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Front Pages

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Editorial and Reviewers' Board

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The current issue is the fourth of the seventh volume of the *Athens Journal of Business & Economics (AJBE), published by the Business & Law Division and the Economics Unit of ATINER.*

Gregory T. Papanikos
President
ATINER

Athens Institute for Education and Research

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Important Dates

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- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **1 June 2021**

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Important Dates

- Abstract Submission: **4 October 2021**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **4 April 2022**

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Crafting a Confucian Culture in Chinese Corporations: A Case Study of Guangzhou Borche

By Saiyu Gu[*] and Haowen Liu[±]

Corporate culture is an important source of enterprise's soft power. Confucianism, which has been regarded as official teaching over a thousand years, manifests its profound values in modern management and is adopted by a number of private companies in China. This paper employs a case study method, concentrating on the development of Borche - a private enterprise in Guangzhou. Data and other information were collected from interviews, open reports and historical records and got ensured by triangulation verification. It seeks to explain how the Confucianism got internalized as part of a corporate culture and serves us its management guideline. The result demonstrates that the internalization of Confucian values in a corporation will go through three stages: cultural identity, identity strengthening and spontaneous order. Confucianism's corporate culture is reflected in four aspects: of spirit, institution, behavior, and matter. The cultural infiltration mechanism is thus created.

Keywords: *corporate culture, Confucianism, cultural internalization mechanism, culture evolution*

Introduction

Corporate culture is deeply rooted in its social context thus traditional belief is, in fact, the cornerstone for most companies. For example, the culture of Western companies has long been influenced by religious elements such as the Christian teaching. While encouraging freedom, independence and innovation, they are also constrained by values including integrity, honesty and equality. Although Chinese enterprises are now open to the ideas of modern management, there is no comparable attempt of incorporating its traditions into organizational culture. Many companies now turn to Confucian, Buddhism and Taoism whilst the culture construction is still influenced by path dependence that makes the process superficial and even deviates from the core traditional values.

Scholars are increasingly advocating building corporate cultures with Chinese cultural characteristics. However, most of the existing researches focus on describing the factors that influence corporate culture, and less on the dynamic process of cultural internalization. To explore the evolution and internalization of Confucian values in a corporation, this research employs the case study method, taking a medium-sized private enterprise -Guangzhou Borche- as a subject and builds a three-stage corporate cultural evolution

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model and explores the cultural evolution process.

Literature Review

Corporate Culture Construction and Evolution Mechanism

Conbere and Heorhiadi (2006) proposed the general evolution path. He believes that organizational culture is composed of four layers of intersecting and independent systems, ideas, personality, and background. These four factors interact and accelerate the development of organizational culture. His research recognizes the corporate culture as a dynamic process for the first time. Hofstede et al. (1990) attributes the evolution of corporate culture to values, rituals, heroes, and symbols. This theory describes cultural evolution as an "Onion Model" which successfully explained multiple cases of corporate culture establishment. Ellinas et al. (2017) introduces an empirically-grounded, agent-based model which relaxes a set of assumptions that describes past work –(a) omittance of an individual's strive for achieving cognitive coherence (b) limited integration of important contextual factors– by utilizing networks of beliefs and incorporating social rank into the dynamics.

This article mainly agrees with Sackmann (1997) that corporate culture is a complex, spontaneous and changing system. This system manifests itself as a self-organizing process in enterprises. The transformation of corporate culture is realized through the internal and external information. At the same time, the organizational culture has different characteristics at each stage within its life cycle (Cheng 2007), information flows through the change of different stage.

Chinese scholars also have some conspicuous findings on the evolution path of corporate culture. Xin and Xu (2004) use an existing scaling system and questionnaires and organize group discussions to study the structure of Chinese state-owned enterprise (SOE) culture. They have identified ten dimensions of SOE culture. Moreover, Wang (2015) chooses the four most representative enterprise culture construction cases from 50 candidate enterprises and conducts the research by using the method of business anthropology. He constructs theory model on the basis of analyzing the first hand data collected using NVio.10 and ATLAS.TI two qualitative analysis software.

Confucian Values and Corporate Culture

Confucian ethics is basically humanistic, obligation, and collectivistic in nature (Ip 2009). Confucianism believes that people are supposed to be self-motivated through morality. In the enterprise management, the oriental values emphasize achieving management goals through moral construction instead of mandatory regulation (Nadkarni and Barr 2008). Chinese enterprises mainly concentrate on the core elements of Confucianism and leave out secondary qualities or peripheral features. In Japan, companies absorbed the Confucian "harmony" culture and created a "lifetime employment system". In Korea, companies advocate "diligence" so that employees are dutiful in their work. Hofstede and Bond (1988) added a fifth dimension to the original four dimensions

of national cultural characteristics: Confucian dynamics. East and Southeast Asian countries score higher on the fifth dimension, which explains the relationship between cultural characteristics and business development.

In conclusion, Chines scholars' research on Confucian culture and corporate culture mostly focuses on the mutual influence factors and common characteristics of the two, and less on the role of culture in enterprises; while western scholars' research on Confucian culture is mainly carried out from the social level, rarely involving individual units and separating from the corporate characteristics of China. Therefore, this article attempts to explore the evolutionary path of corporate culture by combining the evolution of corporate culture with the development cycle of the enterprise. At the same time, it explores case studies and researches on local private enterprise management innovation practices with Confucian culture as the main corporate culture.

Methodology

Sample Selection

As a qualitative research, this paper selects Borche as our sample and the research design is in line with the principle of typicality and reproducibility (Eisenhardt and Graebner 2007).

Firstly, *Guangzhou Borche Machinery Co., Ltd.* is a tech firm focusing on high-precise and eco-friendly molding machines. Since it established, Borche has been continuously explored innovative management methods and introduced traditional culture to provide guidance for development at its early stage. Borche is a typical case that realized the merge of Confucianism culture and modern management. Next, Borche's development is accompanied by the Chinese economic reform. Its export business enables Borche to get exposed to the global market as well as the management skills, insights, and cultures in western corporations. It is a very typical sample for most medium-sized companies in Guangzhou province where private enterprises take a large proportion in the local economy and high-tech enterprises are concentrated. Therefore, the case study is representative and repeatable in an academic sense.

Data Sources

The data derives from interviews and secondary sources. In August 2018, we interviewed the chairman, high-level managers, and general associates. Interviews were conducted in group chat and dialogue interviews (one-on-one), and the information is recorded and reorganized into texts. Table 1 summarizes the data collection.

Table 1. *Data Sources*

Data type	Source
Interviews	Interview time: 2018.8.17 1. Chairman of Borche: 1 hour and 45 minutes 2. Chairman, sales manager, technology manager, etc. (six informants): 1 hour 9 minutes and 27 seconds 3. Senior manager of operation department: 10 min 44 seconds (more than 30,000 words)
Secondary data	1. Official website of Borche 2. Newspaper 3. Official accounts of Borche on Wechat (more than 70,000 words)

Results

The Cultural Internalization Mechanism

This article applies the inductive method and divides the evolutionary process of Confucianism within a corporation into three stages: cultural identity, identity strengthening, and spontaneous order. To verify the influence of Confucianism on corporate management and test the validity of the qualitative research, this article uses trigonometric verification (Yin 2013) that introduces three sources of evidence: factual evidence (events in corporate culture construction practice), textual evidence (official data) and verbal evidence (from interviews). We use Nvivo 11 to encode and analyze these evidences and exhibit the internalization mechanism of Confucianism at each stage.

Cultural Identity

It is normal that employees and leaders to have distinct views. So exploring cultural consistency is imperative for Chinese enterprises. Confucian culture is deeply rooted in Chinese society. It plays a role in evaluating and regulating external behavior (Cheng 2014). People have been exposed to Confucian ethical teachings (e.g., filial piety, integrity and gratitude) for a long time. Borche has selected traditional principles that fit for its real situation to build its corporate culture and has also referred to Inamori Kazuo's management philosophy.

Confucianism is a humanistic philosophy that could complement the scientific management theory. Its implications for business management are: people-centered moral-oriented and behaving oneself to manage others (Liu 2006). As for Borche, in its early stages of cultural construction, there was a set mechanism for the management and employees to interact effectively. Cultural identity was reflected in both psychological and behavioral respects: for one, according to Confucian humanism, Borche began to attach importance to employees' thoughts and improve employees' occupation accomplishment. The evidence such as A1 and B1 in Table 2 shows that Borche tries to arouse the employees' conscience, integrity, filial piety and so forth. For another, only with the help of sincerity, one would be able to rectify one's heart (zheng xin), and only this way man would be

able to practice self-cultivation (xiu shen). Once cultivated, the own family was brought to unison (jia qi), and only with families in unison a state could be governed (zhi guo) in the right way. If all this were achieved, there would be a harmony human relationship in the world (tianxia ping). Pieces of evidence such as A2 and B2 show that employees will take the initiative to receive cultural education. Above all, this paper proposes the proposition I:

Proposition I: In the first stage, employees and the company work together as a community of common interests. The company introduces Confucian culture to stimulate employees' cultural identity (sincerity), and employees who have a sense of self-cultivation link their development goals with the enterprise's goals, and the two sides then develop into a community of common goals.

Table 2. *Evidence of Cultural Identity Stage*

Stage	Evidence	Classification
Cultural Identity	**Factual evidence (A):** A1: The chairman and other senior managers are adhering to the traditional values and have joined a Confucianism community in Beijing. A2: The company has organized a cultural training program to make junior employees recognize the enterprise value and improve their works.	1)Rectify one's heart & accomplish sincerity (A1, B1, B3, C1) 2)Practice self-cultivation & bring family in unison (A2, B2, B4, C2) Community of common interests -- Community of common goals
	Textual evidence (B): B1: "Just entered Bo Chuang, I received cultural education". B2: "Since the company has promoted the study of traditional culture, many employees regard Disciple Regulation as a mirror and constantly regulate their own words and deeds". B3: "Principles of heaven and conscience are the same in essence". B4: **v**Put down the ego and think for others".	
	Verbal evidence (C): C1: "What is known without thinking is the innate knowledge of goodness". C2: "There is no one outside the ethical relationship".	

Source: field interview, August 2018.

Identity Strengthening

In order to develop continuously, enterprises will take further measures to transform employees' cultural identity into a substantial and practical system. In this way, enterprises could utilize soft power to affect an employee's performance.

Confucianism believes that everyone has an inner conscience and can be stimulated to contribute to social goods. Yet it also admits that everyone has shortcomings. The modern business management functions as a supplementary part of moral governance. The evidence such as B5 and B8 in Table 3 show that Borche manages to optimize resource allocation, coordinate their own interests and supervise

employees' behaviors to satisfy the Confucian value in a material aspect. At the same time, Confucianism values human agency and believes that the evil thought could be purified and follow the virtues after education. With moral education in enterprise management, employees will "make products with conscience and services with sincerity and love" (evidence B6 and C3). At this stage, the enterprise continuously strengthens the ideas of benevolence, goodwill and altruism. Employees accept these ideas and apply them to their work that reflects in the improvement of production and business operation. Both employees and employers are interconnected and prosperous. Now we have the second proposition:

Proposition II: In the second stage of cultural infiltration, enterprises strengthen cultural construction through external intervention (learning for practice), employees take the initiative to improve their work (goodwill and altruism); they now become a community of shared future.

Table 3. *Evidence of Identity Strengthening Stage*

Stage	Evidence	Classification
Identity Strengthening	**Factual evidence (A):** A3: Borche set up classes to learn the idea of "attaining liangzhi" and has daily departmental meetings to learn traditional culture. A4: What man knew by instinct was liangzhi (knowledge of goodness).	(3)learning for practice (A3, B5, B7, B8) (4)goodwill and altruism (A4, B6, C3, C4) community of common goals - community of shared future
	Textual evidence (B): B5: "The company tries its best to gather all resources and take all the staff into consideration". B6: "The meaning of work is to bring products to life". B7: Borche is not only a manufacturing plant for injection molding machines, but also a training school for shaping healthy personality". B8: "Leaders themselves should adhere to the traditional culture, but also guide, motivate and drive each member of the team to achieve the goal effectively".	
	Verbal evidence (C): C3: "Be kind to others is the basic requirement for service personal". C4: "Life will be happier by incorporating refined ideas into life and work".	

Source: field interview, August 2018.

Spontaneous Order

Confucianism also involved discussion of human nature and people could be easily influenced by the environment. The management thought embodied in Confucian culture is the most abundant about human nature. Mencius's "the Goodness of Human Nature" is similar to the "Theory Y" in modern management. They all admit that the nature of human nature is pure and good, and the highest realm of management is that the driving force of business development comes from people's value pursuits. In other words, employees conceive the enterprise's mission as their own task.

For both company and employees, sticking to the "baopu" and "shouzhuo" spirits is to correct the existing drawbacks (evidence A5, evidence B9) and remain true to their original aspirations (evidence C6) in Table 4, and this culture further prompts innovation and improvement. This internal driving force will bring employees a sense of mission that connecting their individual interests with the collective goals. It makes employees firmly believe in the corporate culture and fully integrate themselves into the enterprise. Now we could draw the third proposition:

Proposition III: In the stage of spontaneous operation of culture, the company returns to the original aspiration of the enterprise (embrace simplicity), and hopes that employees can also reflect on themselves (nurture his nature), and the employees and the corporation become a community of shared mission.

Table 4. *Evidence of Spontaneous Order Stage*

Stage	Evidence	Classification
Spontaneous Order	**Factual evidence (A):** A5: The company adjusts the development thought, improves the management strategy, advocates to do the subtraction.	(5)sticking to the original aspiration (A5, B9, C5, C6) (6)remains pure (B10, B11, B12, C7) community of shared future - community of shared mission
	Textual evidence (B): B9: "Borche needs to focus one thing and do it well" B10: "Be humble is important for Borche: do everything right and make every good machine". B11: "Those in power should not try to influence people or things with ideas or demands that run counter to their natural conditions. Instead, they should guide the populace back to its simple, natural origin". B12: "In this industry, be humble means craftsman spirit and we should spare no effort to make perfect machines".	

	Verbal evidence (C): C5: "Since established, we were determined to make the best injection modeling machine". C6: "Many problems need to be traced back to their roots". C7: "Every product we produced is like our own children and we should be responsible for every product".	

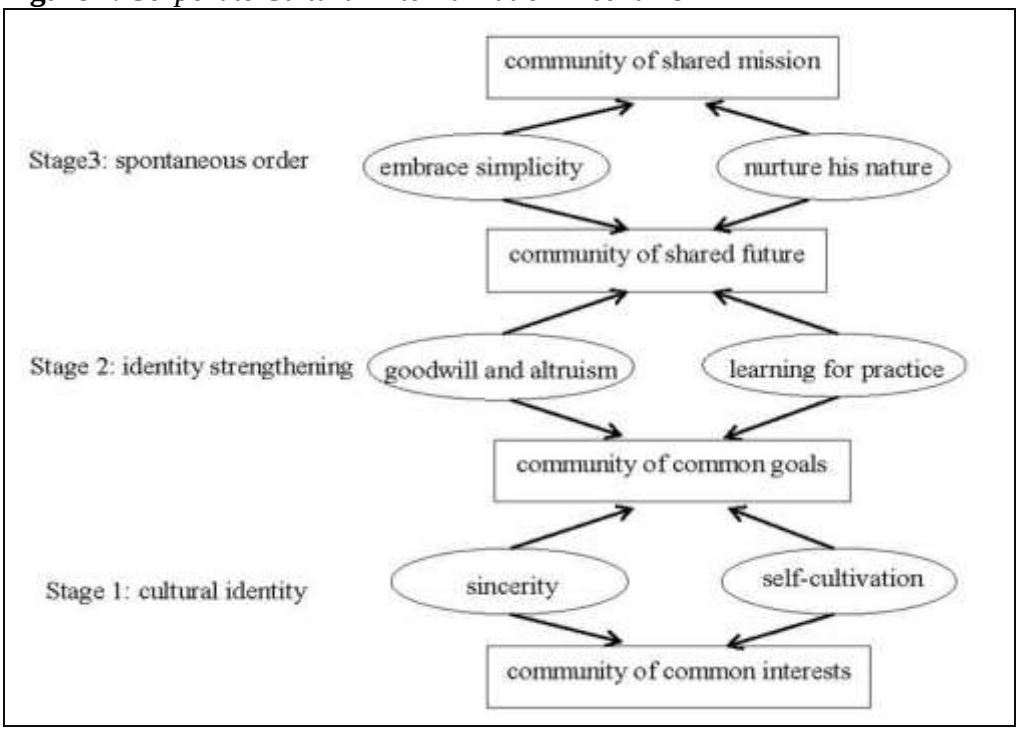
Source: field interview, August 2018.

Mechanism Construction

As the development of enterprises has its own life cycle, the corporate culture has corresponding characteristics at each stage. The influence of corporate culture on individuals is dynamic. We conduct the inductive reasoning in a hierarchical way to analyses the association among variables in the process of cultural internalization. Therefore, this paper divides the merge of Confucian values in corporate culture into three parts: cultural identity, identity strengthening, and spontaneous order according to the degree of employees' cognition and the change of their attitudes (from passive acceptance at the beginning to the exertion of their subjective initiative) in the process of cultural construction. At each stage, enterprises selectively introduce the management elements from Confucian culture, adjust strategies and improve their systems and regulation. In the cultural evolution, the relationship between employees and enterprises becomes closer as the corporate culture deepens. To sum up, the cultural construction mechanism is shown in Figure 1.

In the beginning, the introduction of Confucian culture is to raise the employees' attention to their own quality and help them to set goals. Then in the second stage, the enterprise emphasizes integrity, conscience, and goodwill to reshape employees' values and encourages them to play these qualities. Lastly, facing the development dilemma, enterprises and employees choose to return to their original aspiration, take a retreat as a step forward, and seek a breakthrough from their own characteristics to achieve management innovation. It is worth noting that in this process, culture internalization and individual response fit and interact with each other. The more culture fits with the individual, the more independent and socialized individuals will be after infected by culture, and it is easy to make better performance. After getting external positive feedback, individuals open their minds, actively respond to the new culture or participated in crafting the new corporate culture.

Figure 1. *Corporate Cultural Internalization Mechanism*



Source: author 2019.

Cultural Evolution Analysis

If the enterprise is a living organism, the enterprise culture is periodic. Taking the life cycle of enterprise development as the time axis and the cultural evolution as the background, this paper divides the evolution process of Bo Chuang culture into three stages: culture exploration stage, culture introduction stage and culture development stage. Combined with the four levels of cultural structure: spirit, institution, behavior and materials (Liu 2006), this paper analyzes the evolution of Confucian culture from multiple perspectives.

Culture Exploration Stage (2002–2011)

In 2002, the founder of Borche resigned from the position of domestic general manager with an annual salary of million yuan because he was not satisfied with the value of "benefit first" in his company. He is convinced that shareholders, customers, and employees are integrated, so he puts forward the enterprise tenet of "broad and profound, value co-production". Since China strongly advocated the construction of traditional culture, there is an upsurge of learning Sinology all over the country. The founder of Borche learned the management concept of Kazuo Inamori by chance and was deeply inspired. Inamori's management concept is a combination of Chinese Confucian culture and enterprise management. While the philosophical foundation of Inamori and the philosophical basis of the Meiji Restoration in Japan, are the ideas of "attaining liangzhi" which was raised by the Ming-dynasty

philosopher Wang Shouren. In order to implement the idea of "respect for nature and love for mankind" and the idea of "life is everything", Borche began to vigorously promote Confucian culture within the enterprise. Since the company is still in the early stage of culture construction, it faced many management defects at the spiritual level, institutional level, behavioral level and matter level. Evidence examples are shown in Table 5.

Table 5. *Evidence in Culture Exploration Stage*

Stage	Evidence	Classification
Culture Exploration (2002–2011)	**Factual evidence (A):** A1: The brother culture in the early days of entrepreneurship lacks scientific guidance. A2: Borche uses linear thinking to solve problems.	Spirit aspect: (A1, B2) Institution aspect (B1, A2) Behavior aspect: (C1, C2) Matter aspect: (B3, C3)
	Textual evidence (B): B1: The slogans of "digital Borche" and "happy Borche" were put forward. B2: We gradually summarize the core values of Borche: security, integrity, responsibility, excellence, and gratitude. B3: We try our best to serve the customer and devote ourselves to make products.	
	Verbal evidence (C): C1: In the early stage, Borche found no standard theory to guide its production process. C2: When popularizing the Confucian culture, some people may resist new things. C3: The quality problems in the production of products always exist.	

Source: field interview, August 2018.

Cultural Introduction Stage (2012–2014)

Since the introduction of Confucian culture, Borche has always been firmly confident in the power of mind, and believes that the power of mind is where the power comes from. At the spiritual level, Boche established the core values according to the "benevolence, righteousness, propriety, wisdom and faith" of Confucianism. At the institution level, Borche pursues the establishment of conscious order by advocating Wang Yang Ming's idea of "attaining liangzhi" (B3). In order to help employees understand and learn traditional culture, Borche held a series of cultural activities (A2) and take other actions to inherit and practice the traditional moral virtues (A1). At the matter level, Wang Yang Ming mentioned the importance of determination and held the idea that without determination, nothing can be fulfilled perfectly. As for Borche, the ambition is to innovate the injection molding machine. Borche upholds the integrity-based, customer-oriented principle and dedication to its customers to provide quality products and services (B2). Examples of evidence are shown in Table 6.

Table 6. *Evidence in Culture Introduction Stage*

Stage	Evidence	Classification
Culture Introduction (2012–2014)	**Factual evidence (A):** A1: In August 2011, Borche set up the "Love Fund "and "Trade Union Club". A2: In May 2014, the exhibition hall of "Conscience Park" was opened in Guangzhou headquarters.	Spirit aspect: (B1, B2) Institution aspect: (B3, C2) Behavior aspect: (A1, A2) Matter aspect: (B4, C1)
	Textual evidence (B): B1: Customers and employees as the main interests of the enterprise are important parts of the mission of Borche. The mission of Borche is: everything is customer-centered. B2: Since the Liao-Fan's Four Lessons mentioned that one must feel shame, one must know fear and one must have determination and courage, Borche built a management team of high execution. B3: Before carrying out the idea of Amoeba operating and seven principles of accounting, Borche deepens the philosophical system of "Management of the Twelve" and "Six Refined". B4: Borche defined 2014 as the "year of quality ", with culture as the cornerstone, built "8s", "TWI", "Reasonable recommendations classes" and "Kanban management" four major platforms.	
	Verbal evidence (C): C1: Although there is a management team of high execution providing guidance, the product innovation process has no improvement. The company has always acted on the level of "skill" and has not risen to the level of management philosophy. C2: Only when a person has clear conscience and sincerity can he be responsible for his life and work.	

Source: field interview, August 2018

Culture Development Stage (2015–now)

After the above cultural evolution, Borcher has achieved its primary target of culture construction with continuous growth in business for several years. However, with the improvement of the Borche's management and business performance, there was overconfidence and opportunism within the company. In this regard, corporate culture was adjusted to deal with these new issues. Wang Shouren, a Confucian philosopher, once commented in his letter to friends that "the great trouble for our generations is that the scholars lied to each other with empty words. Only returning to simplicity is the right medicine".

In a cultural aspect, Borche chose to be honest and humble, empty himself and stick to its original values (A1). In terms of its management, Borche attempted to integrate various departments to build a one-experience system. In cultural construction, the enterprise managed to organize its training programs in a flat way where employees and management learning mutually. In its production, Borche stepped forward to intelligent manufacturing along with a new lean strategy. Examples of evidence are shown in Table 7.

Table 7. *Evidence in Culture Development Stage*

Stage	Evidence	Classification
Culture Development (2015–now)	**Factual evidence (A):** A1: The enterprise pays more attention to the innovation ability of the personnel and gives the talented person more development space to avoid the phenomenon that bad money drives out good. A2: Since September 1, 2017, Bo Chong has made major changes in the governance structure of the company, and invited Mr. Jiang Zixue, a well-known lean management expert in China, to join Borche as president.	Spirit aspect: (A1, C1) Institution aspect: (B1, B2) Behavior aspect: (A2, C2) Matter aspect: (B3, B4)
	Textual evidence (B): B1: After sales system changes, the enterprise proposes a complete, systematic and advanced one-stop intelligent solution for customers. B2: The company proposes to integrate the supply chain to promote the negotiation between employees and suppliers, and then establishes an effective supplier management system. B3: As the first batch of 46 pilot demonstration projects of intelligent manufacturing in China, Borche put forward the concept of "injection industry 4.0". B4: In 2017, Borche treats the two-board intelligent injection molding machine as the company's production focus.	
	Verbal evidence (C): C1: In the beginning, everyone may be on the condition of defensive, but this state of mind will change gradually. C2: We insist on writing a family letter every day for five years. Now the whole company is studying my letter, including my article - the letter from the chairman.	

Source: field interview, August 2018.

From Tables 5–7, we come up with the last proposition:

Proposition IV: the corporate culture will be constantly adjusted with the change of the developmental stage. The internally cultural achievement will evolve to external

influence.

An enterprise should be seen as an open system where its culture is affected by internal and external pressures. But the determination is still the enterprise's original practice. For example, the initial cultural exploration and introduction heavily depend on the founders' ideas, styles and acts. The founders' personal influence will remain and form a corporate culture at the very beginning.

With the development of enterprises, the management is gradually influenced by the thought of leaders, and realizes that corporate culture construction is a way to build up an interpersonal relationship and improve employees' efficiency. In the process of cultural implementation, it gradually trickles down from the higher level to the general staff, and evolves into parallel learning under a series of measures such as comprehensive education. Employees' attitude will gradually accept and participate in the cultural construction, which are reflected in their daily work. These works constitute the company's system, products, sales and other strategies. In Table 8, we can clearly see the cultural evolution process in Borche.

Table 8. *A Summary of Culture Construction Process*

Stage	Spirit aspect	Institution aspect	Behavior aspect	Matter aspect
culture exploration (2002–2011)	Corporate culture is not in accordance with the size of the enterprise.	The production system is not scientific.	Culture is not fully implemented in Borche.	Lack of scientific localization
culture introduction (2012–2014)	Improve core values in Borche.	The production system is in order.	Culture infiltration is realized by the employment of top-down processing.	Lean production innovation
culture development (2015–now)	Stick to the original aspiration.	The production system uses the one-stop service management.	All workers learn the culture at the same time.	Intelligent manufacturing

Source: Author 2019.

Conclusion

Summary of the Cultural Internalization and Evolution Model

Under the pressure of external competition and learned from its own practice, Borche has developed a Confucian culture mode that is suitable for long-term development. From the case of cultural construction, this paper

draws the following two conclusions: First, local enterprises can introduce traditional norms and values into modern management when transforming their corporate culture. Confucian management thoughts are of a number of behavior norms from self-cultivation (gentleness, benevolence) to behavior (loyalty, trust) and interpersonal relationship (moderation, harmony) (Yum 1988, Hwang 2001) which can be applied to the management of enterprises. Second, the evolution of corporate culture needs to follow the life cycle of the enterprise's development. It is a common path to evolve from the internal spiritual level to the external level. The core of the cultural internalization is to reshape the values of employees and give full respect to their agency. The path is to stimulate the internal cultural identity of employees first, and then to strengthen the culture by external intervention. It is worth noting that in the final stage of mechanism, Borche chose to stimulate the employees' independent creativity and sense of mission by returning to the original point. This just reflects the highest level of management in a Confucian sense. The essence of Confucian thought of the supreme good is to give full play to the supreme good nature of human behavior through the common entity of enterprise organization, whose essence is to obtain the survival and happiness of the human community. On this basis, employees will work together to achieve the ultimate vision of the enterprise.

The research of this paper also has implications for the practice of enterprise management. Western management thought is mainly based on the hypothesis of "economic man", and the pursuit of efficiency is always the core principle of management theory (Gladwin et al. 1995, Leibenstein 1976, Pfouts et al. 1976). This theory emphasizes on improving efficiency and reducing costs through corporate regulation. Borche adopted western management thought at the beginning of its establishment, but due to the lack of corresponding incentive measures, this system could not function well as they expected. Confucian management thought plays a different role in education. Through inculcating filial piety, honesty, gratitude and other thoughts into employees, Borche cultivates its employees with high engagement. It is found that the degree of engagement is related to the characteristics of employees' sense of responsibility (Kim et al. 2009), achievement needs (Hallberg et al. 2007), and the work resources provided by enterprises such as organizational support and work characteristics (Saks 2006). Borche is a typical private manufacturing enterprise which has developed for more than ten years since it was born. During this period, it constantly introduces Confucian culture, self-adjustment and reflection, until it explores the corporate culture suitable for its long-term development. Therefore, other start-ups can also effectively change the values of employees and shape employees with high engagement by embedding Confucian management ideas in management.

Research Limitations

This paper is an exploratory case study aiming to identify the key elements. It comes up with a theoretical model from a business case. However, the external validity of our propositions and model in the research needs further examination. Next, in the collection of interview data, this study adopts the theoretical sampling

method. Although theoretical sampling helps to develop theory, it may also ignore relevant information (Eisenhardt and Graebner, 2007). For example, most of the interviewees in this study are the chairman and senior managers of Borche. Without feedback from entry-level staff, this sample is not fully represented in our evaluation of cultural construction.

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Digitalization as a Determinant of Tax Revenues in OECD Countries: A Static and Dynamic Panel Data Analysis

By David Hanrahan[*]

The tax challenges of digitalization have been to the forefront of national and international discussions on public revenues in recent years. The digital transformation is seen as being an exacerbating factor in the erosion of tax bases and the shifting of profits to low tax jurisdictions, particularly by multinational companies, thus reducing tax revenues for governments. While there is a large literature examining the role of ICT and digitalization in raising economic growth, productivity and other macroeconomic variables, the relationship between digitalization and tax revenues has been relatively understudied – despite being one of key drivers of what could be most significant change to international tax rules in a century. This study utilizes panel data covering OECD countries during the period from 1995 to 2018, and examines the effect of the rise of digitalization on tax revenues employing both static and dynamic panel data analysis techniques. The findings indicate that digitalization may have a negative impact on the ability of a country with high digital dynamics to generate higher tax returns.

JEL Codes: *H20, H25, L81, L86*
Keywords: *digitalization, taxation, tax revenues, ICT, OECD countries*

Introduction

Background

The tax challenges of digitalization have been the focus of much research by academics and policymakers at both national and international levels in recent years (OECD 2017). This has been particularly true since the Global Financial Crisis of 2007/08, when the public finances of many countries were strained in the face of rising debt and substantial deficits. Governments came under intense pressure from voters facing years of austerity and restrictive fiscal policy, i.e., rising taxes and falling government spending, leading many people to become disillusioned with globalization and to protest at what they perceived to be "unfair" taxation (this pressure also intensified over the decade from 2008–2018 as a result of reports based on numerous financial scandals including the leaking of documents concerning tax evasion and corruption such as the so-called Swiss leaks, LuxLeaks and Panama Papers). Thus, the issue of the erosion of national tax bases and the shifting of profit from high-tax to low-tax jurisdictions has been high on the policy agenda for some time. While digital firms are not exclusively responsible for base erosion and profit shifting (BEPS), it is argued that the process of digitalization

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exacerbates these issues (OECD 2014, p. 13), reducing the base available for national governments on which to levy taxes.

Digitalization has significantly and irrevocably changed all economies across the globe over the last three decades in particular. The process of digitalization, the challenges and, to a much lesser extent, the opportunities it represents to economies have been hotly debated. The diffusion of the Internet, and information communication technologies (ICT) more generally, have been well documented in the literature. However, it has also long been argued that digitalization has a negative impact on the tax raising capabilities of national governments dealing with a new, digital world "without borders". One early warning on the negative impact of Internet-based activities with regard to tax revenues came from Tanzi (1996). Tanzi identified various technological developments – namely aspects of digitalization such as e-commerce, electronic money and cross-border transactions - as being a form of "fiscal termite" which would ultimately erode and undermine the foundations of national tax systems and likely lead to a discernible fall in the ratio of tax revenue to GDP in many OECD countries (Tanzi 2000, p. 15). However, the question must be asked: Is there a "Tanzi paradox" to paraphrase the well-known Solow paradox - can the transformative process of digitalization be seen everywhere, except in the tax revenue statistics?

However, despite the recent focus on the tax challenges of digitalization by policymakers and in academia in recent years, digitalization has been little studied in the literature as a determinant of taxation with a lack of solid, data-based evidence for the flaws which have been asserted to exist in the current international tax system (Olbert and Spengel 2019).

This paper investigates the relationship between digitalization and tax revenues in OECD countries (covering all 36 OECD member countries as of 2019) as a contribution towards filling this gap. As a group of developed and advanced economies, the OECD has consistently been to the forefront of attempting to find a consensus-based, multilateral solution to the issues raised by BEPS and the tax challenges of digitalization since being tasked with this role by major global economies. Representing some of the most advanced (in broader terms) *and* most digitalized economies globally, the OECD is the natural starting point to examining this issue – with 8 of the top 10 countries for e-commerce sales globally being OECD members (UNCTAD 2019) and Internet intensity reaching saturation levels in many countries.

Understanding the role of digitalization in terms of tax revenues is a crucial issue to consider as the OECD attempts to reach a solution in late 2020 as intended. The importance of digitalization during the coronavirus crisis in 2020 (with millions of people worldwide working remotely, or engaged in e-learning and other online solutions) will again bring the challenges it presents to governments to the fore as states seek to recover from the deficits and rising national debt incurred during that crisis.

Using panel data over the period from 1995–2018, including a novel proxy for digitalization, the impact of advancing digitalization over time is examined in order to test Tanzi's "fiscal termite hypothesis" on the basis of the available macroeconomic data on tax revenue.

Digitalization

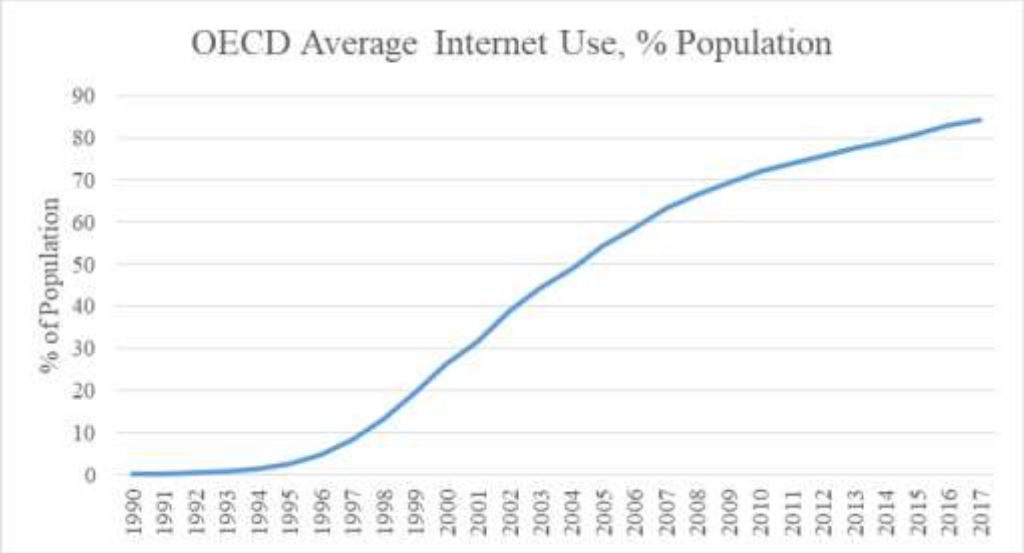
While an in-depth discussion of digitalization[1] is beyond the scope of the present paper, it is worth making some observations on the dynamics of the process (for a broader discussion on digitalization see, e.g., Corrocher and Ordanini 2002). The OECD describes the digital economy as the result of "a transformative process brought about by information and communication technology (ICT)" (OECD 2013a, p. 11). Many forms of ICT have become general purpose technologies impacting and reshaping both economies and societies (OECD 2013b). This process is also known as digitalization.

As Internet intensity rose from the mid-1990s (see Figure 1), traditional firms increasingly moved from a traditional "bricks and mortar" to a "clicks and mortar" business strategy, combining traditional stores and outlets with an online presence, and many new firms (based entirely online) emerged (e.g., Amazon (founded 1994), Yahoo and eBay (founded 1995), Google (founded 1998)). Fast-paced technological progress and falling real prices of ICT (Welfens and Perret 2014) allowed ICTs to become ubiquitous within a very short period of time. Figure 1 shows how average Internet use grew in OECD countries particularly from 1994 on - displaying a familiar S-shaped curve for the diffusion of innovations (Rogers 2003). It is estimated that global e-commerce sales reached over $29 trillion in 2017 with 1.3 billion people engaging in e-commerce transactions, with growth in cross-border transactions (particularly likely to create taxing issues) outpacing growth in e-commerce over all in recent years – cross-border shoppers represented 15% of global online shoppers in 2015, but 21% in 2017 (UNCTAD 2019, see also OECD 2019c).

Digitalization is also a phenomenon which will continue to challenge governments and tax authorities into the future, with the so-called Fourth Industrial Revolution - involving developments such as big data, artificial intelligence, robotics, 3D printing and the Internet of Things - likely to mean that the challenges posed by digitalization to tax revenues shall continue if not even worsen over time.

[1]Note, that while some researchers have identified different phases of the transformative process (e.g., Verhoef et al. 2019), for the purposes of the present paper, it is assumed that digitalization has been a continuous, singular process.

Figure 1. *Individuals using the Internet as Percentage of the Population, OECD Average, 1990–2017*



Source: Own representation of data from World Bank.

From Figure 1, one can see that average Internet use in OECD countries was relatively stable in the early 1990s, before Internet usage rates rose steadily from circa 1996 until the late 2000s as saturation intensities began to be reached in some countries, for example 98% usage in 2017 in Iceland, with Italy, Mexico and Turkey at the bottom of the OECD rankings with 63%, 64% and 65%, respectively.

The Tax Challenges of Digitalization

Within a few years of significant growth in terms of Internet usage in the early to mid-1990s, the role of ICT and e-commerce in particular came on the national and international policy agenda, with the OECD's 1998 Ottawa Ministerial Conference being the first international ministerial-level conference to deal with the issue of e-commerce (Wyckoff and Loux 2019). However, in a survey of national responses to the challenge of taxing e-commerce in 2006, Cockfield (2006) shows that over the ten years from the mid-1990s to the mid-2000s, many countries had not enacted any significant legislation with regard to taxing the digitalizing economy. The result of this seeming inaction was that the digitalization of modern economies had "disturbed and outmanoeuvred taxes" (Corkery et al. 2013, p.1).

The effect of this lack of action – possibly due to a quasi "infant industry" motivation – was that the productivity gains associated with digitalization did not result in increased tax revenues, particularly for larger countries which have been "sorely tested" by the process (Collin and Colin 2013, p. 5). The tax challenges of digitalization are primarily related to corporate tax revenues and sales/value-added taxes on cross-border consumption with digital firms having the ability to take advantage of differentials in tax rates. Aspects of the new digitalized economies, which pose significant threats to the tax base and revenue collection of countries,

include, but are not limited to corporation tax issues surrounding mobility (of firms, users, assets), the use of data and intangibles in particular, network effects, platform models and cross-border transactions (for a broader discussion of specifics of the tax challenges of digitalization, see e.g., OECD 2015, 2018, 2019b, Sand-Zantman 2018, Köthenbürger 2020). Meanwhile, digitalization also poses threats to the generation of value-added taxes as the share of e-commerce in overall retail sales continue to grow, in particular cross-border transactions which are difficult and costly to police by tax authorities. The rise of digitalization and the ease of modern communication also facilitate high income individuals relocating from high tax to lower tax jurisdictions also undermining personal income tax revenues.

In the aftermath of the Global Financial Crisis and with the onset of the sovereign debt crisis in certain countries in Europe, the issue of fair taxation of multinationals began to come to the fore, with a new impetus being provided by the leaders of the G20 at the Los Cabos Summit, in Mexico, in 2012 and of the G8 at Lough Erne in 2013 as they stressed the need for governments to act in order to prevent base erosion and profit shifting (G20 2012, G8 2013) and from the OECD itself which had proposed work on the area of BEPS to the G20 prior to the Los Cabos summit. At the same time, expert working groups were commissioned to examine the issue of taxation and the digital economy at an international level (European Commission 2014, ITU 2015).

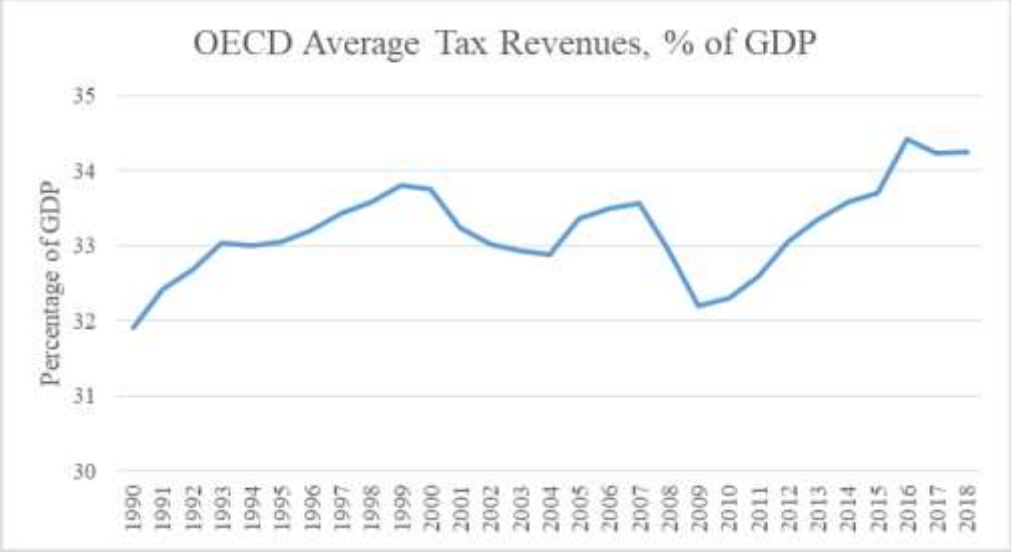
Having received the political backing and financial support to proceed with an examination of issues surrounding BEPS, the OECD published an Action Plan, which detailed 15 areas which required particular attention, in 2013 (OECD 2013a). The first of these areas, i.e., the OECD's Action Plan 1, tackled the tax challenges of the digital economy (OECD 2014, 2015). With no consensus solution being found by the OECD in 2015, individual states took it upon themselves to proceed on a unilateral basis and enact various taxes and tax-related measures in order to try to generate additional tax revenue from digital firms. These measures generally take the form of turnover taxes, withholding taxes, alternative thresholds for the purposes of a permanent establishment (and thus a taxable presence) and specific measures targeting multinational firms, with measures being announced or enacted in, amongst others, the United Kingdom, France, Italy, Spain, Hungary, Turkey and Israel (for discussion of selected unilateral measures, see UN 2017, Hadzhieva 2019, Agyropolou 2019) as well as proposals for a Digital Services Tax at an EU level from the European Commission (European Commission 2017, 2018). Having received a new mandate, work continues at OECD level to develop an international solution to the tax challenges of digitalization (OECD 2018, 2019a). In October 2020, the OECD released the blueprints of its new "two-pillar" proposed approach to fairer international taxation for public consultation. The OECD proposals include measures designed to ensure more transparent and equitable taxation of large multinational firms include leading digital companies and digitalized economies (OECD 2020b).

However, while many seem to accept that digitalization self-evidently poses a challenge to the tax generating capabilities of national governments, there are also analyses that question the notion that digitalization and digital firms pose a particular and pressing challenge in terms of tax (Lee-Makiyama and Verschelde

2016, Schoen 2018). In support of its own move towards an EU tax on digital services, the European Commission has argued that international digital firms faced an average effective corporate tax rate in the EU28 of just 9.5%, compared to the 23.3% effective corporate tax rate faced by "traditional" international firms (European Commission 2017). These figures have been called into question by, amongst others, Bauer (2018), who notes that the figures used by the Commission do not even appear in the sources cited by the Commission in support of their claim and it is unclear how the Commission arrived at their suggested respective corporate tax rates. Bauer (2019) and Lee-Makiyama and Verschelde (2016) have argued that real-world data shows that digital firms indeed face effective corporate tax rates similar to more traditional, less digital firms (e.g., automobile manufacturers). Furthermore, recent studies of the tax planning of some firms reveal findings which seem difficult to reconcile with claims that digital firms face as more traditional firms, for example the case of Apple, with effective tax rates of key Apple subsidiaries of less than a tenth of one percent (Ting and Gray 2019).

On the other hand, it is also broadly acknowledged that digitalization could also have a positive effect on tax revenues through direct and indirect channels. On the one hand, digitalization improves the performance of tax authorities through better software, online tax return filing, and better record keeping etc. improving both compliance on the part of taxpayers and more efficient tax collection (IMF 2018). Digitalization can also be seen as a crucial driver of innovation and growth (Olbert and Spengel 2017). This role can indirectly improve revenue- raising capabilities of government. Digitalization is associated with economic growth, productivity, inward foreign direct investment, and international trade as will be explored in the subsequent literature review.

Figure 2. *Average Tax Revenues OECD Countries as Percentage of GDP, 1990–2018*



Source: Own representation based on data available from the OECD.

A brief look at average OECD tax revenues over the time period from the beginnings of the process of digitalization in 1990 to 2018, shows no prima facie evidence of tax revenues being undermined by fiscal termites, rather average tax revenues as a percentage of GDP in the OECD have risen by circa two percentage points over the same time period (with two noticeable periods of decline, namely the aftermath of the "dot-com" bubble and September 11th attacks in 2000/01, and the Global Financial Crisis from 2007/08).

Thus, the following questions can be asked: Does digitalization really undermine tax revenues? What role does digitalization play as a determinant of tax revenues in some of the most digitalized economies? This paper makes two main contributions to the literature. Firstly, by examining a relatively homogeneous grouping in terms of tax and digitalization in the OECD countries, who are also to the forefront of the search for an international solution to the challenges posed by digitalization, it avoids possible misleading conclusions which would be drawn from an analysis of more heterogeneous countries who are more disparate in terms of economic development, digitalization and tax capacity. The marginal effect of digitalization on tax revenues can be expected to be different for less developed countries with lower tax capacity than for more developed economies. Secondly, this paper employs a novel proxy of digitalization in IP allocation data which allows a broader measure of digitalization than more traditional measures used in the literature such as Internet usage statistics.

The rest of the paper is structured as follows: The subsequent section presents an overview of the literature on the determinants of tax revenue from a macroeconomic perspective. This is followed by a presentation of the data and methodology used in the present analysis and subsequently the empirical models used in the analysis. Following that, the results of the empirical analysis are presented and discussed. The paper concludes with a view on the policy options and ideas for future research.

Literature Review

The body of literature examining the determinants of tax revenues is broad. Many contributions have sought to examine the principal determinants of tax revenue and certain key determinants shall be presented here as some of these determining factors will be included in the subsequent empirical analysis.

Eltony (2002), looking at panel data covering a selection of 16 Arab countries, finds inter alia that the level of economic development is a strong determinant of tax revenue mobilization. Gupta (2007), using panel data to examine over 100 developing countries over a period of 25 years, has provided further supportive evidence for earlier findings that economic development in terms of GDP per capita is a strong determinant of tax revenue, as is trade openness. Furthermore, the sectoral composition of economies is related to tax revenue generation – in particular, the share of agriculture is negatively related to tax revenue. Stotsky and Woldemariam (1997), who use panel data covering over 40 sub-Saharan African countries during the period from 1990–1995, show that the

share of agriculture in GDP is significantly negatively related to tax share as are import and export shares (i.e., openness). Karagöz (2013) – looking at Turkey - finds that the share of industry is positively related to tax revenues. Other contributions to the literature consider the level of public debt (Teera and Hudson 2004) and socio-economic and institutional factors such as the level of political rights, civil liberties (Bird et al. 2008) and education (Piancastelli 2001). More recently, Angeles-Castro and Ramirez-Camarillo (2014) providing further support for the findings of the previous researchers using a panel dataset covering OECD countries during the period from 2001 to 2011.

Many studies have also examined the macroeconomic effects of digitalization – usually employing a proxy indicator such as Internet usage intensity. Productivity gains related to Internet usage and diffusion have been identified in macroeconomic data (Oliner and Sichel 2000, Jorgenson 2001, Collechia and Schreyer 2002). At the same time, the Internet has been found to have a significant and positive impact on economic growth (Noh and Yoo 2008, Salahuddin and Alam 2016). Other contributions have considered the impact of the Internet on international trade (Xing 2018, Meijers 2014, Vemuri and Siddiqi 2009, Baunsgaard and Keen 2010), foreign direct investment inflows (Choi 2003) and inflation (Yi and Choi 2005, Csonto et al. 2019 - who use the same data on IPv4 and IPv6 address allocations as the present study to construct a digitalization index in order to examine the impact of digitalization on inflation). Looking at ICT and income inequality, Richmond and Triplett (2018) examine panel data covering 109 countries over the period 2001–2014 and find that the impact of ICT on income inequality varies by type of the type of ICT considered, whereby increases in fixed broadband subscriptions are associated on average with increases in income inequality, while increases in mobile phone subscriptions are associated on average with decreases in income inequality, with the former effect larger than the latter. Jaumotte et al. (2008) also find that income inequality in many countries has increased due to the biased nature of digitalization which raises the relative demand for, and thus wage premium of, skilled workers who possess the human capital required to fully exploit the benefits of these technological developments (on inequality issues, see also Allen, 2017).

Combining these two strands of the literature on the determinants of tax revenue and digitalization using macroeconomic data is a newly emerging field for research[2]. Those studies which have looked at this issue have considered large samples of developed and developing countries, the highly digitalized with the less digitalized (where the marginal effects of increasing digitalizing on e.g., growth and tax revenues may be larger) and high tax countries with countries with lower overall tax burdens. Koyuncu et al. (2016) explore the impact of ICT penetration

[2]Some contributions have used microeconomic data to study the relationship between ICTs and tax revenues. Looking at the online purchase decisions of 25,000 US consumers, Goolsbee (2000) could show that consumers living in high sales tax jurisdictions were significantly more likely to buy items online, suggesting that early Internet adopters were already motivated to avoid sales tax thus reducing the tax base and, ultimately, tax revenues. Bruce and Fox (2000) also find that ecommerce was reducing the sales tax base in the US, estimating over $10 billion in tax revenue losses in 2003. Many studies have shown similar results in relation to sales and value-added taxes.

on tax revenues. Looking at 157 countries and four indicators of ICT penetration, the authors find that ICT penetration does increase tax revenue across countries during the period 1990 to 2013. Gnangnon and Brun (2018) consider their work to be the first study to investigate the linkage between a variable that they calculate as representing each country's "Internet gap" (i.e., the ratio of a country's internet usage intensity to the world average internet usage intensity) and public revenue mobilization in a sample of 164 countries for the period from 1995 to 2013. Their analysis suggests that by reducing the Internet gap, countries can raise their public revenues with low-income countries standing to benefit the most. Meanwhile, Gnangnon and Brun (2019) analyze the impact of the Internet on resource versus non-resource revenue for 99 countries over the period 1995–2015, finding that a higher Internet usage intensity has a negative effect on resource revenue and a positive effect on non-resource revenue (with the impact of the Internet being higher for less developed countries). The OECD, as a more homogenous group in terms of economic development, digitalization and the tax burden, while also being to the fore in examining the issue of the tax challenges of digitalization, is an interesting sub-group for the subsequent analysis.

Methodology

Measuring Digitalization

The impact of digitalization on tax revenues is examined using a model where the explanatory variables are standard in the existing literature on the determinants of tax revenue with the exception of the variable of interest – a singular measure of digitalization. In the literature, a number of variables have been found to be significant determinants of public revenues as discussed in the literature review, namely the level of economic development, sectoral composition, international openness, as well as socio-economic factors including life expectancy, health, education and political and civil rights of residents.

Trying to measure digitalization has proved a difficult task. While many individual indicators exist, it is rarely possible to get a complete picture without combining several indicators. Many attempts have been made, primarily by international organizations, to measure digitalization to allow cross-country comparison. First published in 1997, a pioneering attempt was made by the International Data Corporation and its Information Society Index covering 53 countries. Since then, a number of broadly similar indices have been published by the World Economic Forum (Networked Readiness Index from 2002, Knowledge Economy Index from 2005), the International Telecommunications Union (ICT Development Index from 2002, Digital Access Index from 2003, Digital Opportunity Index (now known as the ICT Development Index) and the ICT Opportunity Index from 2005), the United Nations (Technology Achievement Index from 2001, E-Government Development Index from 2002, ICT Diffusion Index from 2006) and the EU (Digital Economy and Society Index from 2014)

with a variety of countries, indicators and sub-indicators and time periods covered (for more, see Kononova 2015).

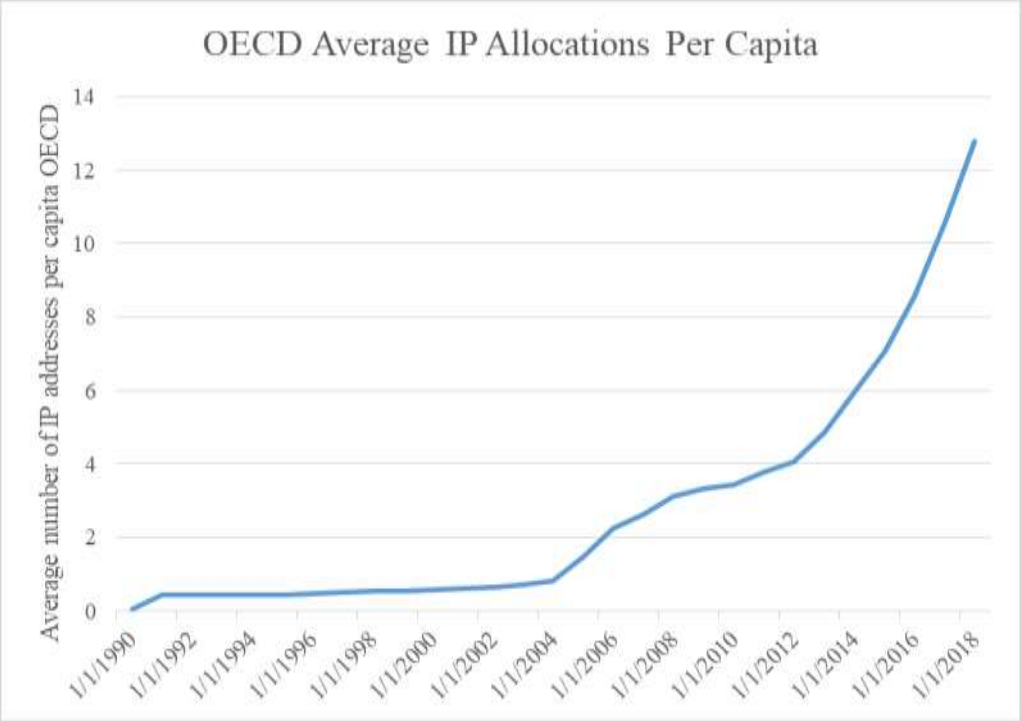
Meanwhile, Corrocher and Ordanini (2002) created a synthetic index and used their index to determine a "digital divide" by means of the standard deviation of each country's result from the mean. More recently, some researchers have compiled digitalization indices for their own research. Katz et al. (2014) construct an index comprised of six components (affordability, infrastructure reliability, network access, capacity, usage and human capital) and 24 sub-indicators. Camara and Tuesta (2017) have created the DiGiX, a digitization index, with six principle dimensions (infrastructure, households' adoption, enterprises' adoption, costs, regulation and contents) and 21 sub-indicators, for 100 countries in 2016 with a ranking for that year based on data for 2015.

The varying nature of individual indices from year to year (where new indicators have been added, other indicators dropped etc. – consider the rise of mobile internet and the role of apps in recent years which are not reflected in earlier years), or the relatively small number of sample years available means that such synthetic indices are not conducive to be used for an analysis over a longer time period.

This paper adapts the proxy used in Csonto et al. (2019) – i.e., the number of internet protocol (IP) addresses allocated per country as a measure of digitalization. An IP address is a numerical label or identification key which is assigned to every device connected to a computer network communicating using internet protocol – i.e., every device connected to the internet including desktop computers, laptops, tablets, smartphones and networked devices such as printers, scanners etc.

With the exponential growth of Internet usage and the progress of digitalization, the number of devices connected to the Internet and thus the demand for the number of IP addresses has also grown exponentially. In use since the 1980s, IPv4 allows for 2^{32} IP addresses. Meanwhile, with a view to the growing demand, IPv6 was introduced in 2012 as a parallel network and allows for 2^{128} IP addresses, thus ensuring a supply of addresses to meet growing demand, as internet diffusion continues and the Internet of Things continues to see more and more devices connected to the internet, from household appliances to cars. Since its introduction, the allocation of IPv6 addresses has also grown dramatically (see Figure 3; a table with all OECD countries ranked according to their IP address allocations for 2018 can be found in the appendix, Table 5) with IP addresses being allocated by the Regional Internet Registry to service providers or private or public entities. Following the introduction of iOS and Android operations systems in 2007 and 2008, respectively, the rapid diffusion of smartphones globally over the following years can be seen in the striking growth in IP address allocations (on smartphone diffusion, see Cho (2015) and Gündüc (2019)).

Figure 3. *Average Number of IP Addresses Allocated per Capita in the OECD*



Source: Own representation based on data available from the APNIC.

Thus, the IP address allocation data allows for a good proxy of digitalization with advantages over other common proxies. Internet intensity/usage (e.g., percentage of the population) does not capture the true diffusion of digital technologies. A single person reporting having used the Internet could have access to the Internet at work, but not at home (or vice versa). The person could have a single desktop computer, which is a different circumstance from an individual with multiple connected devices (i.e., highly digitalized) each with a separate IP address. The same goes for the sheer number of connected devices in smart homes etc. Using IP data also avoids the problem – common to the most frequently used measures or indices of digitalization in the literature - of the addition or dropping of indicators with the emergence of new technologies or devices, i.e. a modern smartphone in 2017 is allocated an IP address in the same way as a desktop personal computer in 1995. However, there are also some caveats: Firstly, the allocation of IP addresses does not perfectly reflect actual usage. Secondly, in some circumstances a single IP address may, by way of a network address translator, be shared by a number of separate devices. Thirdly, where no allocation has been recorded, it does not definitively mean that no connected devices are being used in a particular jurisdiction. However, these caveats are not of sufficient concern to invalidate the usage of the data as a proxy (as also argued in Csonto et al. 2019).

Data on IPv4 and IPv6 allocations is provided by the Asia-Pacific Network Information Centre (APNIC) which has data for almost 200 countries and territories with data on IPv4 from 1990 and on IPv6 from 2009 – data is available on a monthly basis. While Csonto et al. (2019) use high frequency data (monthly)

to construct an index of digitalization based on growth rates per country, for the purposes of the present study, we use annual data (i.e., the number of IP addresses as of 1 January (or closest available date) each year[3] as the macroeconomic data is frequently only available on an annual basis.

Data

The dataset used in the present study is a panel of 36 members of OECD members (as of 2019) covering the period from 1995 to 2018[4]. An overview of the variables is provided in Table 1 (while a brief description of each variable and its source is available in the appendix – Table 4).

Table 1. *Descriptive Statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
TaxRev	860	33.318	7.508	9.912	48.917
LnGDPpc	862	10.269	0.676	8.545	11.615
TradeGDP	862	90.293	53.311	16.679	408.362
AgriGDP	847	2.749	2.058	0.214	16.855
IndustGDP	847	25.633	5.338	10.517	41.107
GovtDebtGDP	839	57.668	38.632	3.664	237.115
UrbanPop	862	75.939	11.18	50.622	98.001
Unemployment	862	7.805	4.142	1.805	27.466
inFDIGFCF	855	0.22	0.444	-1.647	4.313
Inflation	862	3.707	7.741	-4.478	89.113
PolRights	862	1.194	0.581	1	5
CivLib	862	1.447	0.769	1	6
BankingCrisis	862	0.122	0.327	0	1
SovCrisis	862	0.013	0.112	0	1
POPgrowth	826	0.552	0.781	-2.233	2.963
Digital	858	3.295	5.574	0	50.145

Source: Own representation.

The dataset is comprised of economic, institutional, specialization and social determinants of tax revenue, most of which are commonly used in the literature. In addition, our variable of interest is added, as are dummy variables to represent banking crises and sovereign debt crises.

LnGDPpc is the natural log of GDP per capita (in 2010 international dollars) as a measure of the economic development of an economy (Gupta 2007). In the literature on the determinants of tax, this variable is expected to have a positive

[3]Unfortunately, there are some gaps in the data from APNIC, in particular missing data related to the United States and Canada for whom no data on the allocation of IPv4 is available from the period from September 2007 to July 2009. Thus, there is no observation for IPv4 and therefore of the variable Digitalization (which includes IPv4 data) for either of those countries for those two years, namely 2008 or 2009.

[4]After initial reviews of the data, two observations were dropped from the analysis. Firstly, the data for Iceland for the year 2016. Due to an exceptional item of tax revenue – "stability contributions" - related to banks and credit institutions which amounted to over 17% of 2015 GDP - resulting in a tax revenue to GDP rate of over 50% in 2016, compared to 35% in 2015, and 37% in 2017 (for more, see Baldursson et al. 2017). Also dropped was one observation for Luxembourg which preliminary tests showed high residuals and leverage making it a significant outlier in the data.

sign, as economies grow they tend to become more formalized and thus easier to tax, rising GDP per capita also reflects an advantageous stage of the economic cycle which should, amongst others, generate more profits and income and thus higher taxes (Clausing 2007). However, many of the contributions which make this finding consider developing countries. In developed economies, where tax revenues as a share of income tend to already be relatively high (such as the OECD), and in crisis years, during which governments follow expansive fiscal policy to support economic growth and reduce the tax burden, the variable could also have a negative sign (see, e.g., Arnold et al. 2011, Bird et al. 2008).

TradeGDP is the sum of imports and exports of both goods and services as a percentage of GDP. This variable serves as a proxy of the openness of an economy and is expected to have an ambiguous effect on tax revenues (Angeles-Castro and Ramirez-Camarillo 2014). On the one hand, higher levels of trade are a sign of openness and competitiveness which should reflect a formal economy and a good opportunity to generate higher tax revenues (for example, directly via tariffs, and indirectly via overall economic growth). On the other hand, the sample of countries in the present study are characterized by high levels of openness, integration and low barriers to trade which should mean that, particularly the direct channel, should not result in significantly higher tax revenues.

AgriGDP is the share of agriculture, forestry and fishing value-added as a percentage of GDP. The share of agriculture in value-added is expected to be negatively related to tax revenues based on the literature, as the sector is difficult to tax - with a high share of self-employed individuals and small and medium enterprises and shadow economy effects (Gupta 2007).

Industry is the share of industry value-added as a percentage of GDP. This is expected to have a positive effect as it reflects a more formal, advanced sector of the economy which is easier to tax and which creates a larger tax base (Eltony 2002).

GovtDebtGDP is General Government Gross Debt as a percentage of GDP (Teera and Hudson 2004). On one hand, government debt could have a positive effect on tax revenue, as government seeks to increase tax revenues in order to service the costs of servicing increasing debt. On the other hand, government debt could also be used to finance public spending, and governments may wish to borrow to fund spending in a favorable interest rate environment rather than raise taxes in a period of expansive fiscal policy.

Urban Pop considers the percentage of the overall population living in urban settings. This is expected to have a positive effect on tax revenue. Firstly, a higher percentage of the population living in urban areas indicates a higher level of industry, a larger service sector and a lower share of agriculture (Gupta 2007). Secondly, a higher share of urban-dwellers reduces the costs for tax authorities to enforce tax compliance.

Inward FDI/GFCF relates to inward foreign direct investment (FDI) relative to gross fixed capital formation (GFCF). This variable could have a negative effect on tax revenues as higher inward GDI could reflect government approach of using tax policy and other fiscal incentives in order to attract FDI from investors abroad (Cassou 1997). On the other hand, higher levels of inward FDI could also be a sign

of an economy which is competitive on global markets and of the confidence of investors in the stability, including the fiscal sustainability, of a country (Gugler and Brunner 2007).

Inflation can reduce tax revenues in real terms due to the time lag between the tax debt being incurred and the government actually collecting revenues (Gnangnon and Brun 2019). This phenomenon is known as the Olivera-Tanzi effect (see, e.g., Tanzi 1977).

Political Rights and *Civil Liberties* are expected to be positively related to tax revenues (Angeles-Castro and Ramirez-Camarillo 2014). In democratic states with high levels of civil liberty, taxpayers may be more likely to willingly cooperate with state authorities to contribute to public coffers and have a lower incentive to seek to avoid or evade taxes (Alm and Torgler 2006). Strong state protection of individual rights also extends to property rights etc. which are conducive to functioning markets. In this instance a positive relationship will be indicated by a negative sign of the correlation as lower marks for political rights and civil liberties indicate a better performance in those areas.

Population Growth is used here as a proxy variable for social development and is expected to be positively related to tax revenues. Many factors contribute to a growing population including low levels of infant mortality, higher life expectancy, a (relatively) stable birth rate and immigration. The above factors reflect an economy with a functioning and adequate social security system, health care system and a high standard of living, while a growing economy may attract inward migration (Bahl 2003, Gnangnon and Brun 2019).

Banking Crisis and *Sovereign Debt Crisis* are dummy variables which take the value of 1 for the years a particular country was experiencing either a banking crisis (e.g., for many of the OECD countries this covers the Global Financial Crisis of 2007/8–2012) or a sovereign debt crisis. As can be seen in Figure 2, average tax revenues in the OECD fell by almost 1.5 percentage points from 2007 (33.6%) to 2009 (32.3%) before rising from 2010 on. Therefore, the effect of these two dummy variables is *ex ante* ambiguous. Some countries responded to the crises by implementing austerity measures and raising taxes in order the stabilize public finances particularly in relation to rising interest rates and debt levels (Bozio et al. 2015) whereas banking crises are also associated with a decline in tax revenues (Rogoff and Reinhart 2008, Limberg 2020). To construct the dummy variables, information on the years individual countries experienced a crisis was taken from the data on systemic crises from Laeven and Valencia (2018) and the Systemic Banking Crises Database II of Laeven and Valencia (2020).

Digitalization is our primary variable of interest and as discussed previously is a measure of the number of IP addresses (IPv4 and IPv6) allocated per capita. This variable has been used in Csonto et al. (2019). On the one hand, digitalization should have a positive effect on tax revenue via the direct and indirect channels. On the other hand, a highly digitalized economy could see a negative relationship, as digitalization exacerbates the problems of tax base erosion and profit shifting. A correlation matrix for all variables is included in the appendix (Table 6).

Empirical Model

The empirical model estimated is based on the literature, theoretical considerations and the hypothesis that digitalization is a relevant determinant of tax revenues. Thus, panel data analysis is deemed to be the most appropriate approach.

Static Analysis

The following regression is estimated (with subscripts *i* and *t* representing each country and time period, respectively):

$$TaxRev_{it} = \beta_0 + \beta_1(LnGDPpc_{it}) + \beta_2(AgriGDP_{it}) + \beta_3(TradeGDP_{it}) + \beta_4(IndustGDP_{it}) + \beta_5(GovtDebtGDP_{it}) + \beta_6(UrbanPop_{it}) + \beta_7(Unemployment_{it}) + \beta_8(inFDIGFCF_{it}) + \beta_9(Inflation_{it}) + \beta_{10}(POPgrowth_{it}) + \beta_{11}(PolRights_{it}) + \beta_{12}(CivLib_{it}) + \beta_{13}(BankingCrisis_{it}) + \beta_{14}(SovCrisis_{it}) + \beta_{15}(Digital_{it}) + \eta_i + \delta_t + \upsilon_{it}$$

where η_i are time invariant unobservable country-specific effects, δ_t are time effects and υ_{it} the error term.

To determine the model specification, we begin with the standard pooled ordinary-least-squares method (POLS), followed by a fixed effects (FE) method – using diagnostic tests, it is determined that the fixed effects model is preferable to the POLS and a random effects (RE) model using the standard F-test and Hausman test (Hausman 1978) test. Following further diagnostic tests, it was determined that time-fixed effects should be included in the model and that there is a presence of heteroscedasticity (modified Wald statistic), cross-sectional/temporal dependence (using Pesaran's test for cross-sectional independence (Pesaran 2004)) and serial correlation in the error term (Wooldridge test for autocorrelation). Therefore, the Pooled OLS and FE model are estimated with Driscoll and Kraay (1998) standard errors which account for and correct standard errors given these characteristics.

Dynamic Analysis

Extending the static analysis to a dynamic panel data analysis by including a lagged dependent variable on the right hand side is important for two reasons: Firstly, the inclusion of a lagged dependent variable in the model is required in order to examine the relationship between previous values of tax revenue as a percentage of GDP on current year values. In the literature, it has been found that prior tax revenues are a determinant of current revenues. Secondly, it is needed to test the possibility that an omitted lagged dependent variable is causing model misspecification and giving rise to autocorrelation. Thus, an extended General Method of Moments estimator is applied as proposed by Blundell and Bond (1998) which uses lagged differences of Y_{it} as instruments for equations in both levels and first differences, i.e., the system GMM estimation (or sys-GMM). To allow this dynamic panel data analysis, it was required to take a sub-sample, which was done on the basis of time. For this purpose, the sys-GMM was applied to the data for the years 2007 to 2018, the period in which the average allocation of IP addresses per capita, our variable of interest which acts as a proxy of digitalization,

increased substantially across the OECD (see Figure 3). Reducing the time period analyzed is also necessary to avoid instrument proliferation and to ensure that the short N, long T requirement is met. The sys-GMM estimator is based on the assumption that disturbances are not serially correlated, as otherwise the estimator would be inconsistent. Thus, tests of autocorrelation up to order 2 in the first-differenced residuals are required. The test of serial correlation in the first-differenced residuals is consistent with the maintained assumption of no serial correlation. The AR(2) test fails to reject the null hypothesis that the first-differenced residual error term is not second-order serially correlated, while the AR(1) test rejects the null (at 5 per cent level of significance). The results of the sys-GMM dynamic panel data are presented in Table 3.

Results

Two estimation methods are employed: pooled OLS and fixed effects (FE) in a static analysis. Both specifications include year dummies; standard errors are robust to arbitrary heteroscedasticity and serial correlation. The results of the chosen estimators (Pooled OLS with Driscoll-Kraay Standard Errors (model 1) and Fixed Effects with Driscoll-Kraay standard errors (DKSE) (model 2) presented in Table 2.

Table 2. *Results of the Static Model*

	(1)	**(2)**
	Pooled OLS DKSE	**Fixed Effects DKSE**
LnGDPpc	7.422***	-5.525***
	(0.389)	(0.941)
TradeGDP	0.01**	-0.001
	(0.004)	(0.005)
AgriGDP	0.02	-0.903***
	(0.162)	(0.123)
IndustGDP	-0.232***	-0.08*
	(0.065)	(0.042)
GovtDebtGDP	-0.011***	0.032***
	(0.004)	(0.003)
UrbanPop	0	0.081***
	(0.02)	(0.028)
Unemployment	0.286**	-0.134***
	(0.122)	(0.029)
inFDIGFCF	-0.831	-0.005
	(1.007)	(0.148)
Inflation	0.312***	-0.015
	(0.053)	(0.019)
PolRights	-3.273***	-0.047
	(0.577)	(0.306)
CivLib	-0.022	-0.052
	(0.519)	(0.158)

POPgrowth	-3.07***	0.563**
	(0.398)	(0.248)
BankingCrisis	-1.705**	-0.452**
	(0.63)	(0.162)
SovCrisis	1.17	1.91***
	(0.917)	(0.447)
Digital	-0.218***	-0.074***
	(0.047)	(0.011)
Cons	0	89.524***
	(0)	(11.581)
Observations	787	787
(Within) R squared	0.4864	0.3475
Year Fixed Effect	Yes	Yes

Standard errors are in parentheses.
***p<0.01, **p<0.05, * p<0.1

Table 3. *Sys-GMM Dynamic Panel Data Analysis 2007–2018*

TaxRev	**Sys-GMM**
$TaxRev_{t-1}$	1.169***
	(0.124)
LnGDPpc	-2.484*
	(1.321)
TradeGDP	-0.003
	(0.004)
AgriGDP	-0.139
	(0.133)
IndustGDP	-0.018
	(0.046)
GovtDebtGDP	0.007
	(0.005)
UrbanPop	0.012
	(0.019)
Unemployment	-0.135*
	(0.077)
inFDIGFCF	0.045
	(0.164)
Inflation	-0.049
	(0.038)
PolRights	0.363
	(0.416)
CivLib	-0.227
	(0.334)
POPgrowth	0.613
	(0.389)
BankingCrisis	0.442
	(0.236)
SovCrisis	0.449
	(0.615)
Digital	0.059*

	(0.031)
Constant	20.292*
	11.651
Number of obs.	786
Number of groups	36
Number of instruments	32
AR(1)	0.000
AR(2)	0.467
Hansen test	0.545

Standard errors are in parentheses.
***p<0.01, **p<0.05, * p<0.1

Discussion

In terms of the static analysis which examined the determinants of tax revenues for 36 OECD countries over the period from 1995 to 2018, the results are broadly in line with expectations. The coefficient for GDP per capita is negative and significant at the 1 per cent level. The share of value added contributed by agriculture is also negative and significant at the 1 per cent level, as is the unemployment level. The coefficients of the share of the urban population, the sovereign debt crisis and the level of government debt to GDP all have a positive sign and are all significant at the 1 per cent level, with population growth positive at the 5 per cent level. Meanwhile, the existence of a banking crisis is negatively related to tax revenues at the 5 per cent level. While this is in line with the theory (see Limberg 2020), caution is needed in interpreting the relationship as data on the digitalization proxy was unavailable for the United States and Canada for the years 2008 and 2009 which may have impacted the results.

While Gnangnon and Brun (2018) consider an "Internet gap" (i.e., the ratio of a country's internet usage intensity to the world average internet usage intensity) and tax capacity in a sample of 164 countries, their findings suggest that by reducing the Internet gap, countries can raise their public revenues with low-income countries standing to benefit the most. Gnangnon and Brun (2019) examine the Internet on resource versus non-resource tax revenue for 99 countries, finding that a higher Internet usage intensity has a negative effect on resource revenue and a positive effect on non-resource revenue (again with the impact of the Internet being more significant for less developed countries). In the present study, the variable of primary interest, a broader proxy measure of digitalization, is negative and significant at the 1 per cent level in the static analysis. This indicates that digitalization may indeed have a negative effect on the ability of governments in relatively highly digitalized and high tax jurisdictions to raise taxes – providing some evidence in support of Tanzi's fiscal termite warning. Thus, digitalization may indeed be exerting downward pressure on revenues generated which may be a factor in explaining the role of policymakers in OECD countries pushing, via the OECD itself and the OECD/G20 framework, for a multilateral solution to the tax challenges of digitalization.

Based on the dynamic analysis of the subsample of 2007–2018, most variables maintain the sign of their coefficient but lose significance. It can be noted that the lagged dependent variable is positive and significant at the 1 per cent level, showing prior year values of the overall tax burden are good determinants of current year values as expected according to the literature. However, in the dynamic analysis for the subsample of 2007–2018, the variable of interest, namely digitalization, is now positively related to tax revenues but only at the 10 per cent level, contrary to what could be expected in line with Tanzi's fiscal termite prognosis. This suggests that the rapidly increasing digitalization in more recent years (with the diffusion of mobile devices etc.) has in fact had a positive effect on tax revenues. Thus, the findings for digitalization across both the static and dynamic analyses here are ambiguous and must be interpreted with caution. However, the findings are interesting and may nevertheless be useful in the policy debate as they may temper overly positive or negative attitudes on digitalization and tax capacity.

One question that could be raised concerns the argument that macroeconomic data such as gross domestic product, and by extension tax revenues as a percentage of GDP, are increasingly being misstated due to, for example, zero priced digital services and the role of prosumers (Welfens and Perret 2014, Ahmad et al. 2017, Moulton 2018, Itkonen 2019, OECD 2020a). Even a minor restatement of GDP upwards to reflect the realities of the modern digitalized economy, could see tax revenues (expressed as a percentage of GDP) plateauing or even falling. A better denominator for expressing comparable tax revenues across countries may better facilitate using macroeconomic data to analyze the true effects of digitalization on tax revenues.

It may be hard for policymakers to maintain broad support for new digital taxes when tax revenues are already seen to be stable or rising, particularly when digital firms with market power can pass the burden of new taxes completely on to users. If digitalization does indeed pose a threat to tax bases, governments must ensure the best possible data is available to support this argument.

Conclusions

The present paper contributes to the literature by placing a specific focus on OECD countries and examining macroeconomic determinants of tax revenues in a departure from previous contributions to the literature. It is found that digitalization may indeed have a negative impact on developed and highly digital countries' tax revenues, possibly supporting the position of national governments in seeking to find a new multilateral solution to the tax challenges of digitalization. However, results should be interpreted with caution considering the effect found in the static and dynamic analyses.

The findings lend support to previous findings in the literature that a country with high GDP per capita, a low share of inward FDI in relation to gross fixed capital formation, a sizeable industrial sector relative to the agricultural sector, an urbanized and growing population and the protection of civil liberties and

democratic institutions is more likely to be in a position to generate higher tax revenues. Meanwhile, high levels of unemployment and the existence of a banking crisis may have a negative effect on tax revenue generation.

While digitalization and its impact on tax revenues have been to the forefront of national and international discussions on public revenues in recent years, previous studies which have considered large samples of developed and developing countries have found that ICT (usually based on Internet intensity) is positively related to tax revenues – providing evidence against Tanzi's fiscal termite outlook and against the focus placed on digitalization and tax by policymakers, nationally, at an EU level and at the global level (OECD/G20). However, these results may be affected by the heterogeneity of these larger samples of developed and developing countries in terms of level of economic development, tax capacity and the extent of digitalization with the marginal gains for less developed countries possibly masking the effects for more developed and digitalized firms. Future research could consider to expand the sample of countries considered here, to include non-OECD countries which are highly digitalized.

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Appendix

Table 4. *Definition and Source of Variable Used in the Analysis*

Variable	Definition	Source
$TaxRev_{it}$	Tax revenue as a percentage of Gross Domestic Product (GDP)	OECD
$lnGDPpc_{it}$	Log of GDP per capita of country *i* in year *t* in 2010 International Dollars	World Bank/World Development Indicators
$TradeGDP_{it}$	Sum of exports and imports of goods and services as % of GDP	World Bank/World Development Indicators
$AgriGDP_{it}$	Agriculture, forestry and fishing value-added as a % of GDP	World Bank/World Development Indicators
$IndustGDP_{it}$	Industry (including construction) value-added as a percentage of GDP	World Bank/World Development Indicators
$GovtDebtGDP_{it}$	General government gross debt as % GDP	World Bank/World Development Indicators
$UrbanPop_{it}$	Urban population as % of total population	World Bank/World Development Indicators
inFDIGFCF	Inward FDI as a % of Gross Fixed Capital Formation	Own calculation using data from World Bank/World Development Indicators
$Unemployment_{it}$	Unemployment, total (as % of total labor force)	World Bank/World Development Indicators
$Inflation_{it}$	Annual consumer price inflation in percent	World Bank/World Development Indicators
$PolRights_{it}$	Political rights	Freedom House (2020)
$CivLib_{it}$	Civil liberties	Freedom House (2020)
$POPgrowth_{it}$	Growth rate of the total population in percent	Own calculation using data from World Bank/World Development Indicators
Banking Crisis	Dummy variable on annual basis if respective country experienced a banking crisis. Crises over 5 years are truncated at 5	Laeven and Valencia (2018, 2020)
SovCrisis	Dummy variable which takes the value of 1 in years when a country is experiencing a sovereign debt crisis. Crises over 5 years are truncated at 5	Laeven and Valencia (2018, 2020)
Digital	Digital penetration/intensity – allocation of IP addresses per capita	Own calculation based on data provided by APNIC

Source: Own representation.

Table 5. *IP Allocations per Capita 2018*

Country	IP Allocations Per Capita 2018
Iceland	50.1452426
Sweden	41.3802219
Luxembourg	34.0464056
Netherlands	26.314549
Australia	25.4440285
Norway	24.9034517
Switzerland	21.3199972
United Kingdom	19.6373991
Germany	15.3133055
Denmark	14.7342418
Estonia	14.1491191
United States	13.8604189
France	13.1182164
Finland	12.5364134
Ireland	12.4845324
Czechia	11.3123851
Austria	11.0702509
Slovenia	10.3860394
Italy	9.17202016
Korea	8.8472736
Belgium	8.78872828
Poland	7.75557301
Latvia	7.06380967
Japan	6.63836143
Spain	6.22539814
Lithuania	5.57558953
Slovakia	5.46876682
New Zealand	4.43992795
Israel	3.89469461
Canada	3.10869289
Hungary	3.02623417
Portugal	2.82440967
Greece	2.13103752
Turkey	1.4729257
Chile	1.07825706
Mexico	0.4276671

Source: Own representation and calculations based on APNIC data.

Table 6. *Correlation Matrix*

Variables	TaxRev	Ln GDPpc	Trade GDP	Agri GDP	Indust GDP	Govt Debt GDP	Urban Pop	Unemp-loyment	inFDI GFCF	Infla-tion	Pol Rights	Civ Lib	POP growth	Banking Crisis	Sov Crisis	Digital
TaxRev	1.000															
LnGDPpc	0.465	1.000														
TradeGDP	0.189	0.149	1.000													
AgriGDP	-0.316	-0.586	-0.237	1.000												
IndustGDP	-0.356	-0.350	-0.179	0.123	1.000											
GovtDebtGDP	0.164	0.217	-0.261	-0.223	-0.254	1.000										
UrbanPop	0.092	0.432	-0.102	-0.126	-0.288	0.114	1.000									
Unemployment	0.061	-0.400	-0.050	0.175	-0.151	0.190	-0.253	1.000								
inFDIGFCF	0.067	0.159	0.459	-0.150	-0.160	-0.074	0.100	-0.046	1.000							
Inflation	-0.243	-0.408	-0.098	0.618	0.157	-0.173	-0.185	0.041	-0.053	1.000						
PolRights	-0.471	-0.477	-0.148	0.523	0.201	-0.088	-0.098	0.047	-0.101	0.621	1.000					
CivLib	-0.399	-0.540	-0.229	0.481	0.173	0.033	-0.101	0.157	-0.134	0.559	0.739	1.000				
POPgrowth	-0.166	0.368	-0.018	-0.017	-0.048	-0.162	0.407	-0.390	0.085	0.100	0.155	0.099	1.000			
BankingCrisis	-0.005	-0.002	0.072	-0.054	-0.125	0.108	-0.062	0.127	0.082	0.090	0.010	-0.009	-0.065	1.000		
SovCrisis	0.034	-0.046	0.030	0.010	-0.053	0.168	-0.001	0.218	-0.026	-0.050	0.069	0.015	-0.115	-0.011	1.000	
Digital	0.098	0.398	0.079	-0.270	-0.154	0.030	0.239	-0.242	-0.077	-0.151	-0.146	-0.242	0.205	-0.099	-0.010	1.000

Source: Own calculations.

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Integration of Agile Approaches in SME's Product Development: Demand Analysis and Concept Development

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In times of a complex, uncertain and dynamic world with increasingly faster product life cycles agile approaches in the early phase of product development are demanded in small and medium sized enterprises (SME's). Despite the high demand, there is still no generally valid and need-specific solution concept for the integration of agile approaches due to different company specific requirements such as the level of maturity, experience and application purposes. Within this research, the question about the actual needs as well as the corresponding design of a concept for integrating agile approaches in product development for SME requirements is tackled. In order to identify existing challenges in the field of agile product development an empirical study with eleven mechanical engineering companies is conducted and analyzed. By using agglomerative-hierarchical clustering, three distinct types of SME's with similar needs are structured. As a result, this research proposes a systematic procedure, enabling SME's to be clustered by their needs and enable the integration of agile approaches through a problem-oriented roadmap with specified recommendation of actions. Enhancing the integration and application of agile approaches effectively in product development projects, the level of agility appropriate to the situation and needs must be identified and introduced. Therefore, the potential that arises from the process-oriented support of the product development teams in the early phase of innovation projects will be outlined.

Keywords: *agile approaches, needs analysis, small and medium sized enterprises, clustering, product development, mechanical engineering*

Introduction

Many SME's are confronted to counter the pressure of the VUCA (volatile, uncertain, complex, and ambiguous) world (Nandram and Bindlish 2017) and aim at integrating agile approaches due to the necessary adaptivity and flexibility (Dose and Drexler 1988, Kastelle 2013). Especially in the early phase of product development, in which the product gets initially designed and can usually still be flexibly adapted, the use of agile approaches can be of great advantage (Albers et

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al. 2019a, 2f., VersionOne Inc. 2019).According to different studies these advantages are increased flexibility to respond to changes and handle complexity, increased transparency and improved communication within the development teams as well as an improved satisfaction of customer needs (Atzberger et al. 2020, VersionOne Inc. 2019, we.Connect 2018).

Despite the benefits as well as the increasing need of agility, there are only a few SME's in the mechanical engineering context using agile approaches in their product development because of generic and therefore insufficient instructions of integrating agile approaches (Fritsch and Juschkat 2019, VersionOne Inc. 2020). The majority of instructions are based on specific best-cases, designed for specific companies and methods regarding the needs and features of individual SME's (Gloger and Margetich 2014, 90f, Mathis and Leffingwell 2018, 90f). This makes the integration of agile approaches into other companies more difficult and requires a high degree of customization. Heimicke et al. (2019), who evaluated potentials and limitations of the approaches in mechatronic system development, points out that the current approaches are well suited for their respective purposes. "However, they lack the conscious integration of technical or process-related knowledge" (Heimicke et al. 2019).

Since there is still little experience in the research field of the integration of agile approaches into the early phase of product development, this research investigates which practical problem areas exist, how a concept for company specific requirements and characteristics needs to be set up and how this can be facilitated by process oriented support in order to promote agile product development in SME's. To achieve the goal of desinging a new generally adaptable but differentiated approach to integrate various agile approaches, a clustering has been conducted. This enables a grouping of different SME's with similar requirements. Based thereon cluster-specific measures can be derived and presented in the developed concept.

Literature Review

The state of art describes the product development in SME as well as different agile approaches in product development and their action systems of methodically support for the implementation through specific roles.

Product Development in SME

Small and mid-size enterprises are not able to apply the state-of-the-art research which is based on an understanding of larger corporates as they have unique characteristics. As Welsh et al. (1982) already stated, SME's are not miniature versions of large corporates. Meaning that methods and techniques, that are working for large corporates do not necessarily work also for SME's. Therefore, research needs to consider companies in a more granular view.

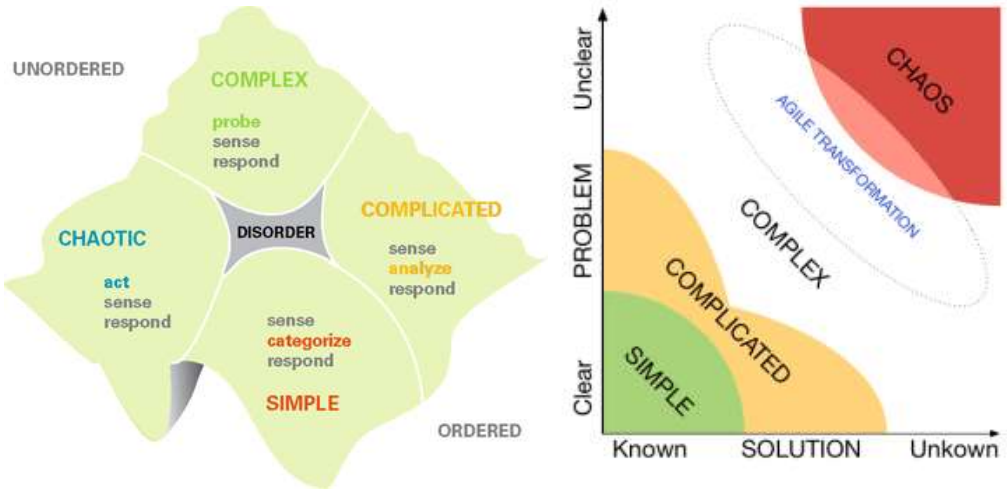
When it comes to new product development and innovation management, SME's are facing different challenges then large corporates. Limited resources (Bicen and Johnson 2015, Massis et al. 2018), family influence (Kammerlander

and Prügl 2016), risk aversion of following generations (Kammerlander and Ganter 2015) and a low degree of process formulization (Berends et al. 2014) are just a few factors which are discussed in the current literature. Especially the low degree of formalization of SME's leads to low internal bureaucracy. Therefore, in terms of innovation they rather follow an experimental approach with close resource orientation instead of a highly formalized process (Berends et al. 2014, Massis et al. 2018). Thus they seldom pursue a systematic and method-based collection of information and ideas in the product development process. Furthermore, agile approaches can only rarely be found in the product development of SME's (VersionOne Inc. 2020).

Agile Approaches in Product Development

One of the most complex processes in companies are the innovation processes as they are characterized by a high degree of uncertainty regarding the problem and solution space (Schoeneberg 2014, 65ff). To classify problems in product development the two models Stacey Matrix and Cynefin Framework (see Figure 1) can be applied. They show that agile approaches are suitable if the described situation or process is particular complex or chaotic while complicated and simple problems can be solved by traditional plan-based methods (e.g., the waterfall method) (Fuchs et al. 2019, 202f). Hereby the Cynefin Framework (see Figure 1, left) divides problems into simple, complicated, complex and chotic problems. Whereas the Stacey Matrix sorts these 4 problem types regarding the scale of the problem and the solution.

Figure 1. *Cynefin Framework and the Stacey Matrix*



Source: Giom. Blog. 2019, Snowden and Boone 2007.

To handle the complexity, different approaches such as SCRUM, Design Thinking, lean start-up as well as scaled approaches like LeSS[5] and SAFe[6] are used in product development nowadays (Atzberger et al. 2020, Heimicke et al.

[5]LeSS stands for "Large Scale Scrum".
[6]SAFe stands for "Scaled Agile Framework".

2019). Further approaches are in research, for example the systematic approach of ASD-Agile Systems Design which handles the situation-adequate integration of agile elements into mechatronic system development (Albers et al. 2019b).

The agile approach of Design Thinking focuses on customer and user needs and iteratively determine the needs and requirements in an early phase. (Plattner, Meinel and Leifer 2011) In the agile project management framework Scrum, this is done through several feedback rounds in which Minimal Viable Products (MVP) are presented and evaluated until the product finally complies with the customer's needs. (Schwaber 2017) The approach of ASD – Agile Systems Design focuses on a systematic combination of structuring and flexible elements in the product development process in order to support development teams in mechatronic system development. As every project is unique, ASD does not provide ready-made instructions, but supports teams in using the right methods in the development process to enable agility. (Albers et al. 2019b).

Enabling Agile Product Development through Methodical Support

To methodically support the realization of agile approaches, current agile approaches as SCRUM, Design Thinking or ASD-Agile System Design enhance the implementation by the involvement of a process oriented role such as the Scrum Master, Design Thinking Coach or Innovation Coach. Additionally, a common role in practice to introduce agile approaches in general is the Agile Coach (Barafort et al. 2014, O'Connor and Duchonova 2014). The Scrum Master is responsible for promoting and supporting Scrum by helping everyone understand the Scrum theory, practices, rules, and values (Schwaber 2017). In comparison the Design Thinking Coach works with the development teams and focuses on a context-related, goal-oriented and sustainable application of the Design Thinking approach (Plattner et al. 2011). Innovation Coaching is a specialized concept for process-oriented support of people in agile product development projects. Core elements are the communication of agile ways of thinking, the ability to apply various methods appropriate to the situation and need of the teams situation as well as the conscious control of team development. (Niever et al. 2019) These different roles are implemented for the methodically support of development teams for specific agile approaches with the goal to establish a dynamic, user-centered and goal-oriented innovation culture within a project and furthermore scaled within the organization. Global studies show the high relevance of methodically support for the implementation of agile approaches and furthermore that internal agile coaches are the most valuable in helping to scale agile approaches in organiszations (VersionOne Inc. 2019, we.Connect 2018).

Integration of Agile Approaches in Product Development

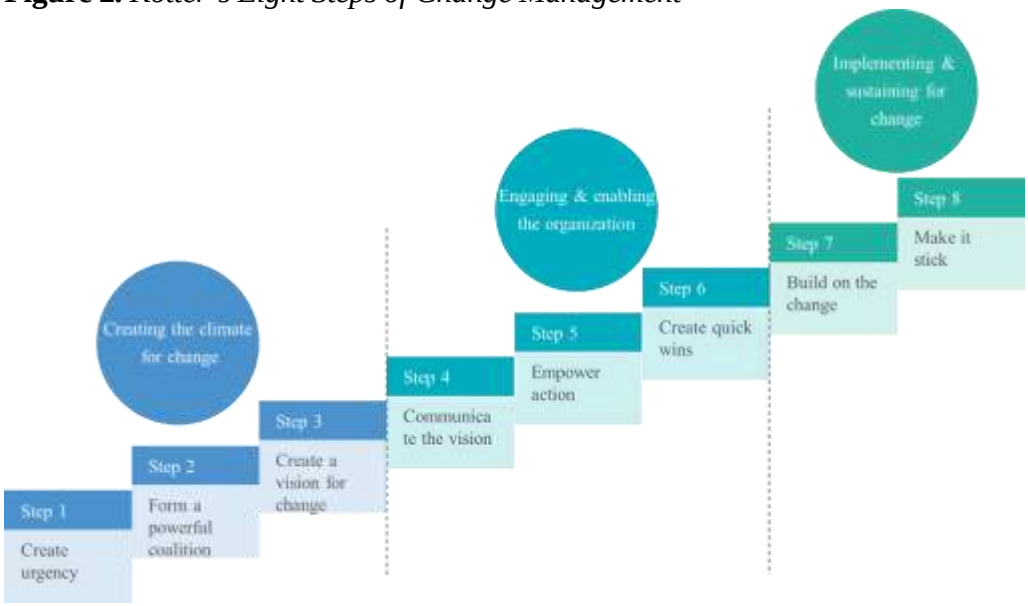
In previous literature, a variety of different applications and instructions are available for integrating agile approaches into the product development process. Of these, three frequently used types of approaches in particular were identified

(Gloger and Margetich 2014, 98f, Leffingwell 2020, Mathis and Leffingwell 2018) and will be presented with some examples in the following.

The first type of integration approaches are top-down measures for problems based on practical experience. Exemplary instructions for action are encouragement of self-organization and decision-making, promoting employees with agile coaching competences or room furnishings decision enhancing agile work (Gloger and Margetich 2014, 98f). There are also measures designed to fight problems during the introduction of SCRUM to resolute residual obstacles e.g., by autonomous teams and/or transition teams, promoting employees with integration roles and other adaption measures of organizational structures (Gloger and Margetich 2014, 104f). All these exemplary approaches have in common that agility is introduced via management. Hereby it is noticeable that they often include measures to combat the problems that arise during the introduction of agility concerning its acceptance.

Another type of approach to introduce agility into an organization is the step-by-step instruction (see Figure 2). The basis of this type is the general change management approach of Kotter and Cohen (2012) with the eight steps of change-management which refers to the introduction of new methods into existing organizations.

Figure 2. *Kotter's Eight Steps of Change Management*



Source: own presentation based on Kotter and Cohen 2012.

Another similar step-by-step guide has been introduced in 2008 by Nanda, Groysberg, Prusiner with the 7+1 steps to encounter SCRUM Introduction with resistance (Gloger and Margetich 2014, 124f). Both methods do not hold a recommended path for a specific company and therefore includes the risk of not having the right problem-oriented measure for the integration of agile approaches into different organizations.

The third type of approach is a general concept for a scaled introduction of SCRUM in an organization depending on the size of the company. Examples are

the roadmap Introduction of Scaled Agile Framework (SAFe) and Large Scaled Scrum (LeSS). SAFe scales Scrum into four formats with different suggested approaches of integration to improve the cooperation of Scrum application based on the number of employees and presents a need-based guidance at the enterprise level (Leffingwell 2020). In comparison, LeSS suggests two different design frameworks based on the number of teams on which Scrum is applied to and focuses on product development (Vodde and Larman 2005). Thus SAFe is focused on a need-based guidance at the enterprise level while LeSS is similar to the paper approach in its focus on product development. Nevertheless, SAFe and LeSS are common models in practice which refer exclusively to the introduction of the specific agile approach of Scrum (Maximini 2018, 121f, Siedl 2018, p. 76).

Research Methodology

According to the current state of research, there are many approaches how companies can proceed in order to integrate certain agile approaches in their company (Gloger and Margetich 2014, 98f, Leffingwell 2020, Mathis and Leffingwell 2018). Nevertheless, there are many challenges and open questions how companies, especially SME, can successfully integrate agile approaches, since there are mainly company-specific best practices available for certain agile approaches. These are only suitable for specific companies after thorough examination, major adjustments and are therefore not easy to transfer. To ensure a situation- and need-specific integration of agile approaches into organizations the requirements and organizational structures must be taken into account. Thus, the research question arises, what are the current challenges of companies by the implementation of agile approaches in product development and which support is needed in their business situation? This research investigates the actual challenges and potentials in order to identify which concepts of support are applicable. Build upon these findings requirements are derived for an overarching concept to enable the implementation of agile approaches in product development according to the situation and needs of the companies.

The applied methodical research approach is based on the four phases of the Design Research Methodology (DRM) and intends a scientific and structured research to ensure a scientifically sound result (Blessing and Chakrabarti 2009, Lind 2017, p. 39). In the first phase, the theoretical foundation is built. In order to form a theoretical basis for further research and to identify the research gap, the status quo of the product development integration measures of agile approaches and methodical support roles are presented on the basis of benchmark analysis and method comparisons through literature research.

To guarantee a company-specific and up-to-date practical concept, the second phase, Descriptive Study I, is realized by an empirical study in the specification of 11 expert[7] interviews of different companies in the mechanical engineering

[7]e.g., head of product development, product developer with agile experience, agile coaches working in the product development. Target group were experienced professionals in product development with a leading role the innovation process.

context. For this purpose, two hypotheses for different types of companies with similar needs were derived from the theoretical results and validated with the empirical study of the 11 qualitative expert-interviews:

1) SME's have the core need to integrate and apply agile approaches as efficiently as possible on a smaller scale in order to realize innovations with limited resources due to their scarcity of resources.[8]
2) SME's without agile experience have the core problem of not having enough know-how to implement and integrate agile approaches in their company.[9]

Within the Prescriptive Study, the obtained data is analysed, whereas the main focus is to determine requirements and criteria for the different company situations. A clustering of the heterogeneous individual companies based on the data enables the development of a cluster-specific integration concept with problem-oriented recommendations for action. Here, the agglomerative method of hierarchical clustering is used, as this approach enables an increasing number of clusters with decreasing distance, in order to select the smallest possible number of clusters that makes sense. Furthermore, it ensures a generalized concept which can be transferred to different companies. Since the empirical data are available in categorical form, they are loaded into a Python script and normalized on a scale of 0-1 with a min-max transformation to scientifically prepare and enable the answers to be interpreted.[10] The scaled data is then divided into clusters using the linkage method.[11] Hereby we use the Ward distance method to define the distance in the linkage procedure. Thus two clusters whose increase in variance by merging them is the smallest, are combined into one common cluster (Cleff 2019, 417f). In order validate its performance, the developed concept was applied at a practical workshop, according the Descriptive Study II. Against this background, the results were evaluated and action measures are derived (Lind 2017, 39f).

[8]This hypothesis is based on the characteristic of SME's compared to large corporations to have scarcer resources. Accordingly, it is in their increased interest to apply agile methods without high capital expenditure and to develop innovations as efficiently and effectively as possible.

[9]This hypothesis is based on the assumption that some SME's have neither the capacity nor the know-how to deal with the implementation and application of agile methods.

[10]The min-max rule thus sets the highest value of the variable (in this case per column in figure 5) as 1 and the lowest value of the variable as 0. Using this formula, the data produces is scaled and normalized data, which now successfully lie between 0 and 1 and can therefore be processed further. Narang 2017, p. 614.

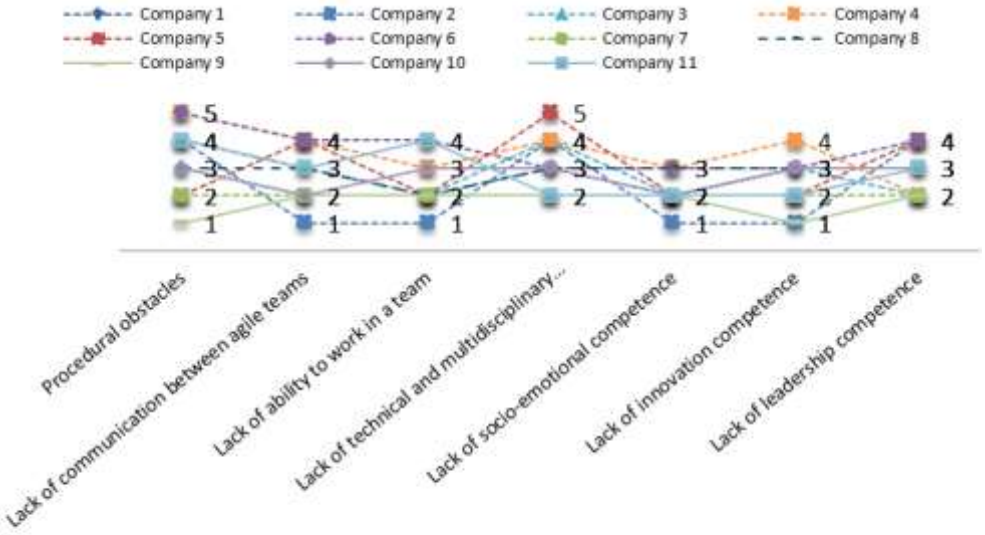
[11]An agglomerative clustering algorithm, in which each object first forms a cluster and then the clusters that have already been formed are gradually combined into larger and larger clusters until all objects belong to one cluster).

Results

Current Challenges of Companies by the Implementation of Agile Approaches in Product Development

To ensure a situation- and need-specific integration of agile approaches into organizations, the needs and organizational structures must be taken into account. In order to identify current challenges of companies and their need for support, the truth content of the presented hypotheses are investigated by analyzing the 11 expert interviews. The results of the study, which have been redacted for data protection reasons, are illustrated in the line chart below (see Figure 3). It illustrates the identified and evaluated problems in the application of agile approaches in the product development of eleven machine-engineering companies. On the abscissa the identified problems are listed and the ordinate describes the severity of the encountered problem using the Likert scale (1 being very weak and 5 being very strong).

Figure 3. *Data Analysis of Problem Fields in Agile Integration and Application*



As a result of the qualitative data analysis the following can be noted: The problems a company faces in integrating and applying agile approaches do not depend on the size of the company, but mainly on the predominant degree of agile approaches and the process-related obstacles in the companies. Employees find it difficult to escape the familiar hierarchical structures and to deviate from the usual waterfall methodology. The hypothesis analysis of the collected empirical data thus shows that the hypotheses are not completely consistent. For example, there are SME's as well as large corporates with high and low process-related obstacles when using agile approaches.

Furthermore, it is noticeable that all companies have serious difficulties with the lack of know-how of agile approaches in product development. However, the

need for agile know-how as well as the need for better communication between and in agile teams are current problems but first must be considered individually for all companies and cannot simply be categorized. Another derivative is the existing lack of understanding of the purpose and added value of agile approaches and accompanying methods for the projects, which prevents their successful application.

The study results show a need for support by the application of methods and tools in the early phase of the product development. Even with the understanding of the methods it is difficult to apply them in the right situation to help the development team to increase their ability to innovate. The application of the right methods in time comes with the big challenge of implementing the appropriate degree of agility that is suitable in the corresponding situation.

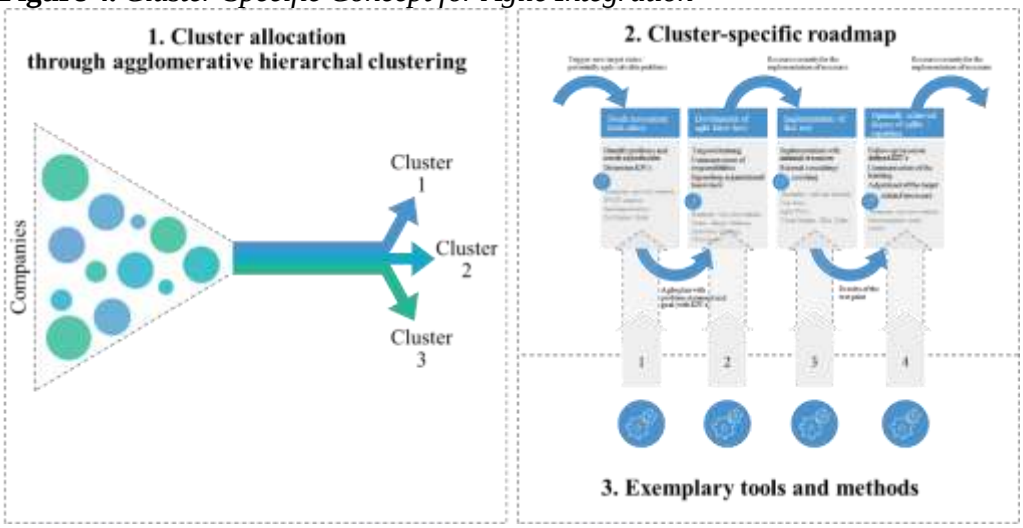
Additionally, the challenge arised, that most of the experts had parallel responsibility for an agile project and tasks of series development. To manage the challenge of running the operating business with incremental improvements as well as simultaneously exploring new possibilities can be assigned to the difficulties of an ambidextrous management. To handle these two action-oriented ways of thinking at the same time a support regarding the prioritization and practical realization would be very valuable.

According to the pre-formulated hypotheses three clusters of companies would result with the respective assumptions. Since the hypotheses could not be fully confirmed in the empirical study and companies also show problems in unforeseen fields, the sole consideration of the number of employees and the agile degree of the company as a clustering dimension is not sufficient to carry out a clear clustering. This allows two conclusions to be drawn for clustering. First, the number of clusters cannot be determined a-priori. Secondly, clustering must be designed in an interpretable way. Finally, companies that are as similar as possible should be grouped together in order to be able to derive cluster-specific action measures that really address the problems for the respective cluster.

Derived Cluster-Specific Concept for Integrating Agile Approaches

With the described status quo in the state of the art as well as the analysis result of the current challenges and needs for support, the research gap in the area of implementing agile approaches in different companies is shown. With the derived requirements for an overarching concept to enable the implementation of agile approaches in product development a problem-oriented concept is developed build upon three parts *cluster allocation, cluster-specific roadmap, exemplary tools and methods* (see Figure 4).

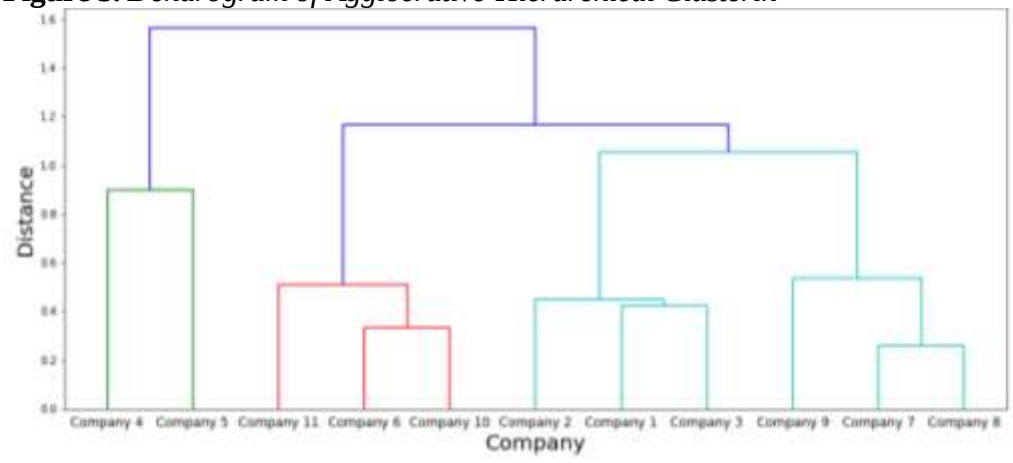
Figure 4. *Cluster-Specific Concept for Agile Integration*



1st Part of the Concept: The Problem-Oriented Clustering

After applying the ward method, explained in the methodology, the clustered companies are presented in a dendrogram (see Figure 5). To determine the optimal cluster number and thus the final clusters, a dividing line must be drawn where the heterogeneity (the increasing distance) increases the injections (the number of clusters). Here the elbow plot is created as it can indicate when such jumps occur (Cleff 2019, p. 418). Under consideration of the elbow plot and previous knowledge of the analysis of the surveys (Kassambara 2017, 101 f), three clusters were formed ex-post as a result.

Figure 5. *Dendrogram of Aggloerative-Hierarchical Clusterin*



The clustering allows an allocation into groups of companies with similar agility needs and results in three clusters with following features (Table 1).

Table 3. *Resulting Cluster*

Cluster 1: No or few agile experience	Cluster 2: Agile experience without procedural obstacles	Cluster 3: Agile experience with procedural obstacles
• Degree of optimal agile product development unclear • Know How - Lack: Organization and new methods • Lack of communication between product development teams • Lack of personnel resources • High risk	• Agile know-how usually through internal training • Lack of understanding and application of agile approaches • Goal: Extend the methodology toolbox (e.g., SAFe approach) for optimized and integrated product development • Communication problems	• Know How - lack in agile approaches (quality assurance is missing) • Procedural obstacles • Product Owner is the Manager (not always suitable) • Management support missing (necessary for fundamental change) • Organizational structures/projects set too late for agile application

2nd Part of the Concept: The Cluster-Specific Roadmap

To integrate agile approaches in a problem-oriented way, corresponding cluster-specific roadmaps are formed based on the findings of the clustering and state of the art problem solving methodologies. The diverse problem severity of the three differentiated clusters is analyzed in addition with the clustered findings of our empirical study and theoretical approaches. Based on this knowledge cluster-specific approaches and recommendations for action are derived to ensure a problem-oriented integration of agile approaches.

Figure 6. *Roadmap to Integrate Agile Approaches for Cluster 1*

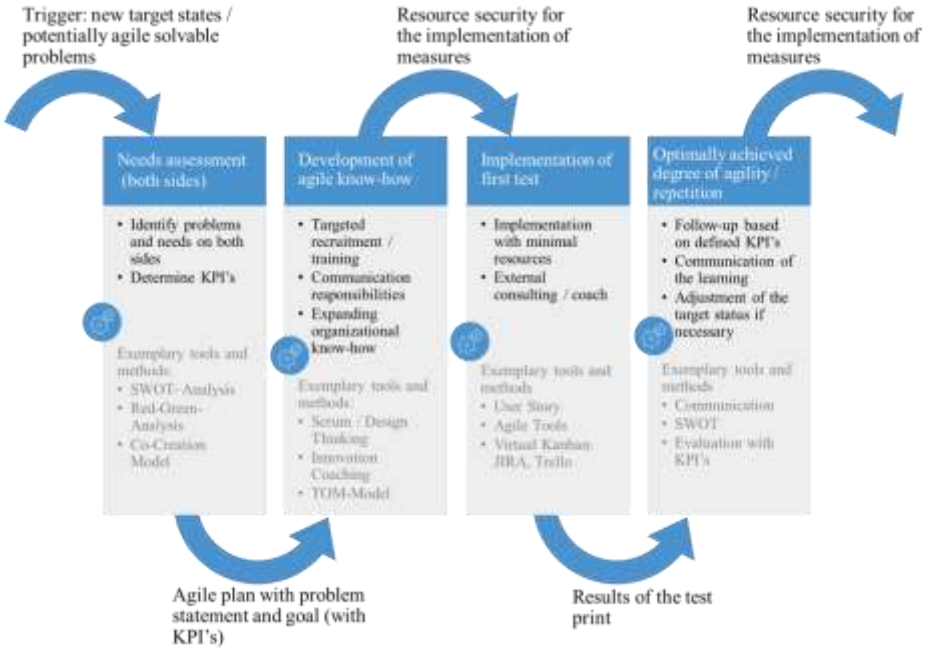


Figure 6 illustrates the four steps of the concept with its in- and output for integrating agile approaches into the product development by the example of the first cluster, companies with no or few agile experience. Exemplary tools and methods which are suitable in these steps are represented by the gears below the steps.

The first step consists of a two-way need analysis in which both, management and product development, analyze what their needs are in the actual situation and whether agile approaches are the right solution. If agile approaches have been chosen with the help of a suitable method, the second step is to build up the know-how of agile approaches and appropriate methods and tools to create the resources for their application. The third step is a first test sprint of the chosen agile approach (due to the lack of experience of the cluster) with recommended methodological support. In the last step the test sprint is post-processed and the new status quo is validated. The involvement of the management is recommended for a comprehensive understanding of all stakeholders and for a possible decision-making in the area of budget or personnel. After the evaluation of the last step, the optimal degree of agility should be reached or the process starts all over again with the determined changes.

3rd Part of the Concept: Tool and Methods for Integrating Agile Approaches

As assistance, a collection of tools and methods for implementing the four roadmap steps in the concept is also added as a third part of the concept. Exemplary methods and analysis tools are the SWOT-Method or the Co-Creation model for the need assessment in the first step of the roadmap which are represented in Figure 6 (Anthony et al. 2019, Bormann et al. 2019, p. 136). These tools and methods are only a few of many methods which can be applied for a structured support of implementing the roadmap and thus can be extended as desired.

Discussion and Limitations

Through the empirical study a research progress was achieved with regard to the current challenges of companies in the integration of agile approaches. Cluster-specific focal points of these challenges were identified. Different problem areas in agile product development were derived which need to be tackled in order to enhance the effective integration of agile approaches. Resulting from the descriptive study, actual challenges of the companies are a lack of knowledge about agile approaches and the application of the corresponding methods. Additionally, the given lack of understanding the purpose and added value of agile approaches prevents a successful implementation. Thus there is a need for support within the management as well as the development team in order to enable a situation- and demand-based application of methods.

Especially within SME´s the leadership competence seems to be important. As teams are smaller and communication channels faster the misleading image

could appear that agile approaches are not necessary. Hence management skills are mandatory in order to integrate a need-driven agile approach. Particularly transparency and open communication within agile development teams must be actively promoted by the management as well as by each team member. This result is comparable with the study results from the state of research which analyzed companies' product development in general.

One of the major advantages of this research is the integration of a need-driven approach. As stated above, SME are not miniature versions of corporates and therefore have different needs when it comes to agile approaches. The knowledge obtained from the expert interviews as well as the validation results within a workshop, indicate the demand of integrating a situation and need specific level of agility into the product development projects. To identify the needs as well as the opportunities by using the presented concept there is a high demand for a process-oriented support of the people working in the early phase of product development projects. This could be ensured by the agglomerative hierarchical clustering (the first part of the concept) and the derived problem-oriented roadmap and tools in our proposed concept.

A potential drawback of this study may be the number of samples. However, here we focus on qualitative expert interviews to ensure highly qualitative data source with high explanatory factor. We do recommend an additional crowdsourced, quantitative interview study as we expect a large differentiation in the (partly unidentified) answers of the actual problem settings. Additional, the information about organizational structures and the type of organizational integration are highly company-specific and sensitive as well, thus they are often not readily revealed.

Due to the main focus of the paper on product development in mechanical engineering, other interesting areas and industries are mostly left out. In the long-term we recommend to transfer the concept to product developments in larger companies or SME´s in different industries as they might have similar needs and attributes in their integration of agile approaches. Further research should investigate the use of process oriented support of development teams and help them integrate agile approaches according to the developed roadmap. Coaching approaches that take into account the needs of each team depending on the situation are promising with regard to the goal of introducing an appropriate level of agility.

Conclusion and Outlook

In this paper we tackled the question of how a concept for integrating agile approaches in product development for different SME requirements needs to be designed. This research gap was narrowed by identifying the actual problems and needs of the SME's. Upon these conclusions a generic and problem-oriented integration concept was developed to consider the different needs of SME's in the context of agile product development.

In order to increase its validity, the concept was applied and optimized in a workshop with four experts from practice. As a result, the concept including its structure and individual parts was rated "very good" or "good" in regards of its added value, showing the sense of the concept. We further validated, that the methodological support through an internal coach leads to a higher contribution of the current implementation of agile approaches, according to the statements within the workshop discussions. In summary, all research questions within the scope of the paper are answered and the goal of developing a concept with a high generalisation character, which contains need-specific measures and methods for its cluster-specific problems, is achieved.

Concluding, the developed cluster-specific concept represents an initial practical integration and application model of agile approaches for different product developments. Due to the three defined clusters, which are based on the experiences and current expert knowledge of different companies, our proposed concept illustrates a problem-oriented concept with transferability. Thus, the concept defines a basis with high potential to facilitate and optimize the integration and application of agile approaches in product development for every company in the future.

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Open Innovation: A New Source of Business Competitiveness

By Saïd Oubaziz[*] & Dalila Matmar[±]

The appearance and diffusion of new forms of innovation called open, lead us to question the relevance of this new paradigm, access to a reformulation of the traditional vision, dedicated to internal control of the R&D process, towards a broadening of practices, including external opportunities in terms of ideas, technologies and skills required. It is clear that the efforts of companies in the field of innovation must enable them to reach a significant level of control, which will allow them to obtain a strategic positioning in terms of competitiveness. However, the major transformations of the last 30 years, in the technological, social and economic fields, have had significant effects and a very strong impact on the level of competitiveness of companies. It is undeniable that innovation is not only the sign of the vitality of a company, according to (Schumpeter), but also, a base on which will be the sustainable economic development of a society. Several experiences in the world, show the development of innovative strategies in the field of innovation, in its different forms, which consist in implementing a policy of strengthening individual and collective initiatives, by implementing new models of support to innovation, as the model of open innovation. Indeed, this form of innovation management tends to strengthen inter-company relationships and to increase the exchange of information and cooperation between the company and its partners. The objective of this work is to highlight the challenges of open innovation, by structuring networked companies around open innovation (BCG and CMI report 2008), and the opportunities offered by the latter to companies. This new vision which, according to (Chesbrouch 2003), no longer consists in being satisfied with the internal resources of the company, but rather in relying on the capacity for innovation of multiple external stakeholders.

Keywords: *open innovation, co-creation, crowdsourcing, business ecosystem, network ambidextria*

Introduction

The search for greater competitiveness of companies and a better adaptation of organizational structures to changes in the economic, social and technological environment, which have become more complex, encourages them to set up new innovation strategies better suited to market needs and rapid changes in industry around the world.

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Open innovation is a response to the company's need to open up its R&D process, combining ideas from the outside with technologies developed in-house.

Indeed, faced with market developments, the company is aware of the constraints posed by the various transformations resulting from an uncertain environment, and adopts a new logic of response for a better exploitation of the opportunities available to it.

For Chesbrough (2006) the company must mark a shift to another paradigm, which is the frame of reference for explaining the process of open innovation. This strategy is based on the need to open up externally through internal / external collaboration in order to generate more value. This is what he defines as a business model geared towards capturing and retaining value.

This strategy is integrated into R&D processes based on knowledge sharing and better exploitation of the potential offered by the internal and external ecosystem. The foundations of this model are based on the openness of society to the outside world in several areas, including innovation activity, which leads to a decompartmentalization of structures and to a collaboration between society and its environment, whether like a small business (Start-ups), or even very large companies such as global companies.

This innovation management responds to the need for companies to open up to their external environment. It is in fact an exploitation of the opportunities provided by shared research and development, as well as the dissemination and management of intellectual property through free licenses (open data, open source, etc.).

In other words, open innovation is a concept that introduces a new "interactive vision of innovation" which pushes towards the development of cooperation between companies and thus promotes the emergence of networks (Cohendet 1996), from cognitive spaces dedicated to sharing, which stimulates the construction and dissemination of ideas.

The objective of this article is to broaden our understanding of the practices generated by the open innovation process, as a phenomenon increasingly taken into account in the economic field, from a review of the literature in the field and strategies adopted to maintain a sustainable level of innovation. This contribution aims to identify this new source of competitiveness, with a more global vision of the new model, thus allowing a better appreciation of this new paradigm.

In the first part, we will return to the foundations of the open innovation model and the main features of the paradigm shift. We will continue in the second part by studying the process of open innovation and its ecosystem, as a way of adapting to change and its impact on the organizational structure of companies. The third section will demonstrate the benefits of open innovation at the strategic level as a competitive lever, for addressing multiple structural and opportunity management issues.

The Development of Open Innovation, a Paradigm Shift

Chesbrough (2003) in his book "Open innovation: The new imperative to create and benefit from technology", lays the foundations of the new paradigm, which advocates the opening of the company to its ecosystem. Entitled open innovation, the author provides an analysis based on an observation of different companies in the United States, and proposes the idea of opening up research and development structures to their environments, which can be a source of benefits for the company. Indeed, this vision has a definite advantage in that it is faced with an environment marked by uncertainty and rapid change.

This model of innovation revolves around the opportunities offered by open innovation as a complement to the traditional model (closed innovation) deemed unsuitable for new realities, and that is the valuation of internal and external technologies

The assumption made by the author, is that companies can no longer rely exclusively on their own resources, but rather move towards the opening of structures and collaboration with the outside through the partnership. For Chesbrough (2003, p. 43) "Open Innovation means that valuable ideas can come from inside or outside the company, and can go to market from inside or outside the company as well. This approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths to market during the Closed Innovation era".

He puts forward the hypothesis that new ideas can be of origin external to the enterprise and also internal to it. In the development of these ideas, the author argues his main lines of analysis, which is based on the hypothesis that innovation can be valued by the company on the market, and also in the other direction, by the capture and follow-up of ideas external to the organization.

For Dahlander and Gann (2010), the open innovation model obeys a transactional logic of property rights, whether with financial compensation or not (Table 1).

Table 1. *Structure of Different Form of Openness*

	Inbound innovation	**Outbound innovation**
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

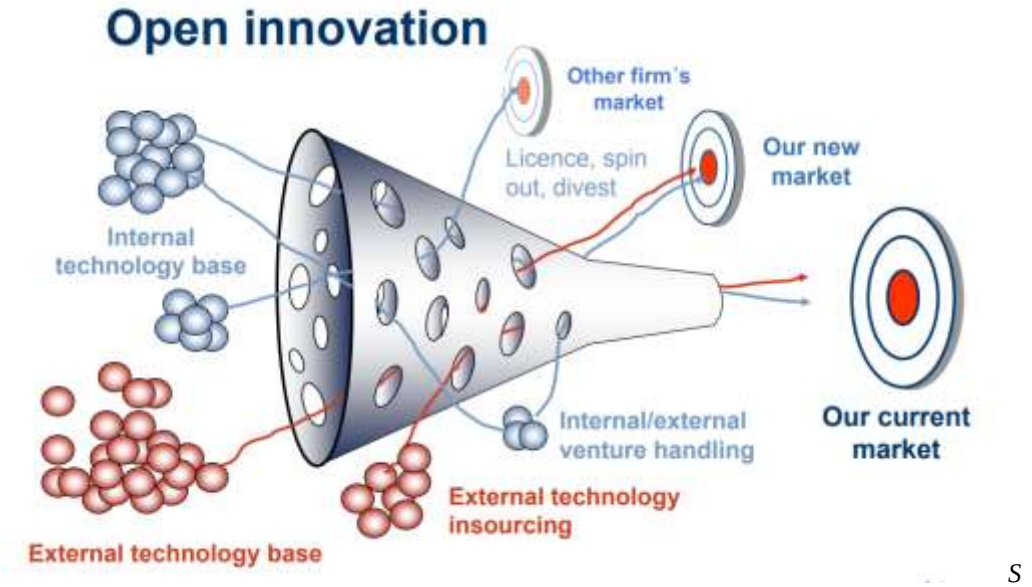
Source: Dahlander and Gann 2010.

Definition of the Concept of Open Innovation

The definition of open innovation has several meanings that help delimit the scope of understanding of this new notion. Christensen et al. (2005) and Berkhout (2006) argue that open innovation is part of a perspective of economic evolution and industrial dynamics, thus laying the foundations of the knowledge economy on four key factors of innovation, a production which is capital, the labor, knowledge and finally creativity.

Chesbrough (2006, p. 2) defines open innovation as "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation". Figure 1 shows the possible combinations, relating to the circulation of information (knowledge) sources of innovation, exploitable and above all profitable for the company. This consideration implies that the investment effort in internal R&D is no longer profitable for the company (loss of value), and that it is more strategic to go towards external knowledge (university, experts, engineers, etc.).

Figure 1. *The Open Innovation Paradigm*



Source: Chesbrough 2004.

To do this, five principles must be brought together for the application of the new model:

- The active use of knowledge (incoming and outgoing flows) to accelerate the innovation process, and thus accept the fact that relevant ideas can also come from external sources.
- The rapid development of internal innovations, either by exploiting them or, failing that, by selling unexploited intellectual property.
- R&D who can be done internally or externally, because in both cases there is profit generation.
- Accept ideas without looking for the origin of the fact that they are essential to success.
- The purchase of intellectual property is sometimes necessary to maintain a high level of competitiveness.

The concept of openness at Duval and Speidel (2014) means the ability of companies to rely on the collective, and especially on the collective intelligence of the actors of its ecosystem in its process of innovation. The process of opening

allows the building of links between the firm and its ecosystem, by creating formal/ informal relations in the short and/or long term, with multiple and varied actors.

In their writings, Duval and Speidel (2014, p. 5) explain that "Open innovation covers the challenge and the ability of companies and organizations to involve all the collective intelligence of the players in its ecosystem - and beyond - in its innovation process". This ecosystem includes external stakeholders such as customers, suppliers, research laboratories, universities, SMEs, start-ups and major groups in its sector. However, it can also call on experts from industrial sectors other than those in its core business "individuals and companies beyond their natural ecosystem".

Modalities for Setting up Open Innovation

In 2007, Chesbrough and Appleyard in their article "open innovation and strategy", develop an analysis of the innovation strategy, and impose the idea that an investment in internal R&D, is no longer justified, to from the observation that the increase in technology development costs, the reduction of product life and the reinforcement of intellectual property rights is increasingly reinforced. The model of open innovation and its notions of "ouside-in" and "ouside-out" is the way to optimize the company's revenue and even maximize value.

The Three Open Innovation Processes

The open innovation model involves three knowledge creation processes, in which the company markets internal and/or external ideas along two axes, from the outside to the inside and vice versa (see Table 2) (Pénin et al. 2013, pp. 15–16).

- Outgoing innovation axis (Inside-Out): this is the promotion of intellectual property from a commercial point of view, that is to say the dissemination of internal knowledge to customers (partners, competitors, etc.) in a traditional way. This logic is based on patents, technologies, publications, spin-offs, etc.Another technique of this process consists in revealing to the other market players of knowledge and technologies by an extension approach that generalizes its own technology and thus becomes a standard entity, and therefore the only entity capable of mastering innovation (radical). This technique helps to make innovation more efficient by opening up new markets and enabling the creation of new strategies, such as alternative brands, while promoting the emergence of co-development practices. This makes the limits of the company less narrow and allows multiplying the speakers, bearers of new ideas.

Table 2. *The Modalities of Open Innovation*

	Open innovation 1.0	**Open innovation 2.0**
Outside-in	Licensing-in Spin-in	Crowdsourcing
Partership (mix of outside-in and inside-out)	Co-design Co-development Research Consortium joint-venture Clusters	Innovation with communities / open source
Inside-out	Licensing-out Spin-out	Online marketplaces/ "e-Bay des idées" (ex.: Yet2.com)

Source: Pénin 2013 (free translation).

- The axis of incoming innovation (Outside-In): it is a strategy of openness, which allows a company, by a reverse process, to enrich its knowledge base through the network, by capturing ideas and solutions, the aim of which improve is the internal innovation process. It is a question of proceeding in a classical way, to the acquisition of knowledge or ideas, through the purchase of patents, licenses, technology transfer from the outside to the inside, to create joint ventures. This practice contributes to developing new forms of inter-company SME-TPE and large enterprise collaboration, and also between companies and their customers (users).
- The Coupled process: combines the first two axes in a real collaborative logic of pooling and co-creation in a network. It brings together several forms of platforms such as: the co-design, co-development, joint projects, alliances, participation in consortia, research cooperation ... the aim of this approach is to link tacit knowledge and explicit. This is a process that made the success of Open Source like the example of Linux.

Crowdsourcing, a Web 2.0 Practice

Burger-Helmchen and Pénin (2001) define crowdsourcing by two elements that characterize it: "an open call and a crowd, both of which are intrinsically linked. First of all, and contrary to usual outsourcing practices, in the case of crowdsourcing, the company does not rely on a single partner or a limited number of service providers, but it makes an open call. The open dimension is fundamental here. It means that access is non-discriminatory".

For Howe (2008), crowdsourcing "is the act of taking a task traditionally performed by a designated agent (such as an employee or a contractor) and outsourcing it by making an open call to an undefined but large group of people. Crowdsourcing allows the power of the crowd to accomplish tasks that were once the province of just a specialized few. Or to put it another way, crowdsourcing is to take the principles which have worked for open source software projects and apply them right across the entire spectrum of the business world".

With both definitions, we understand that the importance of two elements is essential to the functioning of the process; it is the notion of openness and open

participation to all. In the sense of participation or more precisely the "solving problem" and "producing things" (Lakhani and Boudreau 2009, p. 63), and of content on the dedicated platforms, it is the second notion evoked that of the "ICT" information and communication technologies, thanks to the evolution of web 1.0 to web 2.0.

In practice, crowdsourcing refers to the outsourcing of internal tasks to a group of volunteer users on a collaborative platform. It is a technique that connects a community of dedicated experts with skills at the forefront of the innovation process.

The search for new ideas, pushes companies to collaborate with a relatively large mass on its external ecosystem, this collaboration lies in the establishment of creativity competitions (creative networks). This strategy has several advantages such as the mass of available resources and the speed of execution of the network by exploiting the intrinsic capabilities of web 2.0 (sharing software, open source platforms, use of ERP via cloud computing, data security, open information system, etc.).

According to Pénin (2013), five major reasons push organizations to resort to crowdsourcing, which are the following:

- The number and diversity of the crowd (on the internet) make it potentially very powerful to perform certain tasks. Using the crowd provides access to a pool of skills, ideas, resources, much larger than what the company has in-house.
- The use of crowds also allows a company to generate diversity, ideas and new projects. Crowdsourcing allows the organization to get out of the "incremental trap".
- Crowdsourcing rarely uses the remuneration of participants in very small proportions. It makes it possible to reduce the cost of carrying out certain tasks.
- In reality, the need for participation is much more a need to take on a challenge than to express a monetary need to get.
- It also increases competition in the performance of certain activities; putting internal teams in competition with a global pool of other researchers, stimulates them and improves their productivity.
- Lastly, crowdsourcing allows the organization to outsource the risks associated with an activity where the uncertainty factor is very high, while benefiting from the spin-offs resulting from the success of a project.

Open Innovation, an Integrated Business Ecosystem

The paradigm shift, evoked by Chesbrough (2003), moving from the closed innovation model to the open innovation model, introduces new challenges for production systems and their activities of innovation. Henceforth, in an increasingly complex environment, it is necessary for companies to change their business ecosystems through adjustments that can lead to the formalization of new organizational forms.

Competitiveness Clusters, a Necessary Evolution of the Model towards Innovation 2.0

The creation of competitive clusters in France refers to the Blanc report (2004) presented to the government in the May 2004, whose purpose was to set up a new industrial policy. The designation of this strategy refers to the development of clusters across the Atlantic developed by Porter (1998) whose definition is "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a network of neighboring countries".

Mr. Porter's work focused on the study of business combinations in the same sector and on specific geographical areas, to explain the effectiveness of interactions between actors and the virtues of such a configuration mode. The example of Silicon Valley is a demonstration of the effectiveness of the "cluster" model, which will become a reference in terms of national economic policy.

In France, on the other hand, the development of the competitiveness clusters was based on an "addition of an industrial cluster and a scientific base where the synergy of a pole of excellence and a fabric of industries".

The objective of this strategy is therefore to benefit from the advantages that competitiveness clusters provide, based on a coopetitive logic, by cooperating with each other, and benefiting from the wealth of synergies and accumulated critical capacities (Blanc 2004).

The impact of the open innovation model on this type of concentrated organization and the changes brought about by modes of business-to-business cooperation marks a very important transition in the modes of cooperation between firms. From the classical network understood as a mode of organization and coordinating heterogeneous actors (Pesqueux 2004), towards a hybrid network, without necessarily a geographical reconciliation, which allows globally better support for the innovation ecosystem. It is the dimension developed by Chesbrough and Appleyard (2007) that concerns the renewal of the economic model, because to succeed in exploiting the gains made possible by open innovation, the introduction of new rules of the game is essential.

The Business Ecosystem and Business Model, a Dynamic of Internal/External Rapprochement

The concept of business ecosystem (ESA) is defined, as "It is no longer a single business, but heterogeneous coalitions of businesses competing. Alliances, partnerships, cooperation agreements help to create networks that no longer correspond to the concept of industry or the spinneret" (Torres-Blay 2000). This concept directs the company towards the creation of relations with external partners and stresses the need to bring out networks, which can correspond to an open innovation process, which takes into account several forms of inter-firm cooperation (collaborative platforms, co-innovation, co-creation, etc.).

The idea is that the progress of open innovation in the economic field and the transformations induced by technological progress leads the company to open its business process outward; to a better capture, the value in the sense of Chesbrough (2006), and at the same time accompanies the exploitation of the ecosystem within the firm. It corresponds to an open innovation process in a situation of openness of the process, but also and more broadly to that of the opening of the business model (Pénin 2013).

This logic of rapprochement, revolves around the mobilization of skills, knowledge and capacity to master information technology and telecommunications (internet), in order to maximize the benefits of the open innovation model and there to develop more appropriate innovative structures.

The Business Model of Open Innovation, a Lever of Competitiveness for Companies

The problem of innovation is traditionally focused on the company's ability to develop innovations through its internal structure. Nevertheless, the new paradigm developed by Chesbrough (2003, 2006), leads us to reflect on the opportunities offered by open innovation and the answer what can it bring provide to solve problems such as the dilemma developed by Christensen (1997) as well as the case of the management of ambidexterity.

The Dilemma of the Innovator versus Open Innovation

Christensen (1997) describes in his work a phenomenon, that is the innovator's dilemma and where large companies find themselves trapped in their business models (profitability of incremental innovation) and miss out on the opportunities for disruptive innovations, thus losing the opportunity to secure their perenities. For Christensen (1997) "A good manager, from the traditional standards is the one who precisely cannot invest in path breaking products, services or technology […] "Well managed" firms are doomed to miss disruptive innovation".

The logic that can explain this tension between incremental innovation and disruptive innovation (rupture) revolves around the notion of a business model, under which it "describes the logic of the way in which an organization creates, delivers, and captures value" (Osterwalder and Pigneur 2010, p. 14). For the author, the choice of a business model is based on nine questions, which are as follows (Osterwalder and Pigneur 2010, pp. 16–17):

- Customer Segments: the main customer segments to be addressed.
- Value Propositions: the value proposition to these customer segments.
- Channels: The most important channels to bring the product or service.
- Customer Relationships: Types of relationship to build with customers.
- Revenue Streams: the type of pricing product or service.
- Key Resources: the resources you need to create value.
- Key Activities: the main activities to create value.

- Key Partnerships: outsourcing certain activities to partners.
- Cost Structure: the main components of your cost structure.

We propose three key logics to answer our problematic, which is that of the dilemma of the innovator. The first concerns the choice of the client, in relation to the technical aspect of breakthrough innovation, and with the technological changes adopted. Teece (2010) observes that the true desire of the consumers is one solution adapted to the needs that they manage to express, as for example, the passage of the laser printer to the printer with jet of ink; it is the logic Value Proposition.

The second logic is that of profit for the company (Revenue Streams), the best-known example is that of the company Kodak, which did not anticipate the evolution of the market and its passage to the technology of the digital photography.

The third logic revolves around the structure of the company through its resources, processes and values, thus integrating the cost structure, key resources, and finally, the control of the key activities as a source of added value, representing a first condition for success for the business model.

Christensen (1997) explains this paradox by the adopted business model, which prevents it from having strategies other than those of maximizing existing incomes. Indeed, disruptive innovations are only rarely introduced by the dominant firms in the market, but rather, by new entrants or newly created companies,

In the example of Christensen, the Kodak company that focuses on its film camera market (core business), and lacks the transition to digital photography.

USB keys, smartphones ... all these examples, show how dominant companies can miss a breakthrough innovation.

Open innovation as a new model oriented on the external ecosystem, can answer and provide a solution to this type of dilemma. To avoid falling into the trap of incremental innovation, Christensen offers several solutions, the most viable of which are to implement collaborative practices, create spin-offs, acquire external companies, etc., this strategy can be an adequate response to the paradox of the innovator

Open Innovation, a Response to the Need for Ambidexterity

The notion of ambidexterity is a notion that expresses a tension between the exploitation of existing resources and the exploration of new possibilities. March (1991) argues that organizations must mitigate this tension by organizational change between exploitation and exploration activities.

Levinthal and March (1993) express the idea that in order to maintain a long-term competitive advantage, the company must control its activities, accumulate experiences and, at the same time, develop them by way of experimentation.

The problem of innovation for firms is therefore in the search for dual structural form, which allows combinations capable of approaching ambidexterity. This answer lies in the concept of network ambidexterity (Ney et al. 2008), which can be defined as inter-firm cooperation within an innovation-generating network; because firms taken individually, cannot have sufficient research capacity and develop new ideas alone.

This articulation of operational innovation and exploration is similar to the work of Chanal and Mothe (2005), who propose solutions to resolve this tension; she lies in the search for an optimal combination of exploration innovation and operating innovation.

This combination is precisely the dynamic capacity for innovation, which in summary introduces a logic of improvement of the competitive position of the company through innovation, and introduces hybrid, structures whose objective is to articulate its ability to organize relational competence internally and externally.

The network in open the innovation sense, provides the answer to this problem, it allows at a time to reconcile the activity of exploitation, by the focus on the core business, with the activity of exploration by the exploitation of external ideas and technologies.

Conclusion

The importance of innovation as a factor of sustainability and competition for organizations is well established. However, the change observed in recent years and the changing business environment lead us to question the maintenance of a sufficient level of competitiveness for companies knowing that the environment is increasingly complex.

Open innovation, as a new model articulated around the valorization of internal potentialities (exploitation of technologies), and also the necessary capture of external opportunities, offers the company these new possibilities to maintain its competitive position on the market.

Open innovation marks is the passage of a closing logic, concentrating internally the means to carry out R&D and concretizing the projects of innovations, in a logic of protection of the intellectual property, with a logic of openness, allowing the exploitation and capture of ideas and technologies outside traditional structures, it is the new paradigm of open innovation developed by Chersbrough (2003).

The development of Web 2.0 tools making communication costs very low via IP telephony and social networks, the development of technologies adapted to the principle of sourcing such as crowdsourcing, co-creation and co-innovation, in a logic of creation /retention of value. Open innovation thus poses as a complement to closed innovation, thus increasing the capacity for innovation through two principles that are outside-in/inbound, and inside-out / outbound, with a mixed mode that brings together two preceding principles.

The advantage of open innovation lies in its ability to fully exploit the existing potential in the company and outside the company, from a business model integrating the ecosystem of innovation around a model business able to eliminate the constraints underlying the dilemma of the innovator and the difficulty of maintaining ambidextrous structure.

In conclusion, the open innovation model is a source of competitiveness as it has multiple benefits, focused on building the capacity of businesses, to maintain a

level of sustainable efficiency and permanent flexibility, which is conducive to maintaining competitive advantage in markets hyper-complex.

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The Circular Economy: An Exploratory Case Study from the Paper and Retail Industries

By Peter Jones[*] & Daphne Comfort[±]

Recent decades have witnessed increasing interest in the concept of the circular economy within both the business world and political circles. The circular economy spans the entire life cycle of products from product design through production, marketing, and consumption, to waste management, recycling, and re-use, and enthusiasm for putting the concept into practice has been identified across different sectors of the economy. This exploratory case study reviews how some of the leading companies in the paper and retail industries, have publicly addressed the circular economy. The case study outlines the nature of the circular economy, provides a cameo literature review of published work on the circular economy, describes the approach adopted for the case study, reports the findings of the review of how the leading companies in the paper and retail industries have addressed the circular economy, and discusses some wider issues.

Keywords: *circular economy, case study, paper industry, retail industry, greenwash, economic growth*

Introduction

The last decade has witnessed increasing interest in the concept of the circular economy within both the business world and political circles. On the positive side, the "Circular Action Plan" launched by the European Commission (2020) in March 2020 is seen as an essential element in Europe's agenda for sustainable growth, while the Ellen McArthur Foundation (2017a) suggested "a circular economy aims to redefine growth, focusing on positive society-wide benefits". More critically, Gregson et al. (2015), argued that while the concept of the circular economy had received political and commercial support, there was limited evidence of its successful implementation. The circular economy spans the entire life cycle of products from product design through production, marketing, and consumption to waste management, recycling, and re-use, and enthusiasm for putting the concept into practice has been identified across different sectors of the economy.

Within the manufacturing sector, UMP (2020a), one of the world's largest paper producers, argued "pulp and paper are the pioneers of the circular economy", while in the service sector, the European Retail Round Table (2016), the organisation which represents major European retailers, claimed "retailers are a

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large contributor to the European Union economy" and that retailers "are keen to take a front seat in shaping a circular economy in Europe." With these thoughts in mind, the research objective of this exploratory case study is to review how some of the leading companies in the paper industry (which includes the manufacture of paper, pulp, and packaging) and the retail industry, were publicly addressing the circular economy. More specifically, the case study outlines the nature of the circular economy, provides a cameo literature review of published work on the circular economy, describes the approach adopted for the case study, reports the findings of the review of how the leading companies in the paper and retail industries have addressed the circular economy, and discusses some wider issues.

The Circular Economy

For the Ellen MacArthur Foundation (2017b), set up in 2010 to help accelerate the transition to a circular economy, a circular economy is a "systemic approach to economic development designed to benefit businesses, society, and the environment". As such, a circular economy is contrasted to the currently dominant take-make-waste linear model of the economy, in that "a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources". More generally, Lahti et al. (2018) claimed "the idea behind the circular economy is that companies have a responsibility to uphold the environmental and sustainable values of society and must respond to a broad set of stakeholders rather than just their closest shareholders." Geissendoerfer et al. (2017) have suggested that the circular economy is "a new sustainability paradigm".

In theory, the circular economy spans the entire life cycle of products from product design through production, marketing, and consumption to waste management, recycling, and re-use, and enthusiasm for putting the concept into practice the concept, has been identified across different sectors of the economy (e.g. Jones and Comfort 2018a). Design is the first, and in some ways the most important, element in the circular economy. Here the focus is on redesigning products and manufacturing processes around circular economic principles that will increase reuse and recycling, create new business opportunities, and contribute to sustainable economic growth. Essentially, businesses must look to develop their approach to design around new business models that embrace resource efficiency, longevity, and impact. Consumers have a critical role to play in circular economic strategies, not least in that through their buying behaviour they can support or hamper the transition to a circular economy. Within a circular economy, the focus is on recycling waste to recover materials and energy.

Cameo Literature Review

The concept of the circular economy has attracted a good deal of attention in the academic literature, though Urbinati et al. (2017) suggested that academics

"within the strategic management field" are "struggling with a lack of a framework explaining how companies willing to become circular adapt their existing business model or create new one". That said, several papers have provided a variety of literature reviews. Merli et al. (2018), for example, provided "a systematic literature review", of over 600 papers and concluded the circular economy is "an evolving concept that still requires development to consolidate its definition, boundaries, principles and associated practices". Masi et al. (2017), offered a systematic literature review, covering 77 articles published since 2005, of the supply chain configurations in the circular economy. Winans et al.'s (2017) literature review, explored "the history of the concept of the circular economy to provide a context for a critical examination of how it is applied currently". Prieto-Sandeval et al. (2018) conducted a literature review that provided "a knowledge map of the circular economy, an analysis of the main notions of the concept, principles, and determinants of a circular economy".

Given these recent accessible reviews of the literature, there sems little point in adding to, or duplicating, these works with a wide-ranging literature on the circular economy. Rather, the authors provide a cameo literature review of three issues that they believe are particularly relevant to this case study, namely greenwashing, the relationship between the circular economy and sustainable consumption and achieving economic growth within a circular economy. The aim here is to provide some simple reference to, and context for, the issues raised in the case study. In examining the use of circular economy case studies in business education, Kopnina (2019) argued "for many companies, rampant greenwashing will not pay as continuous vigilant consumer organizations or NGO's help to move companies beyond the basic requirements of public relations" and that "greenwashing can backfire not only because it has limited benefits, but also because it poses a major threat to business operations if publicly disclosed". More generally, Sauvé et al. (2016) suggested that circular economy initiatives were not immune to greenwashing and that 'because of all the greenwashing that has been associated with the buzzword sustainable development, many proponents of the circular economy approach will avoid references to sustainable development".

Tunn et al. (2019) claimed "combining sustainable consumption with the circular economy concept could help tackle challenges, such as resource scarcity and climate change, by reducing resource throughput and increasing cycling of products and materials within the economic system, thereby reducing emissions and virgin material use". In looking to discover which future business models would help to achieve sustainable consumption in the transition to the circular economy, Tunn et al. (2019) suggested "the most promising business models for sustainable consumption are those that reduce overall consumption levels and consumer effort". In "re-introducing consumption to the circular economy" Mylan et al. (2016) highlighted "the importance of understanding the dynamics of consumption and waste in the domestic sphere" which will involve "a shift from imagining consumers as users of particular products or services, to conceptualisation as doers of everyday activities".

George et al. (2015) presented a "circular economy model of economic growth", which indicated "that the factors affecting economic growth include the

marginal product of the recyclable input, the recycling ratio, the cost of using the environmentally polluting input and the level of pollution arising from the employment of the polluting input' but their analysis demonstrated that 'environmental quality cannot be maintained or improved via economic growth". Kjaer et al. (2019) focused on decoupling economic growth from resource consumption and concluded that "the ultimate aim of the circular economy should be to enable absolute resource decoupling, which goes beyond simply extracting more value from resources".

Case Study Approach Frame of Reference and Method of Enquiry

In looking to investigate how some of the leading players within the paper and retail industries were publicly addressing the circular economy, the authors employed a simple case study approach, which the authors believe is appropriate in focussing upon the specific issue of circular economy within the context of two sectors of the economy. This is very much an exploratory case study, in that the focus is on answering simple questions concerning which companies within the paper and retail industries were addressing the circular economy, and the themes they emphasised as part of that process. At the same time, the authors recognise the limitations of their case study approach in that it is based corporate information obtained from the Internet, and thus lacks wider empirical inputs, that it provides limited basis for generalisation. The authors would also stress that the case study looked to review how some of the leading players in the paper and retail industries were addressing the circular economy, rather than to provide a systematic comparative analysis of approaches to the circular economy, within, and between, the two industries.

In looking to focus on how leading players within the paper and retail industries were addressing the circular economy, the authors undertook a three-step Internet search process using Google as the search engine. Firstly, the authors searched the websites of the retail associations in Europe and the US for some contextual information on how Europeans and US retailers were addressing the circular economy. Secondly, the authors undertook an Internet search, using the key phrases Circular Economy and the name of the leading players in the paper and retail industries, drawn up from trade sources, in July 2020 using Google as the search engine. This search of companies in the paper industry revealed that six companies, namely, International Paper, West Rock, UPM, Stora Enso, Sappi and Smurfit Kappa, addressed the circular economy on their corporate websites. The search of leading retailers revealed that six European companies, namely Kingfisher, Ikea, H&M, Inditex, Marks and Spencer and C&A, and three US companies, namely Kroger, Home Depot and Walmart, addressed the circular economy on their corporate websites.

Thirdly, the authors then searched the corporate websites of all these fifteen companies to ascertain greater details of how they were addressing the circular economy. The information from this simple content analysis provided the empirical material for this case study, which draws heavily on specific examples

and selected quotations from the websites of the selected companies within the paper and retail industries. The aim here was to demonstrate how the companies publicly described their commitment to the circular economy and how they were addressing it, and the authors believed that this was often best captured in their own corporate words, not least in that quotations could strengthen the corporate authenticity of the case study.

International Paper is the world's largest producer of paper, pulp, and packaging, it is based in the US, and it has 25,000 commercial customers in 150 countries. West Rock is a US based, paper and corrugated packaging company and it has operations in some 30 countries. UPM, founded in 1996, is headquartered in Finland and it has production facilities in 12 countries. Stora Enso, created in 1998, is also headquartered in Finland and while most of its sales are in Europe, it has operations in Asia, South America, and the US. Sappi is a South African pulp and paper company and it in addition to its African operations, it has production plants in Finland, Germany, Switzerland, and the US. Smurfit Kappa is a paper-based packaging company, headquartered in Ireland, and it operates in 35 countries.

Ikea is an originally Swedish, now a Netherlands headquartered retailer, which sells self-assembly furniture, kitchen appliances and household accessories. Inditex is a Spanish based, multinational clothing retailer and its flagship store brand is Zara. H&M is a Swedish multinational clothing retailer, and it operates from over 5,000 stores in some 70 countries. Kingfisher is a UK based home improvement retailer, with over 1,200 stores in 10 countries across Europe, Russia and Turkey and it trades as B&Q, Brico Depot, Screw Fix and Castorama. Marks and Spencer is a British multinational retailer which specialises in clothes, home products and food. C&A is a Belgian/Dutch/German clothing retailer and it has stores in 19 European countries and a small retail presence in Mexico, South America, and China. Walmart is the world's largest retailer, and it has over 11, 500 stores in 27 countries. Kroger's, operations span 35 US states, and its trading formats include grocery and multi-department stores, convenience outlets and jewellery stores. Home Depot is the largest home improvement retailer in the US, with 2,000 stores, and it also has stores in Canada and Mexico.

The Circular Economy in the Paper Industry

In many ways, digital technologies have changed the way hundreds of millions of people live their lives, and as such, more and more people may be seen to live in an increasingly digital world, but paper is still important for many economic and social activities. Trade estimates suggests that global paper production was 490 million tonnes in 2020 (Material Trader.com 2019) and the production of paper makes massive demands on trees, water resources and energy supplies. Such high production demands have a major environmental impact, as does the disposal of wastepaper and its industrial by-products, and they pose increasing concerns for sustainable development. The concept of the circular economy offers a way to address these concerns.

Several of the world's leading paper producers emphasised their strategic commitment to the circular economy. Stora Enso (2019), for example, claimed the circular economy "operates at the heart of the circular bioeconomy". In a similar vein, WestRock (2019) argued "we are proud to play a central role in the circular economy", while Smurfit Kappa (2019) suggested "the circular economy is at the core of our business" and International Paper (2020) claimed it embraced "the concept of the circular economy". Sappi (2019) suggested "at its heart, our business model is circular and interconnected", and UPM (2020b), argued "we see the circular economy as a way to build a sustainable future for both society and business".

Stora Enso (2019) claimed it was in "a unique position to drive society's transition to a circular bioeconomy" and "we always look for ways to make more from less". In taking a broad view, Stora Enso (2019) suggested that "global warming, population growth, urbanisation and eco-awareness were affecting both consumer behaviour and corporate decision making" and claimed "we respond to these trends by developing circular products and solutions based on materials that are both renewable and recyclable". More specifically, Stora Enso (2019) outlined the working of the circular economy in relation to waste and waste management, carbon dioxide emissions, customers, and the United Nations Sustainable Development Goals.

In addressing waste management, Stora Enso reported that it looked to maximise the value of its material streams, and to work towards zero process waste, and that it was working to achieve this through circular material flows in its value chain, while reducing its own process waste to as close to zero as possible. Stora Enso (2019) also claimed "we help our customers become circular". Here the company suggested that as its products are renewable, recyclable, and in many cases compostable, both resource use and waste are minimised and the focus is on maintaining the value and longevity of products and materials, through product design, innovation and recycling. Stora Enso also reported that it had established a circular economy programme to drive circularity in the value chain together with customers, brand owners, and recyclers. This programme focused on circular innovations, industry collaboration to increase the collection and recycling of cardboard products, circular design and co-creation with customers, and work with start-up companies.

UPM (2020b) suggested "the circular economy addresses two key global challenges of our time: climate change and the growing scarcity of natural resources. In a circular economy, waste is minimised, and renewable resources are used in a sustainable, efficient way". The company emphasised that it reused, or recycled, virtually all its production waste, that it and recycled materials and products several times, and looked to create added value through smart solutions, and claimed "our goal is to minimise waste and maximise reuse" (UPM 202b) Under the banner "Circular economy in action" UPM (2020b) provided illustrative examples of how many of its products are made from residues, side steams, and waste generated during its traditional production processes. These examples included, renewal diesel and naphtha produced from a residue from chemical pulp production, and the production of renewable bio-based plastics.

International Paper (2020) outlined that its approach to the circular economy involved "looking to evolve the design of our products so that they can enjoy multiple lives through repeated cycles of reuse and recycling. We want to eliminate the very word waste from our vocabulary — everything we use to manufacture our products has the potential to be viewed as a renewable resource". However, International Paper observed that paper is not infinitely recyclable, not least in that the fibres that make up paper shorten each time they are recycled and the company emphasised the need to introduce new timber resources into the manufacturing process. This led the company to look beyond recycling to the whole value chain, and to champion responsible forestry, to put residual materials to good use in the manufacturing process, and to maximise recovery and recycling.

Sappi (2019) recognised "the necessity for a more circular global economy, as we move away from a take, make, dispose, model of production, to a more regenerative economic system aimed at minimising waste and making the most of scarce resources" and suggested "at its heart, our business model is circular and interconnected" and "we continue to find ways to maximise the circular nature of our activities". Sappi (2019) illustrated its approach with a case study entitled "an innovative solution for the circular economy", which focused on packaging in the food industry. Within the food industry, packaging that meets stringent health and safety standards and is recyclable, has long posed a challenge for paper and packaging manufacturers. The company reported that it had worked with consumer brand owners to develop renewable paper-based packaging materials which provided an effective barrier against oxygen, water vapour, grease, aroma and mineral oil, without ensuring food protection and the required shelf life.

In his Chief Executive Officer's introduction to Smurfit Kappa's 2019 Sustainability Report, Tony Smurfit claimed "our product is a vital element in society's supply chains, improves our customers' environmental footprints, and fully supports the circular economy by being renewable, recyclable and biodegradable" (Smurfit Kappa 2019). The company reported that in designing its operations around a circular business model meant looking to maximise resource efficiency, to minimise waste and carbon dioxide emissions, and to supply packaging that avoids waste. Further, Smurfit Kappa claimed that its circular business model means that 75% of its raw material is recycled fibre and that the company used organic by-products as biofuel, circulated process water as much as possible, and looked to find alternative uses for the paper products items rejected by customers.

In addressing climate change and tackling carbon dioxide emissions, Smurfit Kappa (2019) reported "the circular economy is an opportunity for our business as we seek to use resources efficiently, especially in energy production and the creation of innovative packaging solutions". In reporting on its approach to waste, Smurfit Kappa (2019) emphasised its belief that "the circular economy is the business model for the future", with its focus on optimising resource use and minimising waste. The company also reported on how the circular economy impacted on its host communities. Smurfit Kappa illustrated these impacts with several examples, including district heating systems to householders in Pitea, in

Sweden, supporting municipal water treatment in Nettingsdorf, in Austria and Nervion, in Spain, and collecting recovered paper in Malaga, in Spain.

The Circular Economy in the Retail Industry

The circular economy has also attracted attention within the retail industry. The European Retail Round Table (2016), for example, argued that "transitioning to a circular economy will allow us to reduce our dependency on virgin materials and improve our exposure to volatile commodity prices". More specifically, Eurocommence and the European Retail Round Table (2018) and Jones and Comfort 2018b) reported that European retailers were taking several steps to introduce the circular economy into their businesses. These steps included greater emphasis on sustainable sourcing, the use of recycled and recyclable materials, the removal of damaging chemicals from production processes and increasing the amount of energy from renewable sources.

Several leading European retailers reported on how they have addressed the circular economy. Kingfisher for example, claimed to be integrating circular economic principles into product design, which will increase their longevity and ultimately protect natural resources for future generations. Further, Kingfisher (2019) reported "our target is to have 20 product ranges or services that help customers and our business get more from less, reuse, or use longer by 2025". Kingfisher (2019) also identified its "principles for circular product design", which included materials that are easily and widely recycled, design for durability, low energy and carbon usage and working conditions in the supply chain.

H&M (2019) reported "our ambition is to become a fully circular business within our entire value chain. This means we move from a linear model – take, use, waste – to a circular model where we maximise resource use and reuse, and where nothing is wasted. This circular strategy applies to our products, as well as to our noncommercial goods such as packaging and items used in store interiors, offices, and other buildings". More specifically H&M (2020) reported "our brands offer customers a variety of fashion, design and services that enable people to be inspired and to express their own personal style, making it easier to live in a more circular way" and claimed "innovation drives our circularity efforts" in that "we're rethinking how products are made and used, and then reused" and "we are developing new ways to repair, repurpose and recycle goods wherever possible and encouraging our customers to join us on this journey".

Ikea (2020) reported "our ambition is to see all Ikea products as raw materials for the future, and to design them all to have circular capabilities that help to prolong their lives. We will extend our relationship with customers throughout a product's use and end-of-life to enable them to repair, reuse, resell and recycle Ikea products. We will provide and promote services, solutions, and knowledge for circular and sustainable consumption, such as furniture takeback services". Further, Ikea (2020) claimed "transitioning to a circular business affects every part of our value chain, including how we design our products. Circular products will be designed from the very beginning to be reused, refurbished, remanufactured,

and recycled – extending their lifespan for as long as possible. They will also be material banks for the future, meaning we can take them apart when they are no longer working or wanted and reuse the raw materials".

C&A (2018) argued "sustainability means rethinking how we design our products for their next use" and "making products that are made with their next use in mind and where we no longer talk about end of life, but rather end of use. This is the philosophy of circular fashion" and "for the apparel sector to become truly circular, each part of the value chain must evolve". The company argued that it had developed a three-point strategy to address the implementation of a circular model. Firstly, by creating innovative products designed according to circular principles, secondly by developing its garment collection scheme to ensure that garments can be collected, sorted and eventually recycled, and thirdly by supporting partnerships to accelerate to accelerate the transition to a circular economy and by supporting innovations designed to enable and enhance circularity.

Inditex claimed that the circular economy was one of two core axis of the company's sustainability strategy. More specifically, Inditex (2019) reported that its "commitment to circularity" was essential in contributing to the de-carbonisation of its value chain, in preparing for the recycling of fabrics, and in transforming the concept of waste so it is increasingly seen as a valuable resource. Marks and Spencer (2020) emphasised "the need to transition to a circular economy where the value of the materials and energy used in products are kept for as long as possible', and in outlining its approach to waste, the company claimed 'we support the transition to a sustainable circular economy and will prioritise business model innovation and put circular ways of working into practice".

Amongst retailers in the US, there seems to be less public enthusiasm for the concept of the circular economy. The Retail Industry Leaders Association (2020a) recognised that "the retail industry has an important role to play in creating a more circular economy". In addressing "environmental sustainability", for example, the Retail Industry Leaders Association (2020b), claimed "our priorities are increasing efficiency and waste diversion and exploring circular economy innovations for waste" but there was no presentation of how this priority was to be pursued. In a similar vein, some of the largest US retailers publicly reported on the circular economy in relation to parts of their overall retail operations but fell short of making any wide-ranging corporate commitments. Kroger (2019), for example, reported "in 2018, we used more than 160 million reusable plastic containers to ship produce in our distribution network, reducing waste and moving us toward more circular models", and that its distribution centres "champion our circular economy initiatives through their deployment of reusable shipping pallets and reusable plastic containers". Home Depot (2019) reported that the circular economy was one of the sustainability issues that informed its materiality assessment framework and claimed, "we will embrace circular economy products and packaging as suppliers continue to develop their thinking and capabilities". More extensively, Walmart (2019) reported "increasing global demand is placing unsustainable pressure on the climate and natural ecosystems, challenging us all to shift from a take-make-dispose system of production and consumption to a circular, regenerative approach".

Discussion

This case study revealed how some of the leading companies within the paper and retail industries have addressed the concept of the circular economy, but three wider sets of issues merit discussion. Firstly, there are issues about the concept of the circular economy meaning different things to different players. Corvellec et al. (2020) acknowledged that the circular economy "allows for a whole range of interpretations and approaches to be bundled together". As such, this effectively allows companies to define the circular economy to mean what they want it to mean. This raises the spectre of greenwashing, typically described as "communication that misleads people into forming overly positive beliefs about an organization's environmental practices or products" (Lyon and Montgomery 2015). So seen, corporate commitments to the circular economy might be characterised by what Hamilton (2009) described as "shifting consciousness" towards "what is best described as green consumerism". This he saw as "an approach that threatens to entrench the very attitudes and behaviours that are antithetical to sustainability".

All companies who publicly proclaimed their commitment to the circular economy will need to avoid their commitments and achievements being labelled as greenwash, not least in that such accusations will damage not only the trust between companies and their customers, but it may also reduce the appeal of companies to investors. The European Commission's (2020) new Circular Economy Action Plan, mentioned earlier, suggested "the Commission will also consider further strengthening consumer protection against green washing". However, there was no indication for the time scale for such strengthening, or of what form it might take, or if it might affect manufacturing industry. Ideally, companies should look to take responsibility for reporting on their contributions to a transition a more circular economy, and here a way forward would be for companies to include their achievements in their annual reports or their annual sustainability reports. However, in the past, research suggested that independent external assurance of much of the data in sustainability reports, in both the paper industry (e.g. Jones and Comfort 2017) and retail industry (e.g. Jones et al. 2011) was at best limited. This would, in turn, emphasise the importance of all companies commissioning comprehensive, independent external assurance to verify their contributions to the circular economy.

Secondly, the transition to a circular economy would certainly constitute a dramatic change in the ways in which consumers approach consumption and see the emergence of a "new consumption culture" (Korhonen et al. 2018) with consumers sharing, and leasing, rather than buying, goods and services, and with the emphasis being on collective rather than individual consumer behaviour. The emergence of such a culture would also challenge the social value which consumers often place on the acquisition of goods as part of a process of conspicuous consumption. At the same time, it remains to be seen how enthusiastically consumers, who have been at the heart of materialist culture, in what is often termed the throwaway society, will want to embrace such a new consumption culture.

Any transition to a circular economy is also intimately bound up with the elusive issue of sustainable consumption, described by Cohen (2005) as "the most obdurate challenge for the sustainable development agenda". GreenBiz (2015) argued "entrenched patterns of overconsumption present a massive hurdle to clear before circular economic models can achieve any sort of scale". In many ways, what some commentators see as the continuing and unrestrained pursuit of unsustainable consumption, described by the European Environment Agency (2019) as the "mother of all environmental issues", lies close to the heart of this dilemma. Korhonen et al. (2018), for example, suggested that "the most important question for the circular economy in terms of long-term sustainable development of global society, is how can the saved resources and money generated by the circular economy idea be directed to sustainable consumption practices".

Thirdly, the transition to a circular economy raises issues about traditional business models, and more fundamentally about existing economic and political structures. Such transformations would certainly challenge traditional business models. The dominant traditional business model within large scale European and North American retailing, for example, revolves around price, sourcing across wide international geographical areas, looking to extensive marketing and advertising to stimulate consumer demand and enhancing access and convenience. The transition to a circular economy could see the growth of a larger service economy, with a greater accent on consumers leasing products, as and when they are required, rather than on purchasing and owning products. How well traditional retailers could meet the challenges posed by such changes remains very much to be seen.

At the same time, there are more contentious, issues about the relationship between the transition to, a circular economy, and existing economic and political structures. Gregson et al. (2015), for example, argued that a circular economy "would require radical transformations to the economic order, including fundamental recasting of manufacture, retail, consumption and property rights". How such changes might be played out, and how they might be resisted is a thorny issue. Concerns have been expressed that the concept of the circular economy might be captured by corporate interests, and more specifically by corporate capitalism. Valenzuela and Bohm (2017), for example, argued, that the terms circular economy and sustainability were effectively being "captured by politic-economic elites claiming that rapid economic growth can be achieved in a way that manages to remain responsible to environment and society".

Conclusion

This case study reveals the ways in which some large companies within the paper and retail industries have addressed the concept of the circular economy. While the authors' approach is applicable in principle, to small and medium sized companies, it can only be applied to such companies if they address the issue of the circular economy on their corporate websites. Nevertheless, the case study is valuable in that it provides illustrations of approaches to the circular economy

from contrasting stages of the product life cycle, the one focussed on manufacturing and the other on retailers. In both sets of industries, companies varied in the extent of their commitment to the circular economy, though such commitment was arguably stronger from the manufacturing companies, but many corporate commitments were, at least partly, aspirational. That said, companies in both sets of industries evidenced their commitment with several practical illustrations of the circular economy in action. Many of these illustrations of the workings of the circular economy were of waste management initiatives, and while waste management is an essential part of the transition to a circular economy, it is but one element in the product life cycle. However, all companies might, at best, be seen to be just embarking on long circular economy journey and they may encounter many challenges, often outside their control, along the way.

While this case study has its limitations, as outlined earlier, the authors believe it offers an appropriate exploratory review of how some leading companies in the paper and retail industries are addressing the circular economy, and as such it provides a platform for future research. Such research might include investigations of corporate thinking, and policy development, on the circular economy, and the forces driving the pursuit of circular economy business models; of if, and how, stakeholders' concerns are incorporated into circular economy strategies and policies; of how corporate policies towards the circular economy are communicated to employees, customers and suppliers; and of how data on circular economy achievements is collected, and of how such data is independently verified. Such research endeavours could include comparative investigations of companies throughout the supply chain and detailed case studies of specific companies. The nature of the information on the circular economy posted by the companies in the paper and retail industries, and the small number of companies included in the current case study, does not allow an analysis of the impact of the circular economy on costs, efficiency and productivity, but these issues will certainly provide important future research agendas. At the same time, researchers may look to explore if there are geographical variations in corporate approaches to the circular economy, for example between European and North American companies, and if company size is a factor in the adoption of circular principles

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