure of an organisation (Donaldson, 2001) that is casually prior both to the size of the workforce and organisational structure (see Hickson, Pugh, & Pheysey, 1969). Often boosted through hype cycles, accelerated technological developments create technological imperative (having direct impacts on organisations; see Orlikowski, 1992). The most recent has been dedicated to digital technologies (e.g. social-collaborative technologies, 3D printing and additive manufacturing, artificial intelligence (AI), big data and analytics, blockchain technology, machine learning, robotic process automation, internet of things, etc.).

Digital transformation alters the global economy landscape by introducing new market rules, enabling novel business models and redefining the category of business success. Fast-moving companies, such as *Uber*, *Airbnb* and *Task Rabbit* have already acknowledged this new environmental setting and started to use digital platforms accordingly (see de Reuver, Sorensen, & Basole, 2018), thus making a shift from the traditional (hierarchical) way of managing and organising. Indeed, digital transformation is not so much about technology as it is about transformation of strategy, structure, culture and leadership for choosing the right technology for the right job (Westerman, 2018). Nevertheless, we still do not know whether a digital revolution is just another management fad (e.g. Phillips Carson, Lanier, Carson, & Birkenmeier, 1999), and to what extent organisations are ready for a digital world.

To gain a better understanding of the latest business practice, we use a multilevel perspective and apply the historical analysis method. Specifically, this chapter explores organisational design (OD) of the future through the evolutionary perspective (spanning across the four industrial revolutions) and brings into focus how technological imperatives modified organisational structure, coordination mechanisms and people/job practices. By reflecting on the historical changes in OD practices that happened throughout different phases of industrialisation, we analyse how building blocks of digital OD shape managerial and employee behaviours, thus unleashing the performance potential of digital technologies.

A Multilevel Perspective of Organisational Design

Organisations are multilevel social systems where (1) diverse employees are assigned to various jobs, embedded in multiple dyadic relationships and expected to play diverse team roles; (2) functional and/or cross-functional teams integrate individual efforts and develop intra- and intergroup/unit dynamics; and (3) multiple departments and work processes nested within or spanning across organisational boundaries deliver value through mutual interaction. Therefore, OD is

much more than only the structure of an organisation; it represents the deliberate process of configuring structures, work processes, reward systems and people's practices to create an effective organisation capable of achieving the business strategy (Galbraith, Downey, & Kates, 2002).

Macrostructural design issues targeting system-wide characteristics with a primary focus on organisational structure (i.e. 'the formal reporting relationships that define roles and authority at different levels of the organization'; cf. Worren, 2012) such as grouping and linkage decisions dictate the basic framework within which all other OD decisions are made (Nadler & Tushman, 1997). While a large number of structural variables have been recognised and examined in the literature, we can conceptualise organisational complexity (the level of vertical and horizontal differentiation), formalisation and (de)centralisation as the most relevant dimensions of organisational structure (e.g. Hernaus, Aleksić, & Klindžić, 2013).

Although important, sole or primary focus on organisation level interactions might limit our understanding of the underlying design mechanisms driving organisational life. Effective design and coordination effort at the unit level of the organisation is recognised as being equally relevant for success as macrolevel design practices (e.g. Nadler et al., 1992). In particular, coordination as a design activity is aimed towards connecting individual positions, work units and organisations in a way to ensure fluent and logical integration of differentiated tasks and work processes. The goal of coordination is to achieve the integration of the organisation without, at the same time, losing its necessary differentiation. Different coordination mechanisms might enable integrating organisational activities and contribute to them. Three basic mechanisms of coordination are: (1) direct control (through an authority hierarchy or chain of command); (2) standardisation (inputs, processes and outputs); and (3) direct communication (between managers, and between managers and employees) (Mintzberg, 1992). They can be used interchangeably or simultaneously, which might in general differ across industrial revolutions.

Designing an organisation ultimately involves job or work design – defining the content and organisation of an individual's work tasks, activities, relationships and responsibilities (Parker, 2014). Each job consists of distinctive levels of job characteristics (i.e. job demands and job resources) that shape motivation, work behaviour and emotional and cognitive capabilities of job incumbents (Grant, Fried, & Juillerat, 2010). These job attributes (such as work autonomy, task variety, job complexity, skill variety or task interdependence) strongly define employee motivation and workplace behaviour.

Aforementioned levels of designing are highly intertwined. For instance, as argued by Simon (1996):

> Structure is to break a big purpose or problem into smaller problems and units. The result is a set of tasks that have to be performed. The coordination is managing these smaller problems, units, and tasks into a whole so that they fit together to achieve an overall purpose.

Along the similar line, Burton, Obel, and Håkonsson (2015) described that

> the goal of coordination is to achieve the integration of the organisation without, however, losing its necessary differentiation achieved via organisational unit grouping and task design and bring the units together through choices of adequate coordination mechanisms. (Communications, IT, leadership, culture, incentives, routines and procedures, to name a few)

Obviously, an integrative approach to OD spanning across different levels of analysis is needed and welcome to analyse how organisations operate and create value.

A Brief Overview of Historical Organisational Designs

Historical events have shown that crucial shifts in theory and practice of organisations coincide with industrial revolutions (Kapás, 2008). The industrialisation – a rapid technology-driven transformation in the significance of business operations – started at the end of the eighteenth century. This multiphase process has been accompanied by far-reaching societal, economic and organisational changes.

The first industrial revolution (1800–1875) with the invention of steam engine, cotton spinning and railroads led to a shift from farming to manufacturing society with the establishment of factories characterised by mechanistic design prevailed with functional differentiation (Bodrožić & Adler, 2018), centralised power, exploitation of labour and bad working conditions. Coordination in manufacture production was largely practiced via direct control, and explicitly relied on hierarchical structure of control and formal communication as a way to integrate differentiated tasks. Jobs were rationalised and designed so as to consist of a few routine and manual tasks, at the same time not providing employees with opportunities for discretionary actions and workplace learning. The imbalance in the rights of employees with regard to owners and managers – noted already by Smith (1776) – eventually resulted in setting up first trade unions.

The second industrial revolution (1875–1960) with the development of internal combustion engine and Henry Ford's instalment of assembly line led to mass production, automatisation powered by oil and electricity, growth of organisations in size, job specialisation and technical division of labour. The birth of modern corporations eventually triggered the development of classic theories of organisation and management, which were primarily single focussed on structural and technical aspects of working and organising. Specifically, organisations (still being predominantly functional with centralised power structure, although business divisions were established as decentralised structures in the largest organisations such as *Standard Oil* and *DuPont*) introduced a formal organisational chart and started to use legitimate rules and formal procedures (e.g. administrative management and theory of bureaucracy) to address increased complexity of doing business. Coordination within a multilayered organisation was dominantly

achieved through standards, including standardisation of work processes. Jobs were simplified and depersonalised, routinised and mechanised. High technical division of labour equating workers with machines was justified with efficiency gains achieved. However, employees started to fight for their rights by further unionising themselves. This lack of human-centric design was likewise recognised by scholars and had been addressed through the emergence of behavioural (neo-classic) theories. In other words, motivational and social aspects of human behaviour (e.g. human relations and human resources movement) were recognised as highly relevant for organisational success. Consequently, first personnel departments were established having a primary focus on job analysis (Deadrick & Stone, 2014) and work productivity.

The third industrial revolution (1960–2010) came with the development of mainframe computers, computing, programmable machines and the internet. The growth of service industry resulted in a shift made towards decentralised and fragmented customer-oriented organisational structures (e.g. customer-oriented designs, project and matrix designs and network designs) characterised by greater horizontal coordination. Numerous system-wide theories of organisations evolved (e.g. sociotechnical systems theory, contingency theory, transaction cost theory, resource-dependence theory, population-ecology theory, neo-institutional theory and network theory). Coordination of an increasingly remote and virtual work was achieved mainly through direct (vertical and lateral) communication between members of the organisation. This coordination mechanism was used both in a simple and very complex organisations relying on teams to solve unstructured problems. Teamwork was widely accepted as an effective tool in reducing the degree of red tape and increasing the flexibility of organisational structure models, while at the same time having a positive effect on people's behaviour in organisations, raising the level of employee engagement and fostering a unique corporate culture. Firms increasingly embraced remote work and virtual teams which were able to cross geographical boundaries (Kirkman & Mathieu, 2005). In addition to task interdependence, employees also perceived on average greater levels of other job characteristics such as skill variety and work autonomy (Wegman, Hoffman, Carter, Twenge, & Guenole, 2018). HR departments started to use human resources information systems software for gathering, storing and analysing human resources data (e.g. Ball, 2001).

The evolutionary process of the interplay between technological developments and OD (summary provided in Table 1) offers insights about the change dynamics across time. However, this historical perspective should be further extended to the fourth industrial revolution, as the Industry 4.0 shapes ever more OD decisions across different levels of analysis (i.e. at the organisational, unit and job level).

Organisational Design in the Digital World

Digital organisations function radically differently from industrial-age models; they are designed to operate in real time (Galbraith, 2014) through empowered digital networks, coordinated through culture, information systems and talent

Table 1. Organisational Theories and Design Changes across Industrialisation Phases (1800–2010).

Industrialisation Phase	Technological Development	Multilevel Organisational Design			Organisational Theory
		Organisational Structure	Coordination	People/Jobs	
First industrial revolution	The invention of steam engine lead to a shift from farming to manufacturing society with establishment of factories	Mechanistic organisation design, centralised power	Direct control	Exploitation of labour, bad working conditions	No theory… and later Classic theories of organisation (and management) started to emerge, scientific management (Taylor), administrative management (Fayol), theory of bureaucracy (Weber)
Second industrial revolution	The development of internal combustion engine lead to mass production, automatisation powered by oil and electricity	Technical specialisation, growth of organisations in size, specialisation and technical division of labour, functional and centralised organisation design	Standardisation, automatisation and formalisation	Understanding that motivation, satisfaction and socialisation are important	Behavioural theories such as human relations (Mayo) and human resources (McGregor, Herzberg)