

Peter Granig
Erich Hartlieb
Bernhard Heiden *Hrsg.*

Mit Innovations- management zu Industrie 4.0

Grundlagen, Strategien,
Erfolgsfaktoren und Praxisbeispiele

 Springer Gabler

Herausgeber
Peter Granig
FH Kärnten
Feldkirchen in Kärnten, Österreich

Bernhard Heiden
FH Kärnten
Villach, Österreich

Erich Hartlieb
FH Kärnten
Villach, Österreich

ISBN 978-3-658-11666-8 ISBN 978-3-658-11667-5 (eBook)
<https://doi.org/10.1007/978-3-658-11667-5>

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

Springer Gabler

© Springer Fachmedien Wiesbaden GmbH, ein Teil von Springer Nature 2018

Das Werk einschließlich aller seiner Teile ist urheberrechtlich geschützt. Jede Verwertung, die nicht ausdrücklich vom Urheberrechtsgesetz zugelassen ist, bedarf der vorherigen Zustimmung des Verlags. Das gilt insbesondere für Vervielfältigungen, Bearbeitungen, Übersetzungen, Mikroverfilmungen und die Einspeicherung und Verarbeitung in elektronischen Systemen.

Die Wiedergabe von Gebrauchsnamen, Handelsnamen, Warenbezeichnungen usw. in diesem Werk berechtigt auch ohne besondere Kennzeichnung nicht zu der Annahme, dass solche Namen im Sinne der Warenzeichen- und Markenschutz-Gesetzgebung als frei zu betrachten wären und daher von jedermann benutzt werden dürften.

Der Verlag, die Autoren und die Herausgeber gehen davon aus, dass die Angaben und Informationen in diesem Werk zum Zeitpunkt der Veröffentlichung vollständig und korrekt sind. Weder der Verlag noch die Autoren oder die Herausgeber übernehmen, ausdrücklich oder implizit, Gewähr für den Inhalt des Werkes, etwaige Fehler oder Äußerungen. Der Verlag bleibt im Hinblick auf geografische Zuordnungen und Gebietsbezeichnungen in veröffentlichten Karten und Institutionsadressen neutral.

Gedruckt auf säurefreiem und chlorfrei gebleichtem Papier

Springer Gabler ist ein Imprint der eingetragenen Gesellschaft Springer Fachmedien Wiesbaden GmbH und ist ein Teil von Springer Nature
Die Anschrift der Gesellschaft ist: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

Laying the Foundation of Industry 4.0 by Forward-Looking Planning of Innovation

13

Huafeng's Haptic—a Selective Additive 3D Coating Technology for Sport Shoes

Thomas W. Schmidt, Li Chuan Lillian Tseng and Christina Rothenhaeusler

13.1 Current Business Model in Sport Shoe Industry

Today the global supply chain for sport shoes operates mainly in a linear business model (Fig. 13.1) with suppliers located all over the world. Traditionally the supply chain is structured in TIER-1, TIER-2 and TIER-3 suppliers. The international sport brands operate mainly as marketing companies within that environment identifying trends, creating designs and selling their shoes either directly or indirectly via retailers. The market demands are transferred to the shoe factories (TIER-1)—mainly OEM manufacturers exclusively linked to one of the sport brands -who do the final development, commercialization and production in close cooperation with the brands. Although the brands also foster links to materials suppliers (TIER-2) or raw material suppliers (TIER-3) usually the link to TIER-1 is clearly dominating the business by exclusive partnerships and long term commitments.

The TIER-1 shoe factories have to coordinate purchasing of multiple materials in full range of colors and color combinations, cutting them to size, stitching the patterns together and finally assembling the shoes by bonding sole and upper together. A typical upper component consists of three to ten different materials supplied by different TIER-2 suppliers. All quantities and delivery times have to be coordinated well meeting ever shorter lead time requirements in shoe manufacturing. This is a task, which can be hardly achieved, according to modern market requirements.

T. W. Schmidt (✉) · L. C. L. Tseng · C. Rothenhaeusler
Putian, China
E-Mail: thomas.schmidt@huafeng-cn.com

© Springer Fachmedien Wiesbaden GmbH, ein Teil von Springer Nature 2018
P. Granig et al. (Hrsg.), *Mit Innovationsmanagement zu Industrie 4.0*,
https://doi.org/10.1007/978-3-658-11667-5_13

165

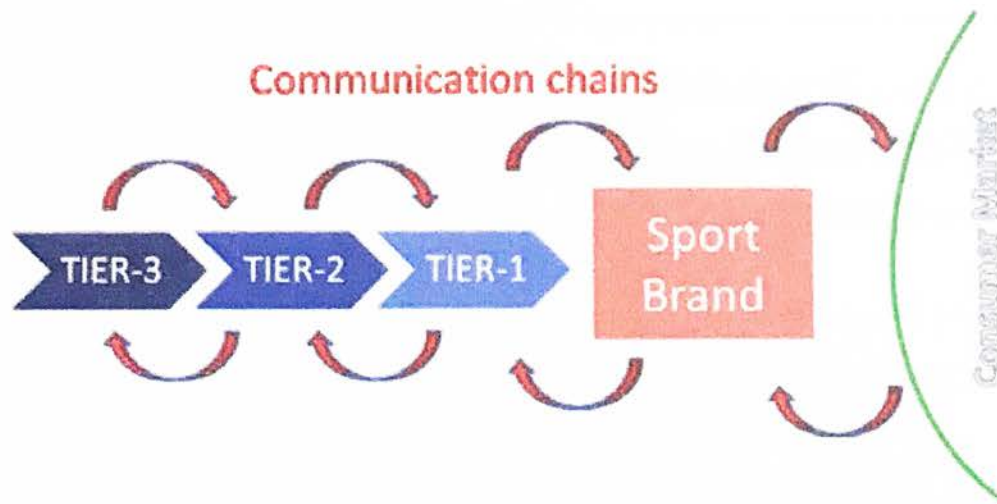


Fig. 13.1 Communication chains in a linear business environment

In the past and up to now China is playing the strongest role in the supply chain of upper textiles and finished shoes. However, there is market pressure either moving to more advanced and less labor intensive manufacturing technologies or moving out of China into countries with lower labor costs. If Chinese companies want to keep their dominating manufacturing positions and western sports brands want to continue utilizing the advantages of manufacturing in China, new technologies and new business models are needed to adjust to modern market demands. Quality, speed-to-market and flexibility are the new driving forces business has to face to satisfy ever changing consumer needs. Innovation is required!

13.2 Changing the Business Model Preparing for Industry 4.0

Innovation enabling Industry 4.0 is not only needed in technology. First, innovative business models need to be created allowing modern technologies to unfold their full advantages. Huafeng, as a typical Chinese TIER-2 textile supplier to sport shoe industry, has started this transformation by creating a new business model of component manufacturing by their new haptic selective additive 3D coating technology (Schmidt and Fang 2016). Component manufacturing and supply are hence in the innovative direction now. Instead of rolls of textile material ready-to-assemble components are supplied to shoe factories. However, by doing so the supply chain is changing and new communication channels are needed. Materializing the advantages of the new organizational structure, footwear upper component manufacturing allows full accountability on quality, maximum speed-to-market, highest efficiency and easy management of the supply chain for the sports brand. Haptic upper components are now replacing the complicated production process of uppers in traditional TIER-1 factories. The result is a very lean manufacturing process in the new TIER-1 facility. Huafeng as a textile supplier integrated forward into the manufacturing chain by haptic technology. There are still rolls of textile

material, but the materials will already be cut into pieces at the textile supplier for the following haptic application process. By screen printing technology a selective additive 3D multi-layer coating is applied creating the whole upper design of the sport shoe already at the component manufacturer. The same is true for component manufacturing, here the traditional TIER-2 moves somewhere in a position between TIER-1 and TIER-2, with regard to manufacturing, and even more important, somewhere in between sport brand and TIER-1 for developing designs. The lines of communication and the way of cooperation are changed. The whole business merges together in an intensive communication network. No additional materials need to be purchased and added at the TIER-1 factory. Sewing work is minimized to tongue fixation and insertion of lining at the shoe factory. The component manufacturing materializes maximum efficiency when communication between brand and component manufacturer are optimized and new direct links between brand and textile supplier (formerly the TIER-2 position) are build up. Fig. 13.2 summarizes the advantages of the component manufacturing business model.

In fact the business environment is getting prepared for Industry 4.0 needs to change communication channels and the way the supply chain is cooperating. Instead of traditional linear supplier/buyer relationships strong partnerships are required with multiple functionalities sorted in a different non-linear business set-up. Operating systems need to be adjusted to a complex communication between all different supply partners. Upstream supply partners need to have much more detailed information about market demand and requirements. They need to establish direct communication with product design and marketing departments of the brand and need to feel the consumer need as close as the brand. The flexibility of adjusting quickly to ever changing market needs and trends can only be provided by a complex network of communication channels between all involved partners.

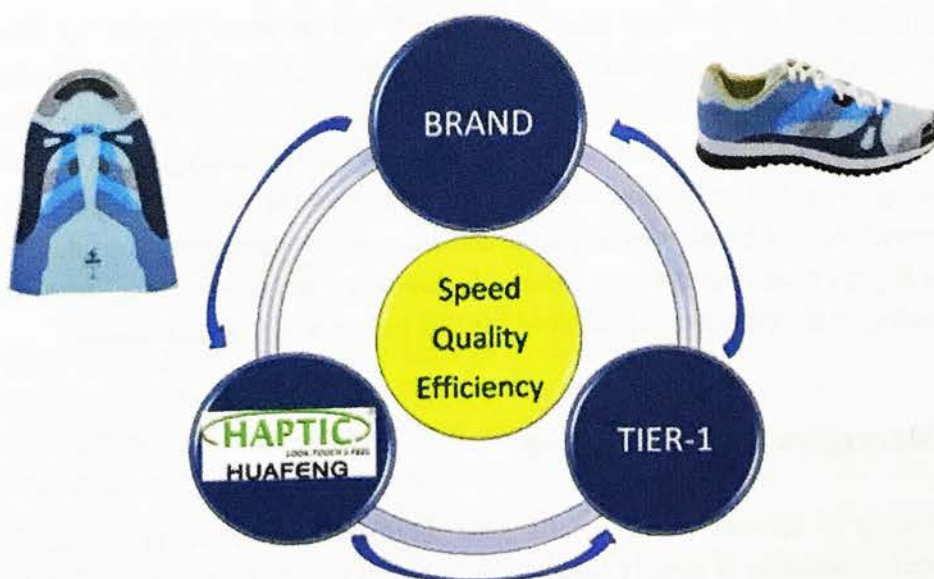
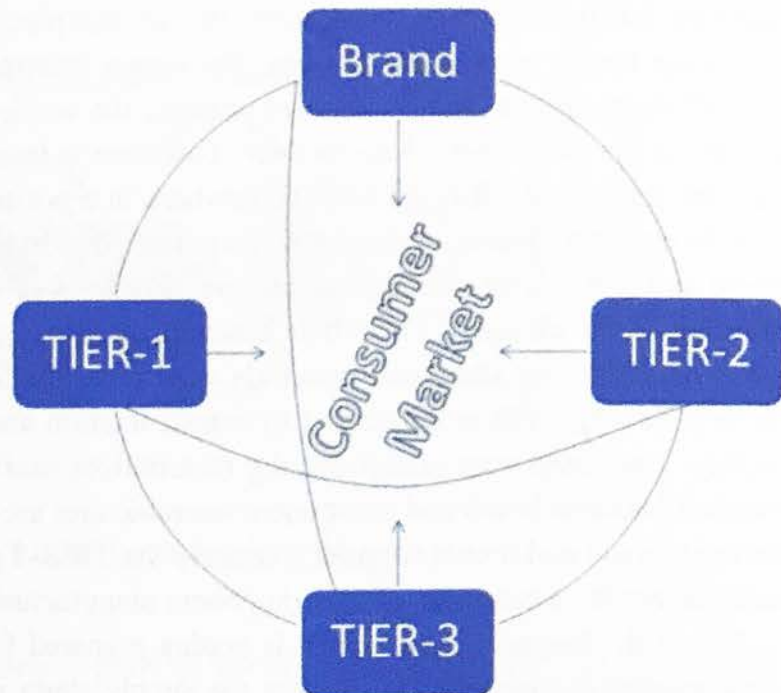


Fig. 13.2 Advantages of component manufacturing

Fig. 13.3 Non-linear business model for Industry 4.0



The non-linear business model Fig. 13.3 satisfies and captures the consumer markets by a network of communication channels, providing flexibility and resilience at the highest level. Non-linear business models are the base for successful Industry 4.0 operation. Once the business model is defined, the new Industry 4.0 supply chain can be set up with innovative technologies described in the next chapter.

13.3 Changing Technology for Industry 4.0

Digital technology is the obvious need for Industry 4.0 projects. Haptic 3D coatings and component manufacturing have laid a foundation at Huafeng to move to the next level of integration in the supply chain by digital manufacturing. Although today modified manual and automatic screen printing methods are utilized for haptic coatings, the business model allows moving to digital technology easily, when ready in the innovation process. Already at a very early stage of haptic development the innovation strategies were developed how to move to digital manufacturing in future. Today there are several long term innovation projects in Huafeng's pipeline, which could fulfill Industry 4.0 requirements:

13.3.1 Decorative Digital Printing

Digital printing of textiles is not totally new anymore. However, in the textile supply chain, digital decoration is mainly done on very small quantity batches, either for sample preparation, small quantity manufacturing of special products or for very individual shoes in piece flow one situations. The focus in most applications is the graphic design

of the resulting products. If industry should be changed to Industry 4.0, there is still a huge need to bring digital printing to the next level of customized and flexible mass manufacturing. Technology for high speed inkjet printing is more and more reliable and several machine manufacturers offer solutions today. However, investment in printing machines is not the only issue to be fixed for materializing all the advantages of a digital Industry 4.0 business. The missing link between manufacturers/digital printing companies and brand/consumers seems to be the communication and the logistic channels between them. For a fully developed digital business, new tools for color management, large data transfer, new sales tools, new thinking at the design level and finally very skilled employees are required. For the consumer it has to be convenient to get the industry 4.0 products. Not everybody wants to design his/her shoes totally individual. Most consumers like a huge choice of design options instead of actually designing their own shoe. So it is all about creating online shops for products selection and guiding the consumers in a world of overwhelming design options. At the same time investing into state-of-the-art high speed digital printing machines is required. And finally a strong effort needs to be spent on creating a huge lot of designs options. All these activities need to be connected and synchronized across the non-linear supply chain. Actually the design is getting a more and more dominating role in these business models, where everything can be done quickly and flexible at small quantities. The effort and the cost of design may, in the worst case, end up being higher than that of the actual manufacturing cost.

Huafeng's Haptic could be one module of digital manufacturing. All haptic components could be manufactured in white color, white base mesh and white haptic coatings providing 3D effects, touch and gloss effects. These white components could be manufactured in more traditional mass production processes and then kept on stock close to consumer markets. Whenever consumers decide on design and color, newly developed digital printing machines, including special picture software and specially developed printing inks, could print the final decoration on top of the white mesh and white haptic coating finalizing the product. Such type of printing machines could be installed anywhere in the world close to consumer markets, but could also run customized mass production in Chinese factory environment.

13.3.2 Digital 3D Printing

Today haptic coatings are made by a kind of analog 3D additive manufacturing process, applying screen printing technology. The future generation of haptic coatings could possibly be printed by fully automatic digital 3D printing machines. Once this technology can offer the right materials to replace haptic coatings on shoes, the digital manufacturing of haptic components could be implemented. That would allow all the advantages of digital business models like small batch size flexible manufacturing and individual designs as well. In the same fashion as described above, the matching communication channels and networks need to be build up and designs need to drive the consumer excitement.

For all interconnected digital manufacturing networks two main challenges appear and need to be overcome to materialize Industry 4.0 advantages:

- (a) Internet quality and speed of data transfer has to be ensured for all partners and locations within the non-linear business model. Countries providing best internet infrastructure, will have a clear business advantage.
- (b) Data security and reliability has to be ensured within the non-linear business partner network.

The foundation of suitable business models and digital technologies lay the foundation for Industry 4.0 projects. The soft side of the business will be the remaining success factor being addressed in the next chapter.

13.4 Changing the Way We Interact

The biggest challenge to Industry 4.0 business networks is probably the new way we interact between all network partners. A simple supplier/buyer relationship will not exist anymore. Everybody will be connected to everybody in non-linear ways hard to control in all details. Data transfer and communication will open up and become more transparent. New ways of cooperation and different mind sets will be needed to work in Industry 4.0. If we want to enjoy full benefit of Industry 4.0 we should not get stucked by technology investment and setting up high-tech equipment only. We need to think about how to make it work for mutual benefit. How can we take maximum benefit out of these technologies for everybody involved? We need to change our mind set and we need to change the way we define our roles and responsibilities. In business a lot comes down to how we share profits in a non-linear Industry 4.0 network. A fully interconnected Industry 4.0 network is something like a superorganism. Superorganisms are made out of many single specialized individuals. The individual on its own cannot survive. Only if all individuals join together and fully align to the same goals, a fully operational superorganism can exist. You can see a human body as a superorganism, with all the specialized cells in various organs doing their job and being connected by nerves and blood. Only if all cells work closely together the human being can stay alive—the overall goal. The same applies for ant colonies. Ants actually exist already 400 millions of years on our planet, by the way much longer than human beings, and they have developed amazing social skills during that time. They act as eusocial superorganism (Hölldobler and Wilson 2010). It is a good model for how Industry 4.0 could work.

The new style of cooperation will be a sharing economy. Everything will be more transparent. Data will be exchanged quickly and continuously between different entities. We need high speed links and networks, where we can trust that the data are correct, safe and used in the best way to support our superorganism and not to cannibalize it. This needs the trust that profits are shared in a reasonable way and everybody, within that superorganism,

benefits for the better of the whole organism, without any egoistic extremists taking all the profits. We can see that some of these mind set changes are happening in society already. People get linked to each other by WhatsApp, WeChat and other social platforms. They exchange data about their live all the time. They get transparent to their groups. We see the Wikileaks and other media release information which was considered highly confidential in the past. Data storage and exchange also leads to disclosure of data and makes our world more transparent. In many cases this is for the better. How we handle that new transparency is up to us. We have to learn how to deal with the newly gained transparency in Industry 4.0 environments. There are many benefits for the superorganism, if we stay tolerant to each other, cooperating well and nobody is taking advantage on the cost of others. There is, on the other hand, also a big risk that data will be used to dominate others. If that happened, Industry 4.0 would fail. So it has to be taken care, that a “self regulation” takes place in that sense, that self-responsibility is focused on. Especially for this (e.g. data) transparency will be increasingly important for fair interaction between partners.

References

- Hölldobler B & E Wilson (2010) *Der Superorganismus*. Springer Spektrum Verlag, ISBN 978-3-540-93766-1, Berlin Heidelberg
- Schmidt T W & V Z Fang (2016) *Haptic—a new additive manufacturing technology*. Research Publishing, ISSN:2424-8967: https://doi.org/10.3850/2424-8967_v02-3251, Singapore



Dr. Thomas W. Schmidt
Director of Innovation & Creation, Huafeng

Dr. Thomas Schmidt, born 21.09.1967, is Director of Innovation & Creation at Huafeng, based in Putian, China. He has a strong scientific background in chemistry and material science. His PhD degree was granted from the University of Wuerzburg for applied nanotechnology research in cooperation with the Fraunhofer Institute ISC and Siemens AG. His scientific work includes a PostDoc at the University of Durham, UK working on thin layer photovoltaic solar cells. Following was an international industrial career, developed by assignments with Adidas in China, working on social and environmental affairs and later joining TIGER Coatings in Austria, where he was leading the R&D and innovation team for many years. Since 2014 he joined Huafeng, a Chinese textile manufacturer, supplying the global sport industry. Shaping the change of Chinese sport textile industry from contract mass manufacturing to creative innovation and high tech manufacturing motivates and provides plentiful opportunities.

**Li Chuan Lillian Tseng****Supply Chain CSR & Sustainability, ASICS Corporation**

Li Chuan Lillian Tseng, born on 10th March 1964, is a Regional Manager of the Supply Chain CSR & Sustainability at ASICS Corporation, based in Kobe, Japan. She is leading supply chain CSR in a globalization position; develop global strategy, introduce industry's best practices and competency to promote suppliers' compliance management system; engaged stakeholders' expectations to build a collaborate partnership. She holds PhD Candidate in Graduate Institute of Management at National Taiwan University of Science and Technology (NTUST), and Master in Industrial Engineering & Management at NTUST. Her strong experiences includes Industrial Management; Manufacturing Operation and Management; CSR Compliance & Auditing; CSR Management System and Capacity Building; Safety and Environmental Accounting Management; Environmental Assessment; Sustainable Supply Chain Management, Materiality Analysis, Social and Environmental Life Cycle Analysis;

Lillian used to work at Adidas Group from 1998 to 2012. Starting as an Apparel Technician she moved on to the Social & Environmental Affairs (SEA) team as a Compliance Auditor covering Tier 1 factories in Taiwan, Japan, South Korea and the Philippines and conducted more than 1000 factories audit within 14 years. 2006 she accepted responsibility as Area Manager for the North China SEA and moved to Shanghai. During her tenure with the Adidas Group, she developed energy savings program in China; environmental management accounting program in the Philippines; CSR and Lean system synergy project in China, supported migrant worker projects in Japan, Korea and Taiwan, instrumentally setting up the KPI improvement program for Japanese vendors in China. She has a strong technical background in Industry Engineering and Management, and leading team work excellently. Her manufacturing and industrial experiences have been involved in fields of textile, apparel, footwear, accessory and gears, golf and IT industry.



Dr. Christina Rothenhäusler
Innovation & Creation, Huafeng

Christina Rothenhäusler, born 1st June 1963, is a specialist on scientific outdoor activities; while on expeditions from Polar Circle to Great Rift Valley in Africa and to many countries in Asia she is sampling on mineralogical, biological and aquatic systems.

Her love for close look at mother nature is merging perfectly with her academic background in Crystallography and Inorganic Structural Chemistry.

She studied Chemistry at FU-Berlin, Germany and holds a PhD in Material Sciences/Inorganic Chemistry from University of Wuerzburg, Germany.

Living 5 years in PR China she has gained profound insight of industrial and urban development and is connecting cultures and people.

Mit Innovationsmanagement zu Industrie 4.0

Dieses Buch bietet einen breiten Querschnitt und Überblick über Industrie 4.0 sowie seine derzeit gelebte Praxis auf einer internationalisierten Ebene.

Dazu beschreiben renommierte Experten den Beitrag von Innovationsmanagement sowie die Grundlagen und Prinzipien von Industrie 4.0. Sie gehen dabei aus unterschiedlichen wissenschaftlichen und technischen Fachdisziplinen interdisziplinär auf theoretisch relevante Aspekte ein. Anschließend werden die gesellschaftlichen und personellen Auswirkungen der sich verändernden Arbeitsbedingungen beleuchtet, unter der Berücksichtigung der Auflösung interkultureller Grenzen im Zuge einer zunehmenden Globalisierung. Schließlich geben Praxisbeispiele für Industrie-4.0-Anwendungen im Bereich neuer Geschäftsmodelle, innovativer Technologien, der Prozesssimulation sowie der Logistik Einblick in den aktuellen Stand von Industrie 4.0 in der Praxis.

Der Inhalt

- Beitrag von Innovationsmanagement zur Entwicklung von Industrie 4.0
- Grundlagen und Prinzipien von Industrie 4.0
- Auswirkungen von Industrie 4.0 auf die Arbeitswelt der Zukunft
- Anwendungsbeispiele von Industrie 4.0

Die Herausgeber

Dr. Peter Granig ist seit 2016 Rektor der Fachhochschule Kärnten, war zuvor seit 2014 Vizerektor der Fachhochschule Kärnten und ist seit 2005 Professor für Betriebswirtschaft und Innovationsmanagement an der FH Kärnten.

Dr. Erich Hartlieb ist seit 2009 Professor für Innovations- und Technologiemanagement an der FH Kärnten und leitet seit 2013 den Studiengang Wirtschaftsingenieurwesen.

Dr. Bernhard Heiden ist Fachprofessor für Produktionstechnik und leitet das Smart Lab Carinthia der FH Kärnten.

ISBN 978-3-658-11666-8

