SPRINGER BRIEFS IN ENTREPRENEURSHIP AND INNOVATION

Tuğrul U. Daim
Zahra Faili

# Industry 4.0 Value Roadmap

## Integrating Technology and Market Dynamics for Strategy, Innovation and Operations

Springer

# SpringerBriefs in Entrepreneurship and Innovation



More information about this series at http://www.springer.com/series/11653

Tuğrul U. Daim • Zahra Faili

# Industry 4.0 Value Roadmap

## Integrating Technology and Market Dynamics for Strategy, Innovation and Operations

Springer

Tuğrul U. Daim
Department of Engineering and Technology Management
Portland State University,
Portland, OR, USA

National Research University Higher School of Economics,
Moskva, Russia

Chaoyang University of Technology,
Taichung, Taiwan

Zahra Faili
Technical University of Hamburg
Hamburg, Germany

ISSN 2195-5816 ISSN 2195-5824 (electronic)
SpringerBriefs in Entrepreneurship and Innovation
ISBN 978-3-030-30065-4 ISBN 978-3-030-30066-1 (eBook)
https://doi.org/10.1007/978-3-030-30066-1

# Abstract

Industry 4.0 has been one of the latest concepts which has altered as well as disrupted the business model of organizations around the world. The adoption, however, has been slow in various industries as a clear roadmap for the integration of the same lacks in project planning. Hence, the main purpose of this thesis is to develop a value roadmap for three different industries: Automotive, Healthcare, and Telecommunication so to satisfy the market demand. The value roadmap for these three sectors is developed by taking into consideration five various factors which are market drivers, product features, technology features, enablers, and resources. Finally, these five factors are combined to form the final value roadmap. The roadmap is also segregated into two timelines which are short term and long term. For the evaluation of the value roadmap, views of experts from different organizations have been put into use.

**Keywords** IoT, Value roadmap, Quality function deployment

# Acknowledgments

This work is partially funded by the Basic Research Program of the National Research University Higher School of Economics (HSE) and by the Russian Academic Excellence Project “5-100.”

# Contents

# List of Figures

# List of Tables

# Nomenclature

| | |
|---|---|
| AAR | Audio augmented reality |
| ABS | Anti-lock braking system |
| AFSA | Artificial fish swarm algorithm |
| AH | Authentication header protocol |
| AM | Additive manufacturing |
| ATV | All-terrain vehicle |
| BCM | Body control module |
| BP | Blood pressure |
| C-ART | Connected autonomous road transport |
| CDPD | Cellular digital packet data |
| COPD | Chronic obstructive pulmonary disease |
| CRRM | Cognitive radio resource management |
| CT | Computed tomography |
| DARPA | Defense advanced research projects agency |
| DCF | Discounted cash flow |
| EAP | Extensible authentication protocol |
| ECG | Electrocardiogram |
| EDA | Electrodermal activity |
| EGR | Exhaust gas recirculation |
| EMG | Electromyogram |
| ENEC | Emerson network energy center |
| EPS | Evolved Packet System |
| ESC | Electronic stability control |
| ESP | Encapsulated security payload |
| EWOD | Electrowetting on dielectric |
| FCD | Floating car data |
| FHRP | First hop redundancy protocol |
| FRN | Fixed relay node |
| GDP | Gross domestic product |
| GMR | Giant magnetoresistance |

| | |
|---|---|
| HCP | Health care professional |
| HetNet | Heteregeneous network |
| HMD | Head mounted display |
| HR | Heart rate |
| IC | Integrated circuits |
| IC engine | Internal combustion |
| ICT | Information and communications technologies |
| IEA | International Energy Agency |
| IoT | Internet of Things |
| IPComp | IP payload compression protocol |
| ITS | Intelligent Transport Systems |
| LED | Light-emitting diode |
| Li-Fi | Light fidelity |
| LiPF6 | Lithium hexafluorophosphate |
| LOS | Line of sight |
| LTE | Long-term evaluation |
| MCM | Mass customization manufacturing |
| MIMO | Multiple-in, Multiple-out |
| MODV | Modular vehicle |
| MRI | Magnetic resonance imaging |
| MRN | Moving relay node |
| NAC | Network access control |
| NLPRS | Network layer packet redundancy scheme |
| NPV | Net present value |
| NTP | Non-thermal plasma |
| OECD | Organization for Economic Co-operation and Development |
| OEM | Original equipment manufacturer |
| PAN | Polyacrylonitrile |
| PHEV | Plug-in hybrid electric vehicle |
| PM | Predictive maintenance |
| PMR | Professional mobile radio |
| PRP | Parallel redundancy protocol |
| PSS | Public safety and security |
| QFD | Quality function deployment |
| QoE | Quality of Experiences |
| R&D | Research and Development |
| RAN | Radio access network |
| RC | Redundancy controller |
| RHMAS | Remote health monitoring and alert system |
| RMBI | Remote machine–brain interface |
| RRM | Radio resource management |
| RTC | Road traffic crashes |
| S&T | Science and Technology |
| SCR | Selected catalytic reduction |
| SPA | Scalable product architecture |

| | |
|---|---|
| TRM | Technology roadmapping |
| VAD | Virtual auditory display |
| VANET | Vehicular ad hoc network |
| VBTO | Virtual-build-to-order |
| VoIP | Voice over Internet Protocol |
| VRM | Value roadmapping |
| WAP | Wireless access points |
| WAVE | Wireless access in vehicular environment |
| WBAN | Wireless body area network |
| WBSN | Wireless body sensor network |
| WDM | Wavelength division multiplexing |
| WEP | Wireless equivalent privacy |
| WSN | Wireless sensor network |