

Mapping the Collaborative Economy Landscape and its Relationship with Information and Communication Technologies

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Abstract

Collaborative economy (CE), defined as a peer-to-peer sharing of information, goods and services, has seen a large rise recently due to the global financial crisis and the advances of information and communication technologies (ICT) and infrastructures worldwide. This is one of the first surveys that examines this rise from a technical perspective, under the prism of ICT, attempting to map the landscape of the most popular CE initiatives that make use of ICT for their operation, categorizing CE companies into six main categories and 14 sub-categories. This chapter tries to understand, at each of the 14 sub-categories, which software and hardware elements, software design aspects and online communication tools have facilitated the growth of the most successful CE-based companies, reducing the barriers of acceptance, participation and engagement among the public. More than 150 well-known initiatives are reviewed, which operate around the world based on the CE principles, using ICT as the main medium for interaction, collaboration, sharing and exchange of information, goods and services. Successful and failed practices are discussed, obstacles for further adoption are listed and best software design elements involved are identified. Finally, this chapter attempts to predict the future of this promising practice, in parallel to the projected evolution of ICT such as the Internet and Web of Things, the Semantic Web, alternative currencies, predictive intelligence and big data analysis.

1 Introduction

Reasons such as global financial crisis and advancements in information and communication technologies (ICT) have led to a rise of the popularity of the collaborative economy practice, encouraging numerous successful initiatives (mostly) in developed countries. Collaborative economy (CE), known as sharing economy too, is defined as a peer-to-peer-based sharing of access to goods and services

(Owyang et al., 2013; Belk, 2014a; Schor, others, 2016), characterized by complex interactions among peers who collaborate to achieve certain socioeconomic goals (Thomas et al., 2013). It is a new socioeconomic practice in which traditional sharing, bartering, lending, trading, renting, gifting, and swapping are redefined through technology and peer communities (Glind Van de, 2013; Hamari et al., 2015; Albinsson, Yasanthi Perera, 2012), forming platform-enabled consumer ecosystems (Choudary et al., 2016; Möhlmann, 2015), evolving into systems of collaborative consumption (Botsman, Rogers, 2010).

Many believe that CE will redefine the buyer-seller relationship and it constitutes a natural evolvement of social business (Owyang et al., 2013; Rifkin, 2014), emerging in collaborative consumer-producer networks as a hybrid economy with hybrid modes of exchange (Scaraboto, 2015), where circulation enables the systemic creation of value by connecting networked participants (Figueiredo, Scaraboto, 2016). CE is also highly related to the modern concept of circular economy (Ghisellini et al., 2016), in which there is an emphasis in recycling and reuse of products and raw materials, and efficiency of resource use in a sustainable way.

Some companies have already joined this movement (e.g. Toyota, NBC, Enterprise) as they risk becoming excluded by customers who connect to each other (Enterprise CarShare, 2012). CE is becoming a big business, as the companies in US operating in this domain are valued now at 17 billion USD, employing 60K employees raising 15 billion USD in funding (Jeremiah Owyang and VBProfiles, 2015), (CrowdExpert.com, 2016). Projections from PwC mention that the total volume of transactions of the most important branches of CE in Europe could reach 570 billion EUR by 2025, from 28 billion which is the volume today (PwC, 2015). Reasons for the increasing support of citizens to CE include enjoyment of the activity, economic gains, personal reputation and social acceptance, and sustainability (mainly to people to whom ecological consumption is important) (Hamari et al., 2015; Wasko, Faraj, 2005).

In CE markets, as Jeremiah Owyang notes, people do not act anymore as consumers (only), but as micro-businessmen too (Jeremiah Owyang, 2014). He claims that CE has appeared because of the financial crisis, leading consumers to seek less expensive ways to cover their needs. Other reasons include increasing urbanization, which leads people to compete for space and physical resources, with the practice of sharing being the best action in many cases (Finley, 2013; Benkler, 2004). Moreover, the advances in ICT, including richer online experience, more trust in online financial transactions, the availability of broadband internet access from mobile phones, the rise of online social media and the use of mobile phones as smarter, more powerful computing devices with multiple embedded sensors, have enabled the larger adoption of many CE-based practices across the world (Rifkin, 2014).

As an example, citizens who saw their income being reduced due to the crisis, took the opportunity to sell products or services to other people through online websites and mobile applications, earning some extra money. This peer-to-peer manner of exploiting goods and services resulted in recognizing more the usability of a product or service than its ownership (Bardhi, Eckhardt, 2012; Botsman,

Rogers, 2010). The actual sharing and collaboration relies heavily on social dynamics (Scaraboto, 2015; Figueiredo, Scaraboto, 2016; Benkler, 2004), promoted through the aforementioned advancements in ICT in latest years (Wiertz, Ruyter de, 2007). This observed conjuncture of the establishment of the digital era and the rise of the CE practice has largely motivated this study, in an effort to examine the relationship and correlation between CE and ICT.

Related work in the context of this chapter is about how ICT has influenced or has been used in recent CE practices. Relevant literature has examined the concepts of sharing in Web 2.0 (Belk, 2014a), the business implications of on-line collaborative consumption (Belk, 2014b), reasons for online participation (Hamari et al., 2015), impact of online social dynamics (Wiertz, Ruyter de, 2007), motivations for online information sharing (Nov, 2007; Nov et al., 2010; Wasko, Faraj, 2005), legal aspects in online sharing (Manner et al., 2009), trust in online collaborative consumption (Keymolen, 2013) and e-commerce (McKnight et al., 2002) etc. However, an elaborate mapping of the landscape of the CE-based most well-known initiatives which use ICT for their operations has not yet been performed, nor how ICT have been precisely used.

Thus, this chapter aims to fill this gap in literature by exploring the most high-impact initiatives¹ employing CE practices, in relation to the use of ICT employed, as well as how these technologies have reduced the barriers of wide adoption and facilitated overall operation and success. The authors believe that this effort is of particular interest from societal, economic and environmental perspectives (EU Environment, 2013; Belk, 2014b), as most of these ICT-based initiatives operate in a sustainable way, promoting concepts of community spirit, (pseudo-)sharing and reuse (Hamari et al., 2015; Belk, 2014a; Benkler, 2004), although some misuse, dangers and challenges do exist as well (Martin, 2016; Schor, others, 2016). It is noted that this chapter focuses on a technical analysis of CE, not touching upon other *sensitive and open questions*, such as ideological underpinnings, dynamics of the field, logics and paradoxes, promises and myths, emergent business models, forms of power and social control etc.

The rest of the chapter is organized as follows: Section 2 describes the survey methodology and Section 3 presents the CE initiatives identified, divided in six different categories. Then, Section 4 performs an analysis of these initiatives with a strong focus on ICT, and Section 5 discusses challenges and opportunities as well as future directions of this promising practice. Finally, Section 6 concludes this chapter.

2 Methodology

The methodology of this survey involved three steps:

1. Collection of CE-relevant initiatives.

¹As there are several hundreds worth-mentioning CE-based initiatives around the world, only the most popular, successful and representative ones for the purposes of this survey were selected.

2. Clustering of related work.

3. Analysis of each cluster.

In the first step, a keyword-based search in popular web search engines (e.g. Bing, Yahoo, Google) was performed. Various keywords were used such as "collaborative economy", "sharing economy", "sharing goods", "sharing services", "peer-to-peer sharing" and combinations of them. Through this approach, many initiatives that had a web presence were identified, and also some articles and papers which listed and reviewed relevant companies and organizations (Owyang et al., 2013), (DGRV, 2015). By focusing only on initiatives that used ICT during their operations², 156 initiatives were collected in total. These initiatives cover both monetary and non-monetary exchanges (Albinsson, Yasanthi Perera, 2012).

In the second step, these initiatives were divided in categories according to their area of application/operation and which type of goods or services are being shared, exchanged, borrowed or used. Six broad categories were created, in which the initiatives were placed according to their highest relevance. These categories are as follows: 1) Money and Finance; 2) Transportation; 3) Communities and Agriculture; 4) Sharing Experiences; 5) Sharing Services; and 6) Sharing Goods. Then, each category was split into more relevant sub-categories, defining in total 14 sub-categories (see Section 3). It is noted that these categories and sub-categories have been selected by the authors based on the list of recorded initiatives, and they seem to cover more or less the whole spectrum of ICT-based CE companies, projects and initiatives.

In the final step, each category was examined separately (see Section 4), studying and analyzing each sub-category and its initiatives one-by-one, addressing the following questions:

1. Has CE practice been successful in this category?
2. Has it been popular and widely adopted?
3. Which are the barriers for wider adoption?
4. Which ICT have been used and how?
5. Which have been the success points?
6. Which have been the failure factors?
7. Are there any design elements (focusing on ICT), which make it more successful/engaging to its user community?

To answer the seven questions above, two parallel approaches were followed: a) directly asking the people involved (CEOs, managers) and b) based on authors' own research, considering review and news articles about CE, particular

²Various ICT as discussed and referred in this chapter are listed and explained at the beginning of Section 4.

(sub-)categories or specific initiatives. From the former approach, all the 156 identified initiatives were contacted, either by locating their CEOs or managers through their social media accounts, or through their public email addresses as listed on their companies' websites. To increase their honesty, full anonymity was promised, as well as discretion to any private data they would share with the authors. After 30 days and two rounds of reminders, 28 responses were received (17.9% response rate), having at least one response coming from each of the six categories as defined above. From these 28 responses, 19 were from the initiatives' CEOs/managers (67.8%), and nine (32.2%) from normal employees. The rest of this survey is based on the aforementioned methodology and the three steps involved.

3 A Review on Collaborative Economy Initiatives

In this section, the CE-based initiatives identified through the study are listed, categorized according to their relevance into six main categories and 14 sub-categories, based on the methodology described in Section 2. The whole ecosystem of CE is illustrated in Figure 1. In the following subsections, the 14 sub-categories and some of their popular initiatives involved are described. At the end of each subsection, an example is provided of how the CE practice works in this particular domain, using two hypothetical characters, Alice (as the consumer) and Bob (as the producer of some particular transaction or exchange). In some examples, Bob serves as a friend or consultant for Alice, to help her with her task or issue she needs to address.

3.1 Money and Finance

This category represents initiatives related to money and finance, such as crowdfunding and banking.

3.1.1 Crowdfunding

Crowdfunding is the practice of funding a project or venture by raising monetary contributions from a large number of people (Share, 2013), with an estimated fundraising volume 34 Billion USD in 2015 (CrowdExpert.com, 2016). Example initiatives that perform this practice, funding creative projects based on online web platforms, are Indiegogo (Indiegogo, 2007), Ulule (Ulule, 2010) and of course the popular Kickstarter (Kickstarter, 2009). Peer-to-peer investments are also supported by Abundance Generation (Abundance Generation, 2011), TRINE (TRINE, 2015) and Green Crowding (Green Crowding, 2015), focusing on environmental-based projects, especially ones related to sustainable energy.

On crowdfunding targeting renewable energy projects, we encounter Citizenenergy (Citizenenergy, 2014), Lumo (Lumo, 2010) and Lendosphere (Lendosphere, 2014). Also, Joukon Voima (Joukon Voima, 2015) is a marketplace

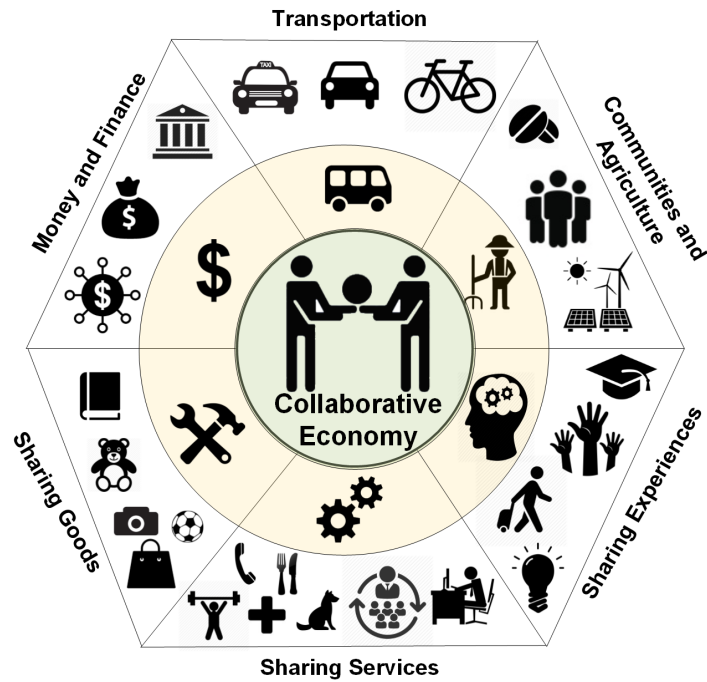


Figure 1: The ecosystem of CE.

where projects related to sustainable consumption and production of energy meet willing funders. Neighborly (Neighborly, 2012) provides better ways for people to invest directly in the (local) places and civic projects they care about, creating new options for communities to approach civic capital formation. Finally, funding bodies supporting CE efforts include Heinrich Bll Foundation (Heinrich Bll Foundation, 1986) and United Nations Development Programme (UNDP, 1965).

Example: Alice has a novel idea to develop a technological product that allows mobile phones to become charged while performing cycling, from energy produced by the bike’s movement. She needs some funding to develop this creative project and Bob suggests her to use Kickstarter, where she can describe her idea and invite micro-investors to fund the project, with the promise to ship them the product as a gift when it becomes ready.

3.1.2 Banking

The alternative form of banking is called ethical banks. An ethical bank, also known as a social, alternative, civic, or sustainable bank, is a bank concerned with the social and environmental impacts of its investments and loans, and not having profit as its overriding objective (Move Your Money UK, 2016). Often in these banks, multiple private investors are involved in capital raise. Examples of such banking institutes include Triodos (Triodos Bank, 1980) (multi-European),

EBanka (EBanka, 2014) (Croatia), Banka Etica (Banka Etica, 1999) (Italy) and La Nef (La Nef, 1989) (France). Also, the ratio between the highest and lowest salary within Triodos is always kept below 10:1, with no executive bonuses paid. Moreover, the bank publishes details of every organization they lend to and invest in, so customers can know exactly what their money is being used to support. Moreover, Charity Bank (Charity Bank, 2002) (UK) has a mission to help charities and social enterprises, having lend more than 250M GBP to charities and social enterprises since 2002. The federation of the aforementioned banks is FEBEA, the European Federation of Ethical and Alternative Banks (FEBEA, 2001).

Example: Alice wants to make a loan for an environmental project that will benefit her community, creating recycling stations where people can dispose their organic waste for future reuse. She contacts Bob, who works at an ethical bank, which is a bank that funds environmentally-friendly projects, where the funding comes from peers who assign to the bank the responsibility to invest other peers towards green actions. Alice convinces Bob about the positive environmental aspect of the project, and the bank decides to fund it.

3.1.3 Finance

Here we encounter initiatives dealing with alternative forms of financing by offering relevant services, the so called *social lending*. Crowdfunding Academy (Crowdfunding Academy, 2012) provides services and advice on how to prepare a successful funding campaign. Tilt (Tilt, 2012) builds software that makes pooling resources within a group easier and without any risk, matching borrowers and investors. Lending Club (Lending Club, 2006) and Zopa Bank (Zopa, 2005) are two of the world's largest online marketplaces, connecting borrowers and investors, transforming the banking system to make credit more affordable and investing more rewarding, by passing the savings on to borrowers in the form of lower rates and to investors in the form of solid returns.

Example: Alice wants to borrow a small amount of money in order to buy a new laptop for her daughter who just went to college. She wants to avoid banks as they charge high interests so she uses Tilt, which matches her request with Bob who is a micro-investor. They agree on the exact amount, the payback period and the interest rate, and they both profit from the transaction, Alice from the lower interest rate paid and Bob from the higher rate received, instead of depositing his money at a bank through a fixed-term deposit.

3.2 Transportation

Transportation in the eco-system of CE relates to car or ride sharing between individuals, as well as sharing a taxi or bicycle. It is relevant also to sharing info about available parking spots.

3.2.1 Car Sharing

Uber (Uber, 2009) is one of the most famous platforms for peer-to-peer car sharing, with much buzz lately for conflicts between its users and professional taxi drivers (The Telegraph, 2016). By means of Uber, people can use their car as a taxi for earning money, or use other people's taxi services and pay them money. Lyft (Lyft, 2012) and Getaround (Getaround, 2009) are taxi services matching user's current location with local drivers being around them for rides in minutes. Lyft considers also rides involving groups of friends. Turo (Turo, 2009) is a US-based company allowing users to select from a vast collection of unique, locally-owned cars, DriveMyCar (DriveMyCar, 2010) offers similar services in Australia, SnappCar (SnappCar, 2011) in Netherlands and Autonetzer (Autonetzer, 2010) in Germany. FlightCar (FlightCar, 2012) allows people who park their vehicles at the airport during trips abroad, to rent them out to other approved traveling members.

Furthermore, sharing knowledge about parking spots is useful when driving a car. Park Circa (Park Circa, 2010) and JustPark (JustPark, 2006) connect people who have empty parking spaces during a set time to people that need them. MonkeyParking (Monkeyparking, 2013) does a similar job, encouraging users to list spots they discover. In all the aforementioned platforms, parking providers earn money when drivers book their spots. As a more professional parking service, ParkOnMyDrive (Tanach Enterprises, 2010) allows those who have empty driveways and garages to rent them out on a daily, weekly or monthly basis to motorists. Finally, City Car Share (Share, 2013) was a non-profit program in the metropolitan region of San Francisco, providing its members with the use of fuel-efficient vehicles by the hour. Now it has joined forces with Getaround (Getaround, 2009).

Example: Alice wants to take a taxi to go to her best friend's party. She uses Uber through her mobile phone to locate a nearby taxi, checking at the same time the profile of the driver Bob and the ratings performed by other travelers in the past, to examine how safely he drives or how polite he is with the customers. As she is happy with his profile she decides to book the taxi, and she is informed in real-time where it is located and how far it is from her current spot. Bob drives her safely to her destination and Alice pays a smaller amount than the expected one if she used a normal taxi service.

3.2.2 Bike and Ride Sharing

Bike sharing is about renting a bike from a company or other peers. Users rent bikes using one of the following methods: a) issue a special electronic card by paying a monthly or yearly fee; b) pay the current fee with a credit card at the renting point. In the former case, the user uses the electronic card to unlock the bike for some specified amount of time. In the latter, the user either gets direct access to the bike or receives at his mobile phone information on how to access the renting system.

From company-based rental, we identify Velib (Velib, 2007) in Paris, France,

Bixi (Bixi, 2008) in Montreal, Canada, BCycle (BCycle, 2010) across US and Call-A-Bike (GmbH, 2000) in Germany. From the latter category, Spinlister (Spinlister, 2011) and SocialBicycles (Social Bicycles Inc., 2010) work as marketplaces, offering online platforms supporting transactions between people who want to rent a bike and people who want to share their bikes and earn some money for every rent. Also, worth mentioning are Boatbound (Boatbound, 2012), which is about boat sharing, having a list of 11,168 boats in over 2,100+ cities around the world and OpenAirplane (OpenAirplane, 2012), which makes it easy to find, book, fly, and pay for aircraft rental.

About ride sharing, Zimride (Zimride, 2007) is a secure ride-sharing platform for companies and universities, saving employees' time and money, helping them to know their co-workers relieving parking congestion. Nuride (Nuride, 2002) gives rewards to their users when they walk, bike, or take public transportation and helps them locate a carpool or commute buddies. Rewards include restaurant coupons, retailer discounts and tickets to shows and attractions. Carma is pioneering the Ownerless Car (Carma, 2015), promoting car pooling, aspiring to transform wasted parking lot hours into dynamic mobility services that respond to people's different transportation needs throughout the day. Finally, BlaBlaCar (BlaBlaCar, 2006) and Taxistop (Taxistop, 2013) promise trusted ridesharing, connecting people who need to travel with drivers who have empty seats.

Example: Alice wants to visit her grandparents who live in another city. To save money, she uses BlaBlaCar to locate drivers who plan to perform the same trip. She locates Bob who is doing the same route at the same day, while his overall feedback by other travelers is very positive. She contacts him through BlaBlaCar paying with her visa the requested amount, and she reserves a seat at Bob's car.

3.3 Communities and Agriculture

This category includes communities whose goal is to become socially, economically and ecologically more sustainable, as well as local or national agricultural cooperatives, for addressing collectively the challenges of farming.

3.3.1 Agriculture

The agricultural section is quite famous for its many cooperatives and coalitions around the world. These cooperatives involve collaboration between operators in the production chain, single selling brand and exporting operations, exchange of goods, know-how and technology, as well as financing. One of the most popular cooperatives is Coop de France (Coop de France, 1966), representing many other smaller cooperatives and hundreds of organizations, while Vignerons coop (Vignerons, 1932) is another French cooperative for wine producers. Worth-mentioning examples are also La Terra e il Cielo (La Terra e il Cielo, 1980), an organic farming cooperative in Italy that prioritizes quality and sustainability and Milcobel (Milcobel Cooperative, 2004), a cooperative of dairy farmers

in Belgium. Bios Coop (Bios Cooperative, 2012) is a cooperative non-profit supermarket, selling goods produced by more than 400 producers in Northern Greece.

Slow Food International Association (Slow Food, 1989) is a global organization counting 100K members and 1M supporters in 160 countries, acting as an umbrella organization for local groups that work to promote a new food system that pursues cultural, environmental and social goals built around the rights of good quality food access, food security and biodiversity protection. Finally, seed sharing communities include Seed Savers Exchange (SSE) in North America (SSE, 1975), Seed Saver Foundation (SSF) in Australia (SSF, 1986), Let's Liberate Diversity (LLD) network within Europe (LLD, 2012) and Peliti community in Greece (Peliti, 1995). These communities promote the cultivation of organic, non-GMO crops at the farms of their members.

Example: Alice became recently a farmer in Italy, producing organic apples and vegetables. To reduce her costs on distribution of goods and avoid the hassle of dealing with wholesalers, she decides to join La Terra e il Cielo cooperative where her friend Bob is also a member. She realizes that, through the cooperative, she can exchange know-how with other farmers and share agricultural tools and machinery, reducing her overall costs. At the same time, the cooperative protects and supports the community's rights and farmers' interests.

3.3.2 Renewable Energy

Energy cooperatives constitute projects locally owned by farmers, investors, businesses, schools, utilities, and other public or private entities who utilize (mainly renewable and sustainable) energy to decrease the energy costs of the local community and reduce dependency of the community on the utility's grid. Possible benefits span across finance (reduction of electricity costs, higher energy efficiency, new employment opportunities), society (respecting the environment, better air quality from reduced emissions) and politics (promoting more resilient, stable and fairer communities). A nice example is Som Energia (Som Energia, 2010), which manages community projects involving renewable energy production, mostly related to photovoltaics. Similarly, De Windvogel (De Windvogel, 1991) operates in Netherlands focusing on wind turbines and Coopernico (Coopernico, 2000) in Portugal, claiming to have created 217 contracts with 285K EUR investments. Moreover, Solar Century (Solar Century, 1998) is a UK-based company encouraging and managing communities to come together and pool investment to fund their own solar farms. Finally, Trade Unions for Energy Democracy (TUED, 2012) is a global initiative aspiring to advance democratic energy direction, promoting solutions to climate crisis and energy poverty.

Example: Alice is the president of a local community in south Portugal that wants to switch to photovoltaics to cover the energy needs of its members. The community decides to fund the project with money coming from its members, with the promise that members who invest more in the project will have priority over their energy needs, while any profits from selling excess energy back to the

grid will be used to payback their members slowly through time. Alice listens to the suggestion of Bob, who is another community member, to collaborate with Coopernico to take care of the project. Coopernico deals with all legal and technical aspects, and the project begins to be implemented.

3.3.3 Eco-communities

Eco-communities are committed to ecological, social and economic sustainability of their members and of the physical environment where they are located (L.O.V.E. Production, 2015). Global Ecovillage Network (GEN, 1995) is a growing network of sustainable communities and initiatives that bridge different cultures, countries, and continents, serving as an umbrella organization for eco-villages, transition town initiatives, ad hoc communities, and ecologically-minded individuals worldwide. A nice eco-village example is Findhorn (Findhorn Eco-village, 1998), serving as a tangible demonstration of the links between the spiritual, social, ecological and economic aspects of life. Also, ToolzDO (Etoolbay Inc., 2009) is a social platform for connecting neighbors to each other and to their local community, in order to strengthen community life. Transition Towns (Transition Towns, 2006) are community-organized social innovations present in 44 countries that are attempting to build local resilience to climate change and economic crisis. Finally, time banking (Time Banks, 2006; Seyfang, 2004) is a value-based mechanism for reciprocal service exchange, focusing on the contributions everyone can make to meeting needs within a local community. The unit of exchange and account is simply the hours spent giving or receiving service. It counts 40K members in 587 communities.

Example: Alice is the manager of a transition town in New York. Bob, who is a member of the community working as an agri scientist, proposes to develop a project related to urban agriculture. Alice and the other members are excited, and the agreement is that all members who have space at their backyard will grow organic vegetables, which they would then exchange and share with the other members of the community. This project helps community members to learn and appreciate farming, get access to organic, healthier food, and it increases community spirit.

3.4 Sharing Experiences

The most recreational form of CE is that of sharing experiences with other peers, such as education, know-how and best practices, volunteering for good causes or in exchange of training and accommodation, as well as CE-based tourism services and eco-tourism.

3.4.1 Education and Knowledge

Here we can observe communities and online platforms for education and skills sharing, as well as schools with alternative, anthropocentric and sustainable educational goals. Edufire.com (Edufire, 2010) is a distance education platform

and social network service for teaching and learning. The Brooklyn Skillshare (Brooklyn Skillshare, 2012) is about community-based learning events organized and taught by Brooklyn residents, where participants teach and learn from each other. Grassroots Economic Organizing (GEO, 2008) is a decentralized collective of educators, researchers and grassroots activists working to promote an economy based on democratic participation, worker and community ownership, social and economic justice, and ecological sustainability.

Online education includes as well the popular examples of massive open online courses (MOOC), such as Moodle (Moodle, 2002), Udemy (Udemy, 2009) and Coursera (Coursera, 2012), offering courses from statistics to astronomy and from yoga to photography.

Schools with an alternative learning approach include Steiner Waldorf schools (Steiner Waldorf, 1928) in Ireland and UK, focusing on helping students as much as possible to choose and, in freedom, to realize their individual path through life as adults, and Findhorn Foundation College (Findhorn Foundation, 1998) in Scotland, which has an interesting curriculum, engaging participants in transformative education for sustainability and personal empowerment, offering a holistic education for sustainable living. DESIS (DESI, 2009) is a network of design labs, based in design schools, actively involved in promoting and supporting sustainable change. Gaia Education (Gaia, 2005) supports communities to replace input-intensive agriculture with new food systems, focusing on well-being and resilience. Finally, Nea Guinea (Nea Guinea, 2007) is a Greek-based online community providing support for self-management of our daily life.

Example: Alice is a passionate violin player living in Brooklyn. She wants to create a small neoclassical metal-style band that will play metal songs through classical music. Through the Brooklyn Skillshare she meets Bob, who is a talented cellist, and she teaches him about the concept she has in mind, in order to form together an alternative band. Their band eventually meets great success in Brooklyn and beyond.

3.4.2 Volunteering

Volunteering services are about providing work in exchange of accommodation, education, entertainment and new skills. Modern volunteerism goes beyond traditional forms of charity and involves dynamic activism and participation in various actions, demonstrations, initiatives that deal with well-being, justice, sustainability, solidarity etc.

HelpX (HelpX, 2001) is an online listing of farm and home stays, lodges, hostels and even sailing boats who invite volunteer helpers to stay with them for a short term in exchange for food and accommodation. Similarly, WWOOF (WWOOF, 1971) links volunteers with organic farms and growers. Leftover-Swap (LeftoverSwap, 2013) and Copia (Copia, 2016) are about peer-based donations of excess food, handling the process of food donation and distribution, enabling peers to receive enhanced tax deductions and reduce disposal costs.

Example: Alice aims to learn about organic farming through practical work and volunteerism. To achieve this, she uses HelpX to get in touch with Bob,

who runs an organic farm producing dairy products. Bob agrees to host Alice at his farm for two weeks, offering her food and accommodation, while Alice with offer volunteering services related to the farm's everyday operations.

3.4.3 Travel and Tourism

Growing concerns over environmental impacts, poverty and financial crises have inspired discussions on alternative models of tourism that promote sustainable development (Dredge, Gyimóthy, 2015). CE-based initiatives in travel consist of sharing of space and accommodation, tourist guide services performed by locals, as well as eco-tourism in sustainable communities and organic farms.

In accommodation sharing, the most popular are Airbnb (Airbnb, 2008) and Couchsurfing (Couchsurfing, 2003). Their difference is that Couchsurfing is free, encouraging *couchsurfers* to open their homes and share their lives, and it supports 4M *surfers* each year. Airbnb is about renting places from local hosts, supporting 60M guests in 190 countries and 34K cities. The numbers are astonishing. Statistics indicate that CE now accounts for approximately 40% of the overall world accommodation market (Berlin, 2014).

Regarding vacation rental marketplaces, worth mentioning are also Pillow (Pillow Homes Inc., 2014), HomeAway (HomeAway, 2005), FlipKey (FlipKey, 2007) and Flatbook (Flatbook, 2012), while misterbnb (misterbnb, 2013) focuses in particular on gay people. Tripping (Tripping, 2010) and VRBO (VRBO, 2005) operate as intermediary services, comparing vacation homes listed in other marketplaces, as the ones aforementioned.

As alternative traveling services, Le Mat (Le Mat, 2005) plans travel itineraries to discover new places, meeting and spending time with social entrepreneurs in situ. Furthermore, related to tourism, there is the option to hire locals for guides around their cities. Rent-A-Guide (Rent-A-Guide, 2010) offers more than 5,6K tours in 81 counties. Shiroube (Shiroube, 2011) not only offers guides for different places but sorts them out according to interests as well. Viator (Viator, 1995) and Vayable (Vayable, 2011) have a large repository of travel guides, their reviews, portfolios and descriptions. Finally, Jib.li (Jib.li, 2011) uses social network-like connections to match those with unused allowances with others on the same flight looking to avoid such charges.

Example: Alice wants to travel to Thailand and experience the Southeast Asian culture. As she does not have the complete budget for such a trip, she uses Couchsurfing to locate Bob who lives in Bangkok, and agrees to accommodate her at his house during her trip for free. During her stay in Bangkok, Alice uses Vayable to find a travel guide who guides her through the city for a small fee.

3.5 Sharing Services

Sharing services span a variety of industries, and are related either to individuals or to companies (Belk, 2014a).

3.5.1 Personal

Personal services are those provided to individuals on a sharing and/or peer-to-peer basis. Nanny in The Clouds (Nanny in The Clouds, 2012) enables parents to find out whether there will be any registered nannies traveling on their flight who would be willing to provide childcare services for a pre-negotiated fee. Heal (Heal, 2014) makes it easy and affordable to see a doctor at home, based on the customer’s schedule. Wello (Wello, 2011) is like working out with a personal trainer in a gym or attending a group fitness class at a studio, but over live video. A user has the same interactive, personalized experience but from the comfort of his home or office, together with other group members, hence the cost becomes lower.

GetMaid (GetMaid, 2012) offers subscription-based eco-friendly green cleaning services with discounted pricing. Guevara (Guevara, 2013) offers lower-cost driving insurance to groups of people, saving up to 50% when claims are kept low. Friends from around the world can also become available for hire, e.g. to attend a social event, act as a tourist guide, teach a new skill/hobby, or just for companionship (RentAFriend.com, 2009). TaskRabbit (TaskRabbit, 2008), Handy (Handy, 2012), Zaarly (Zaarly, 2011) and AtYourService (AtYourService, 2012) are platforms connecting people to safe and reliable services from professionals at their neighborhood, at reasonable costs.

Moreover, related to food, EatWith (EatWith, 2012) and HomeDine (HomeDine, 2012) are about sharing meals with other community members, offering an easy way to access the underground food scene of a city and connect with creative people. Feastly (Feastly, 2012) is a central marketplace where passionate chefs connect with adventurous eaters seeking more authentic dining options by offering unique meals served at a chef’s home. Fon (Fon, 2005) asks you to allow others to access your home WiFi network in exchange for getting free WiFi at any of the 8M worldwide hotspots in Fon’s network. Focusing on pets, DogVacay (DogVacay, 2012) helps to find *pet sitters* when traveling by paying a small fee, while Rover (Rover, 2011) provides a platform to find and book local dog sitters in 10K+ cities. Finally, revolutionary urban logistic on-demand delivery platforms include Postmates (Postmates, 2011) and Deliv (Deliv, 2012), which connect customers with local couriers, who purchase and deliver goods from any store in a city. Instacart (Instacart, 2012) and Deliveroo (Deliveroo, 2013) offer similar services, operating in the delivery of food and grocery goods. Finally, in Sidecar (Sidecar, 2011), individuals use their cars for on-demand delivery of various products, with the company claiming that its services cut delivery times in half, with more than 95% on-time rate guaranteed.

Example: Alice plans a trip to her parents who live in another country. As she cannot take her dog with her, due to the high charges of air carriers, she uses DogVacay to find a pet sitter to take care of her dog during the trip. She locates Bob, who has an excellent profile based on the positive comments of the community about his petsitting services, charging a logical fee for them. Bob takes care of Alice’s pet and she visits her parents without any worries about her dog’s safety and well-being.

3.5.2 Enterprise

Enterprise services are provided to companies on a sharing basis. Desks Near Me (Desks Near Me, 2012), Desksurfing (DeskSurfing, 2010), PivotDesk (PivotDesk, 2012) and Spaceout (Spaceout, 2008) help to find or rent out storage, office, parking, rural or commercial space, converting extra or unused space into a regular income. FLOW2 (FLOW2, 2012) and Getable (Getable, 2010) are sharing marketplaces for business equipment and services, such as cars, meeting rooms, MRIs, communication specialists, trucks, aerial platforms, designers etc. Cohealo (Cohealo, 2012) is a technology company that helps health systems share medical equipment across facilities, so they can optimize their spending, accelerate cash flow, and improve access to health care. Yard Club (Yard Club, 2013) is about renting agricultural machinery among peers.

Another interesting area here is outsourcing, which is a practice used by some companies to reduce costs, by transferring portions of work to outside suppliers rather than completing them internally. HourlyNerd (HourlyNerd, 2013) and Freelancer (Freelancer, 2009) are online platforms that can instantly connect users with the world's smartest business experts at a fraction of the price, for solving their business problems. Similarly, UpWork (UpWork, 2003) is about finding freelancers to solve business problems quickly and less expensively and UpCounsel (UpCounsel, 2012) is about hiring lawyers. CrowdSource (CrowdSource, 2016) moves one step further, not only connecting internal teams with freelance talent but also by providing a fully customizable workflow interface to complete large content- and data-driven projects with more efficiency. Moreover, TechShop (TechShop, 2006) is a community of inventors and entrepreneurs that facilitates access to tools, software and space. StudioMates (StudioMates, 2008) is a collaborative workspace of designers, illustrators, bloggers, writers, and developers, located in Brooklyn. Finally, Coloft (Coloft, 2010) and Impact Hub (Hub, 2005) are communities of entrepreneurs, sharing their knowledge, collaborating in open work environments.

Example: Alice runs a startup company offering data analysis services to insurance companies. As her company is still young and she tries to keep her running costs low, she uses Desksurfing to locate similar small companies who want to share their workspace to reduce their costs. She agrees with Bob to share a common office and they both keep their expenses low by splitting equally the total monthly rent and utility fees.

3.6 Sharing Goods

Sharing goods is about the exchange of products and physical objects among peers, from the ones who do not need them anymore to those who are in need, and the transaction is usually performed either for free, or for a price much lower than the one of buying the product brand-new. Exchange is either for a short period (rent) or for ever (sale).

The most popular marketplaces are eBay (eBay, 2010) and Etsy (Etsy, 2005), supporting millions of buyers and sellers, and billions of annual gross mer-

chandise sales. One of the most "traditional" product types being exchanged are books. Chegg (Chegg, 2005), BookRenter (BookRenter, 2006) and Zookal (Zookal, 2011) focus on higher education, renting textbooks for a fraction of the cost of the bookstore (claiming savings up to 90%), offering also matching services for tutors in various subjects. Similarly, CampusBookRentals (CampusBookRentals, 2007) supports over 1M students across nearly 6K campuses, offering also free shipping services.

Taking advantage of the fact that kids play with some toy only for a short time period and then swap to another one, Pley (Pley, 2013) is a toy rental company aiming for "no more money wasted on toys left gathering dust on shelves". Memberships start from 20 USD per month, and involve unlimited exchanges from a large collection of toys. babyPlays (babyPlays, 2007) sells second-hand toys after an elaborate sanitization process at a much lower price.

Related to fashion, Poshmark (Poshmark, 2011) is a peer-based marketplace for clothing items. Rent the Runway (Rent the Runway, 2009) is a novel initiative, through which customers can rent cloth on a monthly membership basis (139 USD per month). Customers start by collecting up to three pieces, keeping them for as long as they want. After, they can exchange these items for something new. No rental fees, free dry cleaning, insurance and free shipping are in the deal. Bag Borrow or Steal (Bag Borrow or Steal, 2004) is an online platform for people to borrow, sell or rent handbags. Fashion Hire (Fashion Hire, 2006) offers similar services on a monthly membership basis in UK.

frents (frents GmbH, 2013) is about renting things between friends and neighbors in Germany, either for free or at a low price. Neighborrow (Neighborrow, 2005) is about sharing items among peers in the US. Items are for free, except those above 250 USD, which are available for a membership fee (50 USD per year for one item at a time). Friends with Things (Friends with Things, 2010) and Streetbank (South Park Studios, 2010) promote borrowing or sharing things between neighbors, supporting also the sharing of skills, expertise and local knowledge. Yerdle (Yerdle, 2012) promotes swap of stuff for money savings, using *Yerdle Dollars* during swap for the purchase of new stuff. Finally, Garage Sale Trail (Garage Sale Trail, 2010) is a people-powered reuse movement, organizing events across Australia for garage sales. It claims to provide the biggest reuse and community events in the country.

Example: Alice wants to buy some toys for her baby, but she realizes that toys have a very small living cycle since children get bored of them rapidly. Hence, she decides to buy second-hand toys from babyPlays. At the same time, Bob sells his child's old toys to babyPlays, which become available to Alice after they become sanitized by the company.

4 ICT-Based Analysis

In this section, each (sub-)category of CE as described in Section 3 is analyzed, addressing the research questions listed in Section 2. Table 1 lists our findings in regard to these questions, separately for each sub-category. The first

column contains the research questions, and the rest provide the results per sub-category. In the first two questions, a Likert scale³ was followed, and the findings are based on the 28 responses of the CEOs/managers/employees of the CE initiatives, as described in Section 2. The possible bias in these first two questions is acknowledged by the authors.

The ICT used by the CE initiatives under study include the following:

- *World Wide Web*: The web constitutes a standardized communication environment between users and content providers on the internet, for the distribution and exchange of text, documents, images and video. Web 2.0 basically refers to the transition from static HTML web pages to a dynamic web that is more organized and based on serving web applications.
- *Web applications*: Software applications in which the client (or user interface) runs in a web browser. Modern web apps are highly responsive, dynamic and adaptive to the users' needs and requirements, personalized according to their profiles.
- *Electronic markets*: E-markets are online marketplaces where users exchange goods and services with other users or with the owner/host of the market through web interfaces. Transactions through e-markets usually have reduced costs, are easier, more transparent and faster. In the case of peer-to-peer transactions, the e-market is called *online social commerce* (Wang, Zhang, 2012; Hamari et al., 2015).
- *Websites*: Mostly static web pages with general information over some topic, theme, company, services etc.
- *Smartphones*: Mobile phones that perform many of the functions of a computer, typically having a touchscreen interface, internet access (Wi-Fi, 3G), and an operating system capable of running downloaded applications. The most popular operating systems used are Android and iOS (for iPhones). Smartphones carry various sensors for smarter operation, such as GPS receivers, proximity sensors, magnetometers, accelerometers, light sensors, thermometers, barometers, pedometers etc.
- *Mobile apps*: Software applications designed to run on mobile devices such as smartphones and tablet computers, exploiting the sensory capabilities of (smart)phones as listed before, especially location and proximity services.
- *Online social media*: Online web platforms that assist making connections with friends, family, classmates, customers and clients. Online networking can occur for social purposes, business purposes or both, through sites such as Facebook, Twitter, LinkedIn etc.

As Table 1 indicates, the most successful CE approaches seem to be in car sharing (e.g. Uber, Getaround), travel and tourism (e.g. Couchsurfing, Airbnb),

³1: Not at all, 2: Little, 3: Average, 4: Much, 5: Very much

as well as agricultural cooperatives (e.g. Coop de France, Vignerons). The least successful ones are in banking and finance, mostly because they are still at their infancy.

Category	Money and Finance			Transportation		Communities and Agriculture			Sharing Experiences			Sharing Services		Goods
Question / Sub-Category	Crowd funding	Banking	Finance	Car Sharing	Bike/Ride Share	Agriculture	Renewable Energy	Eco-communities	Education Knowledge	Volunteering	Travel Tourism	Sharing Personal Services	Enterprise Services	Sharing Goods
Has CE been successful?	Much	Little	Little	Very much	Much	Very much	Much	Average	Average	Average	Very much	Average	Much	Much
Popular and widely adopted?	Very much	Little	Little	Very Much	Average	Very much	Little	Little	Average	Little	Very much	Average	Very much	Much
Barriers for wider adoption?	Policies, protocols, ROI, trust, marketing strategies, customer services, competition with conventional banks, unfamiliarity.			Trust, convenience, privacy, personalization, unfamiliarity		Policies, motives, incentives, trust, proof of concept, ROI, unfamiliarity		Convenience, public services, work,	Recognition, incentives, trust, unfamiliarity	Incentives, trust	Trust, unfamiliarity	Trust, unfamiliarity	Incentives, trust, unfamiliarity	Convenience, trust, indirect costs.
Success points?	Fast and easier fundraising, high-tech products involved, ethics, transparency, lower rates, solid returns			Lower cost, friendly to the environment		Robust processes and sales, lower costs, reliability, reputation, friendly to the environment, sustainable, personal satisfaction, connection to nature, community spirit, sustainability			Low cost, targeted, personalized education and experiences, sustainability, personal satisfaction, connection to nature, convenience.			Lower cost, convenience, personalization, community spirit		Lower cost
Failure factors?	Over ambitious projects, campaigns that did not deliver their products, payment issues (crowdfunding), no reputation and trust, limited deposits' insurance (banking)			Fear of strangers, privacy, convenience, small market		Lack of good coordination, clear policies, motives and trust. ROI not well defined.			Degree recognition, limited business opportunities	Gap between offer and demand, reliability, trust, small market		Lack of reputation and trust, small market.		Inconvenience, indirect costs, small market.
ICT used?	Web apps, social media	Web apps	Web apps	Web apps, mobile apps	Web apps, mobile apps	Website	Website, social media	Website, social media	Web apps, social media	Website, social media	Web apps, mobile apps, social media	Web apps, e-markets, mobile apps, social media	Web apps, e-markets	Web apps, e-markets, mobile apps, social media
Successful and engaging design elements?	Cool videos for high-tech products and community building (crowdfunding). Personal stories of sustainability, transparency, ethics, good causes, promotion of community spirit (banking and finance).			Reputation systems, user profiling, personalized services, social networking features, community building.		Success stories of cooperatives and eco-communities, community spirit, environmental awareness campaigns, community building.			Promoting alternative curriculums, distant learning, remote courses, social net. features, personalization.	Photos and videos of the accommodation, venue, location, events and operations involved, community building, reputation systems, privacy.		Personalization, short self-explanatory animated videos, social networking features, user profiling.		Success stories, guarantees and free shipping, privacy, user profiling, reputation systems, community building.

Table 1: Analysis of CE per category.

Most popular and widely adopted are initiatives related to crowdfunding (e.g. Indiegogo, Kickstarter), car sharing, enterprise services (e.g. DeskSurfing, Freelancer), agriculture, travel and tourism, while least popular are those in renewable energy, eco-communities, banking and finance, and volunteering. Sharing goods has been widely adopted only by a few initiatives (e.g. eBay, Etsy, CampusBookRentals), while most approaches did not scale at large (e.g. frents, Neighborrow, Yerdle).

4.1 Barriers and Reasons for Success or Failure

Barriers for wider adoption differ per category, however issues of trust (Owyang et al., 2013), privacy and unfamiliarity with the renewed concept of sharing (Belk, 2014a) are quite common obstacles, similar to the findings of Möhlmann (Möhlmann, 2015). In money and finance-based initiatives, legal issues (e.g. policies, protocols, fully respecting privacy) seem to be important barriers (Manner et al., 2009), while competition with conventional banks is difficult. Ethical banks and crowdfunding campaigns lack experience in effective marketing strategies and high-valued customer services, but this can change with time. Particularly on crowdfunding, investors sometimes do not understand precisely their return on investment (ROI). Lack of convenience is a common barrier in transportation (i.e. time consuming, not convenient pickup points), eco-communities (i.e. limited access to facilities, no availability of certain services) and sharing of goods (i.e. time needed for the agreement with the seller, time and cost of purchase/delivery or product status not as expected), while better recognition, motives and incentives are required in agriculture (i.e. explain potential benefits to farmers to join a cooperative), eco-communities (i.e. difficult to live there for a long time especially as the member gets older and needs access to health services or cannot contribute much to the community), education (i.e. companies and universities not recognizing some online courses performed by employees and students), volunteering (i.e. the effort of the person does not have any recognition besides personal satisfaction and skills acquired) and enterprise services (i.e. no incentives for medium-to-large companies to share resources with other institutes or to use outsourcing).

On sharing goods, indirect costs involved (i.e. product shipping, guarantees), especially for low-cost products, are core barriers for revenue growth. Further, new forms of cooperatives in agriculture and renewable energy still need to publish proof of concept success stories and solid ROI estimations (e.g. La Terra e il Cielo, Coopernico). Finally, some general barriers present in all categories are regulatory issues (e.g. gray zones for taxation) and vested interests (e.g. taxi drivers demonstrating against Uber (The Telegraph, 2016)).

Success points that have facilitated CE initiatives to flourish involve in general lower cost of product purchased (e.g. second-hand toys, books) or service used (e.g. outsourcing tasks to freelancers), common use of resources (e.g. goods, services, community-produced energy, shared office space), connection to nature (e.g. eco-communities, volunteerism), community spirit (e.g. agricultural cooperatives, eco-communities, renewable energy projects), personal satisfac-

tion for being sustainable and preserving the environment (e.g. crowdfunding, eco-communities, volunteering). Moreover, convenience and personalization are positive factors used in education/knowledge (e.g. attend the course on free time, select from a wider range of courses and difficulty levels) and in sharing services (e.g. choose a professional based on people’s feedback and service provider’s online profile and availability). Specifically in crowdfunding, rapid fundraising and access to high-tech products constitute engaging elements (e.g. Indiegogo, Kickstarter), while ethical banking counts on ethics and transparency (e.g. Triodos, Banka Etica). Finally, CE-based financing promises lower lending rates and solid investor returns (e.g. Lending Club, Zopa Bank).

The above findings are in line with related work (Hamari et al., 2015), (Albinsson, Yasanthi Perera, 2012), (Möhlmann, 2015), suggesting that people participate in CE because of sustainability, enjoyment of the activity, sense of community as well as economic gains. Sense of community has been identified in related work also as an important driver of participation (especially) in non-monetary-based CE initiatives (Albinsson, Yasanthi Perera, 2012).

Reasons for failure in most sub-categories include privacy, convenience and trust, lack of reputation and reliability. Crowdfunding sometimes fails because of over-ambitious projects, while car sharing approaches face people’s fear of strangers. In agricultural and renewable energy coops, it has been observed lack of good coordination, clear policies and motives while CE-based education suffers from limited degree recognition and poor business opportunities for graduates. The small market and targeted user group are failure factors in transportation-based initiatives, volunteering, travel and tourism, sharing services and goods. Related work (Tussyadiah, 2015) reveals lack of trust, lack of efficacy with regards to technology and lack of economic benefits as barriers in CE-based transportation, factors that agree with our findings. In all cases, radical innovations may have too much of a distance from the status-quo and thus fail to align and expand (e.g. banking, finance), while many efforts suffer from a lack of window of opportunity and misconception around the presence of a true user need, which they try to address collaboratively (especially in sharing services and goods) (Gauthey, 2014).

4.2 ICT Used

Focusing on ICT used in the CE initiatives under review, most of them (with the exception of the ones coming from agriculture, renewable energy and eco-communities, which mostly use simple websites), have grown by employing web and mobile apps. The authors believe that also the three aforementioned sub-categories can benefit from the use of ICT, which could be harnessed to reduce some of the barriers for wider adoption, such as better presentation of success stories, more interactive demonstration of ROI estimations and proof of concept, as well as stronger, more connected and resilient collectives in agriculture.

From all the rest sub-categories, Web 2.0 has been the dominant platform, while mobile apps have been extensively employed in transportation, travel and tourism, as well as in sharing personal services and goods. It seems that mobile

apps are useful when people need to use some services while commuting or on the go, being outside home/work, for example to book a taxi (transportation), scroll across accommodation options for their coming weekend getaway (travel and tourism), find someone to take care of their pet in the next day (sharing personal services) or rent some tool for home repairs in lower price (sharing goods). E-markets are being used for the sharing of goods and services (Wang, Zhang, 2012; Hamari et al., 2015), where transactions are mainly performed on a peer-to-peer basis through web interfaces (Einav et al., 2016).

Also, many initiatives from various sub-categories have relied on online social media (e.g. Facebook, Twitter) for community building and news/stories sharing, especially those related to crowdfunding, renewable energy, eco-communities, education and knowledge, volunteering, travel and tourism, sharing personal services and goods. Apparently, online social media offer an easy way to reach the masses and acquire new members, followers and supporters.

5 Discussion

It seems that CE is an upcoming trend (Jeremiah Owyang and VBProfiles, 2015; CrowdExpert.com, 2016; PwC, 2015; Schor, others, 2016). Peer-to-peer communities from the most well-known Airbnb and Uber, to small-scale local networks for exchange of food or tools is the new "hot thing", with origins and growth stemming from the tech-driven culture of Silicon Valley (Hamari et al., 2015). Yet, this trend has not yet been widely adopted in all commercial areas, being a niche whose development and growth is promising, dynamic, gradually increasing but also still uncertain with various risks and challenges (Rifkin, 2014), as well as barriers (see Section 4.1).

5.1 Technologies, Similarities and Challenges

Perhaps the most widely adopted CE area constitutes the sharing of experiences, which has been largely developed by means of Web 2.0 and mobile application development. Through web portals and platforms, users are encouraged to produce and consume rich and modern content, share experiences, knowledge and ideas. Blogs, collaborative platforms, discussion forums, online communities and chat rooms offer to the users the opportunity to become creators and editors at the same time. These online spaces are being largely used as sources and tools for knowledge, creating new opportunities for alternative, faster and more targeted learning experience through collaboration, sharing and interaction. Except from knowledge, the benefits of using such platforms include multi-cultural interactions, acceptance of and influence from different religions, cultures and ideas, increase of self-esteem and responsibility, positive psychology and acquisition of various personal skills such as organization and innovation potential. This sharing of knowledge and experiences is booming in the CE areas of education and knowledge, volunteering, travel and tourism, with popular examples including TripAdvisor (TripAdvisor, 2000) (for travelers), StackOverflow (Stack

Exchange, 2008) (for computer programmers), Moodle (Moodle, 2002) (open-source learning platform for students), Ask.com (Ask.com, 1996) (for the general public) and of course Wikipedia (open online encyclopedia).

Almost in every CE category (except perhaps from some initiatives in agriculture, renewable energy and eco-communities), the content and information produced and shared by users of Web 2.0 technologies have a large impact on the operations, overall popularity and user engagement with the particular CE initiative. The most successful, profitable and popular initiatives understand this impact, maintaining an e-business model developed and adapted to the needs of their user community (Belk, 2014a), (e.g. TripAdvisor, HelpX).

Seeking for similarities among popular initiatives, they all combine trust, respect of privacy, significantly lower costs in comparison to conventional approaches, convenience (or avoidance of lack of it), feelings of personal satisfaction, sustainability and bulletproof success stories (Hamari et al., 2015). Botsman claims that (particularly) "trust will become the currency of the new economy" (Botsman, Rogers, 2010). CE is not expected to lead to interpersonal trust (e.g. interaction between peers) but technology itself will shape and build these trust relationships, and this is a big challenge for CE initiatives (Keymolen, 2013). In other words, "online trust is not just about you and me, but about you, me and the system that brings us together". For example, a company may safeguard its online community by proactively monitoring the platform to catch frauds and other malicious actions, or have clear and detailed resolution processes, such as the measures taken by AirBnb and eBay (McKnight et al., 2002). On the other hand, all failed initiatives lack some of the aforementioned qualities, or the society and markets are not yet ready for them, or even their target groups are not large enough for satisfactory profits. Other general reasons for failure include mistrust in internet transactions (McKnight et al., 2002), and lack of knowledge of who is the responsible in case a problem arises (European Commission, 2016).

Specifically on aspects of reputation, it seems to be a crucial element for building trust, as the examples of large, successful platforms such as Airbnb (Finley, 2013) indicate. For the Airbnb case, an emergent philosophy regarding the development of trust within the platform is highlighted, in a "the more information, the better" approach. This information includes, in the example of AirBnb, the hosts' rating by other users, the hosts' response rates, verified emails and telephone numbers. All this info, together with message-based communication creates trusting relationship between the participants (guests) and hosts. It is also important to note the concept of the *electronic word of mouth* (eWOM) (Hennig-Thurau et al., 2004), where users and consumers seek for comments, feedback and ratings from other users before purchasing something or using some service offered. Positive eWOM helps a company to build trust and good reputation.

A challenge of future ICT-based CE initiatives in building trust is to leverage an individual's digital footprint to build a portable, trustworthy reputation (Finley, 2013). TrustCloud is a leader among this trend of reputation-oriented startups, using a point system to score individual buyers and sellers online,

based on the principle that if someone has good reputation in apartment renting, she is also likely to be a reliable provider of other services too (Kolodny, 2012).

5.2 Design Elements

Some general successful design elements and guidelines adopted in current CE-based initiatives (recommended also in future initiatives) have been identified and listed in Table 2. It is of great interest to observe which specific elements of the ICT employed proved to be successful and engaging for building user communities, adding more members, customers and users, or increasing profit.

It seems that different sub-categories have different *winning* design characteristics. These characteristics aim to address or mitigate the barriers for adoption as identified in Table 1, especially privacy (e.g. privacy features), personalization (e.g. personalized services, user profiling) and trust (e.g. reputation-based systems, user profiling, success stories, photo/video descriptions).

Community building is a necessary component for various initiatives (e.g. in crowdfunding, transportation, sharing services and goods) for the creation of value (Cova, 1997), especially since a critical mass of users is required for them to operate (Keymolen, 2013), and this community building is facilitated by social networking features, promotion of community spirit, environmental awareness campaigns and, most importantly, common socioeconomic interests (e.g. eco-communities and renewable energy projects). Research indicates that networks of possibly heterogeneous actors tend to preserve their continuity when community members depend on each other for social and economic resources (Thomas et al., 2013), and this could explain the resilience and long-lasting operation of agricultural collectives.

It is noted that community building practices in CE have been inspired by well-accepted and successful gamification-based methods used generally in community-driven web platforms (Michael, Chen, 2005), with examples including badges and points (e.g. TripAdvisor - Travel and Tourism), discounts (e.g. BlaBlaCar - Car Sharing), certificates (e.g. Moodle - Education and Knowledge), gifts (e.g. Kickstarter - Crowdfunding), virtual money (e.g. Time Banks - Eco-Communities), as well as recognition and thanksgiving (e.g. Indiegogo - Crowdfunding) and user ranking (e.g. Kaggle (Kaggle, 2010) - Education and Knowledge).

Initiatives in agriculture, crowdfunding, banking, renewable energy and eco-communities pay much attention to success stories and environmental awareness campaigns, in order to convince potential users, members and customers. Crowdfunding has a suggested roadmap to follow, in order to achieve a successful campaign, and Indiegogo provides a complete guide to successful crowdfunding (Indiegogo, 2016). Distant learning has become established as the mainstream channel of collaborative education and knowledge-based initiatives. Moreover, interactive geospatial maps are being used to visualize real-time useful info for the users, such as where is the closest bike rental place or the most convenient getaway for the weekend, while it is particularly useful for carsharing, to share

and locate similar routes and schedules with other people.

Specifically related to mobile apps, according to Applause (Gray, 2015), users of CE-related apps have high expectations for the following: elegance, stability, usability, quality and accuracy of content, security, performance of operation, interoperability with other apps and systems, privacy of user information and pricing. Designers of CE-based mobile apps need to carefully consider the aforementioned aspects to increase the overall users’ satisfaction, participation and engagement. This holds for all CE categories.

No.	Design Element	Sub-Categories
1	Video describing a high-tech product/service in less than 5 minutes	Crowdfunding
2	Photos and videos describing goods, services, location, events and operations	Volunteering, travel and tourism, sharing services and goods
3	Narratives of success stories	Crowdfunding, banking, finance, agriculture, renewable energy, eco-communities, sharing goods
4	Promotion of community spirit	Banking, finance, agriculture, renewable energy, eco-communities
5	Community building	Crowdfunding, car sharing, bike/ride share, agriculture, renewable energy, eco-communities, volunteering, travel and tourism, sharing goods
6	Environmental awareness campaigns	Agriculture, renewable energy, eco-communities
7	Social networking features	Car sharing, bike/ride share, education and knowledge, sharing services
8	Privacy features	Volunteering, travel and tourism, sharing goods
9	User profiling	Car sharing, bike/ride share, sharing services and goods
10	Personalized services and recommendations	Car sharing, bike/ride share, sharing services
11	Reputation-based systems (crowd feedback/ratings)	Car sharing, bike/ride share, volunteering, travel and tourism, sharing goods
12	Mashups of information together with interactive geospatial maps	Car sharing, bike/ride share, volunteering, travel and tourism, sharing personal services, sharing goods
13	Distant learning and remote education, promotion of alternative curriculum	Education and knowledge

Table 2: Successful design elements in CE.

5.3 Projections for the Future

It is not easy to predict the future of this practice, but its impact on economy is already large (Jeremiah Owyang and VBProfiles, 2015; CrowdExpert.com, 2016; PwC, 2015). Figure 2 illustrates a timeline which relates the year each of the 156 identified initiatives was founded, together with important advancements in ICT, spotting some particular initiatives that met great success and popularity. Without surprise, most of the initiatives were founded after 2005, when Web 2.0 and online social media became available, while their large majority appeared after 2007, when smartphones (iPhone, Android etc.) entered the market, accompanied by low-cost broadband internet access.

Some particular categories (e.g. sharing experiences, services and goods, transportation, crowdfunding) have benefited most from ICT in order to inspire novel initiatives, while some more "traditional" categories (e.g. ethical banks, finance, eco-communities and agriculture) although many of their initiatives existed before this ICT evolution, they improved significantly their ser-

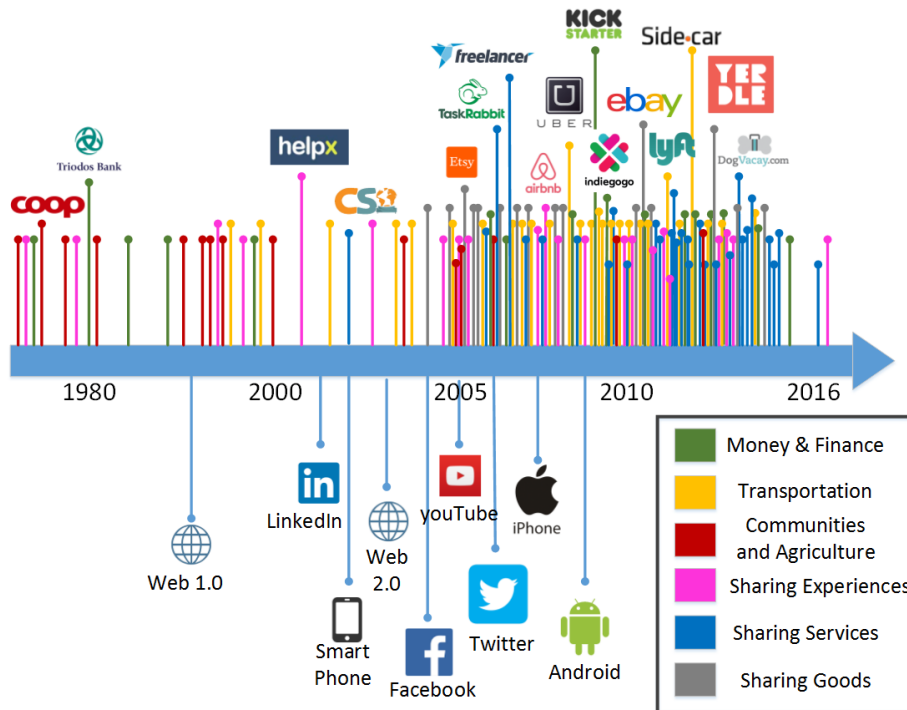


Figure 2: CE initiatives in relation to ICT evolution.

vices/operations by exploiting ICT, especially related to community building and services offered to their members or information exchanged. Hence, it is evident from Figure 2 that ICT has been a large driver and enabler of the CE practice globally.

It seems that new ICT innovations could inspire even more CE-based initiatives, either in one of the six categories and 14 sub-categories identified in this chapter, or perhaps in new areas. Trying to project the evolution of ICT in the next 10 years, and how this can influence the future of CE, the following possible scenarios are listed:

- *Internet of Things* (IoT) (Mattern, Floerkemeier, 2010) becomes a reality, which means that physical devices become connected to the internet. In this way, transactions for sharing of goods and things can become much more reliable and trustful, while new CE-based initiatives would become smart enough to propose things needed or missing from one's home, hence personalization would be highly increased (Rifkin, 2014). For example, IoT sensors at one's smart fridge could sense absence of some vegetables, and bring the citizen in touch with a local producer of organic goods or perform an order for vegetables automatically. Easier and seamless discovery of things would enhance existing sharing initiatives, e.g. some user could get notified while walking in the city that in less than 200

meters there is a useful service or needed tool. For example, ride sharing (see Section 3.2.2) could benefit from more information over the journey's cost, according to weather conditions, existing petrol price, current traffic etc. This cost could then be recommended to the driver and the potential passenger(s) to agree on a fairer price.

- *Web of Things* (WoT) (Kamilaris et al., 2011c) becomes enabled on top of IoT, allowing people to share real-world devices and their services through the web, monitoring in real-time and automating their smart homes (Kamilaris et al., 2011b) or becoming better informed and more engaged with their smart city environment (Kamilaris et al., 2011a). For example, agriculture (see Section 3.3.1) could benefit from web platforms that provide fast alerts and notifications to farmers when some pest is detected on the crops or some disease on the animals (Kamilaris et al., 2016), sensed from web-enabled sensors that push this event, as soon as it happens, to a web platform where community farmers are subscribed for relevant local events.
- More popularity and adoption of *alternative currencies* such as BitCoin (Bitcoin Project, 2007) and Litecoins (Litecoin Project, 2011) could affect CE initiatives to adopt these currencies for payments. The most famous example is Silk Road, a shared marketplace using Bitcoins, operating at the Deep Web selling (also) illegal stuff. Alternative currencies could help to avoid some barriers such as the dependency on conventional payment systems, regulatory and legal issues, and privacy concerns. More powerful smartphones could perform encrypted cryptocurrency transactions on the go. Another alternative currency could be *time banks* (Time Banks, 2006; Seyfang, 2004), using time as a unit of local currency, where participants or members of the community give and receive help in exchange for time credits. For example, eco-communities (see Section 3.3.3) could adopt some alternative currency in order to form more resilient micro-societies not dependent on their country's economy and tax system.
- More penetration of *online social media* to CE. Having access to people's online profiles and visibility to their preferences, views and interests (respecting what they wish to keep private) allows trust between peers to be developed more easily, personalized services to thrive and user communities to grow more resiliently and organically, forming islands of similar-minded people. For example, people who aim to perform volunteering actions (see Section 3.4.2) could be directed only to good causes at which the people involved have positive feedback from others, similar visions and ideology, or they share common actions and activities or even have common online contacts.
- The introduction of the *Semantic Web* (Berners-Lee et al., 2001) (or Web 3.0 as referred), is expected to bring more semantics and better annotations of data on the web, allowing easier integrations among online data

sources. This would enhance the services offered by various initiatives, as they could seamlessly harness other online (real-time) sources of information. For example, tourism services (see Section 3.4.3) could harness well-described open data in order to suggest future destinations based on current levels of safety and potential dangers, weather forecasting, organization of local events, celebrations etc, taking into account among others the user's profile and preferences, budget available and previous trips performed.

- *Predictive Intelligence* is a method of delivering unique experiences to each individual, enabling CE-based initiatives to observe their users' behavior, and -with every action taken- to build a profile of users' preferences for delivering better content. This relates of course to personalization (mentioned in the previous scenarios), but it is a much stronger concept, as it anticipates users' intents, providing more unique recommendations, driving key business results. It can combine advances in IoT/WoT, online social media and semantic web to achieve this. For example, in platforms providing educational services and online courses (see Section 3.4.1), the system could monitor the actions of the user on the platform (e.g. clicks, time spent at each course/activity/exercise, current performance), to adapt the learning experience to her needs, level of expertise, capabilities etc.
- *Big data analysis* (Labrinidis, Jagadish, 2012) for identification of higher-quality services to use, products to purchase in lower cost and more convenience, suitable places to visit and experiences to gain, better recommendations for shared investments and more precise ROI estimations. For example, CE enterprise sharing services (see Section 3.5.2) would be improved by analyzing large-scale data coming from a large variety of different, possibly heterogeneous sources, in order to match companies with similar goals and aims, identifying and suggesting win-win opportunities that could relate to improvement of production, more productivity, reduction of costs, higher quality research and development, minimization of financial and technical risks etc.
- More *secure and private communication protocols* on the internet/web are expected to increase trust and reliability of online (micro-)transactions, and this is expected to help CE to grow even faster, overcoming barriers of convenience, trust and unfamiliarity. For example, this will influence primarily initiatives for sharing goods (see Section 3.6) and services (see Section 3.5), as it would encourage peers to sell or rent their unneeded tools and old stuff or offer their services easier to other interested people.
- *Collaborative commerce* (Thuraisingham et al., 2002), as a strategy for the next stage of electronic business evolution, could be harnessed by CE initiatives to create, manage, and use data in a shared environment in order to design, build, and support better collaborative products and services.

A global public collaborative e-marketplace could be developed, based on open principles, which would give rise (together with big data analysis) to improved "CE-relevant inventory" visibility, event notification, performance measurement, as well as real-time decision making, recommendations and analytics. For example, this would benefit significantly money and finance (see Section 3.1), since investors will match smoother, more effectively and faster with borrowers, while the potential risks and dangers will be reduced, and transparency and visibility will be increased.

- In more *futuristic* scenarios, CE could involve sharing drone- and robot-based services, community-owned solar-powered cars, synthetic organs (Colton, 1995) or even realities and conscious experiences of people's minds available as shared virtual reality information. For example, sharing drones and robots between farmers would be very beneficial in agriculture for improving productivity and enabling precision agriculture (Zhang, Kovacs, 2012), while community-owned cars could serve as low-cost services for citizens in car sharing scenarios (see Section 3.2.1). The cost could be reduced even further in the future when autonomous cars and the concept of *Internet of Vehicles* become mainstream (Gerla et al., 2014), possibly replacing traditional taxi services. In this case, the total costs for cars' purchase and maintenance could be shared among interested community members.

6 Conclusion

In this chapter, a survey on collaborative economy has been performed, identifying and listing 156 relevant and popular initiatives from all around the world, examining their relationship with information and communication technologies, discussing successful practices and failure factors, best design elements involved and obstacles for wider adoption, trying to predict the future of this practice, in parallel to the projected future of ICT.

Various conclusions can be derived from this chapter. The reader can be persuaded that CE has penetrated into numerous aspects of people's everyday lives and business operations, and this survey mapped the CE initiatives collected into six main categories and 14 sub-categories. Most successful CE practices exploit ICT, especially by means of web applications, mobile apps and online social networking for user interaction and community building. Future creators and designers of novel CE initiatives need to carefully study the successful points or reasons for failure of previous and present CE efforts, as listed in this chapter, trying to adopt the positives and avoid the negative ones, overcoming common barriers such as policy and privacy issues, user unfamiliarity and reduced trust. Trust is definitely the most important characteristic of successful initiatives (Botsman, Rogers, 2010), and it needs to be supported inherently by the systems involved (Keymolen, 2013). Moreover, there are some general design elements, listed in the previous section, which seem to be well-accepted and

understood by the user communities at each CE area/initiative, constituting important characteristics that lead to user engagement, active participation and support, and overall satisfaction. Finally, this chapter has listed some promising ICT innovations that could disrupt even more the CE landscape, creating more targeted and personalized, secure, intelligent, efficient, resourceful and trustful peer-to-peer services. The Internet of Things, predictive intelligence and big data analysis could be game-changing technologies in the next 5-10 years.

It is apparent that CE offers solutions in almost every possible aspect where human (and machine?) interaction is involved. Aspects not discussed in this survey which constitute potential sources of inspiration for future CE-based start-ups include sharing of natural resources (e.g. water, energy, land), financial risks and business opportunities. Particularly for agriculture and farming, there are still large opportunities for sharing of water, fertilizers, pesticides, crops, machinery and land. Sharing of energy is at its infancy, and can become reality through distributed generation of electricity and micro-grids (Smallwood, 2002).

An important question would be what CE companies could do now, to improve their services and their revenues. To the authors' opinion, existing initiatives need to better understand the importance and influence of ICT in commerce today, and exploit them as a medium for interacting with their users, or maintaining and supporting a user community. Interactive web applications, accurate and reliable mobile apps and strong online social communities are crucial aspects. These technologies need to support some of the aforementioned design elements, supporting trust organically through their systems. CE initiatives need to reduce existing barriers of wider adoption, overcoming policy and legal issues, satisfying users' privacy, investing on convenience, user acceptance and familiarity.

Another important question would be how CE initiatives could adapt to the future needs of people and societies. They should definitely need to carefully monitor, consider and assess ICT advancements and innovations, as listed in the previous section, to further improve their operations and overcome existing problems that are difficult to be solved by existing technology. A real challenge and huge future opportunity for CE initiatives is to collaborate together in order to offer better services to their users, or innovative initiatives can act as mediators/brokers or umbrella companies, combining other initiatives' services for higher-quality user service and improved overall experience. For example, a marketplace for sharing car services could communicate with a marketplace about sharing car parts, to provide an augmented service of car repair based on cheap, second-hand parts from local users. Or perhaps education-based shared platforms (e.g. Moodle, Udemy and Coursera) could collaborate with volunteering organizations and renewable energy or agricultural projects, for matching volunteers who wish to become educated on renewable energy, farming and sustainability by offering some labor service to these organizations and projects. The performance of students could decide their acceptance opportunities at these organizations/projects, offering recognition to their learning efforts. The opportunities of these combinations are tremendous. As mentioned before, examples of this concept currently include Tripping (Tripping, 2010) and VRBO

(VRBO, 2005), which operate as vacation rental intermediary services.

For future work, the authors plan to continue their analysis involving more stakeholders to contribute with their experiences, trying to predict more quantitatively how ICT can further facilitate the rise of more CE-based practices and initiatives, trying to better assess the impact of emerging technologies such as IoT, big data analysis and predictive intelligence on various CE areas and applications.

Summing up, it is becoming evident that ICT, especially Web 2.0 and mobile apps, are accelerating collaborative economy, changing people's mindsets from possession to (pseudo-)sharing, towards common profit (Botsman, Rogers, 2010; Belk, 2014a). As Rifkin points out (Rifkin, 2014), ICT together with IoT, which connects everything and everyone as a new technology platform, are leading us to an era of nearly free goods and services, where the inherent entrepreneurial dynamism of CE-based markets could change forever the global economy and "business as usual" practices. In parallel to this trend however, the big stake is whether and how the sharing economy niche could be steered toward a pathway aligned with a transition to sustainability (Martin, 2016; Schor, others, 2016). It is in our hands to guide this growing collaborative economy force, empowered through ICT, as a driver of change towards a sustainable future for humanity and our planet.

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