



THE FUTURE OF SMART AND INCLUSIVE COMMUNITIES

How will people live and interact in communities
in 2035 to improve their well-being?



POLITECNICO
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Foreword

A better quality of life, the general well-being of people, the preservation of the environment and access to vital resources are issues of collective concern that are becoming increasingly urgent, not least because of recent events in our society, from the pandemic to the Russian-Ukrainian conflict. In an era of increasing resource scarcity, accompanied by government systems that structurally fail to respond dynamically and flexibly to changing needs, the way people will live and relate to each other will contribute to the definition of a new form of society. The evolution of digital technologies will enable people to share and make the most of a valuable resource: their time. More and more individuals will be able to access goods and services that are either scarce or otherwise unattainable for a large segment of the population. This is the vision of Smart and Inclusive Communities that we explored in this study, to understand how new patterns of sociality and new technologies will accompany our needs in 2035. Geographical boundaries, within which people traditionally congregate and services are delivered, will be overtaken by the introduction of new technologies that will enable ubiquity and continuity in the dissemination of tangible and intangible goods, regardless of distance and their availability. Our needs will increasingly be constantly monitored. Our well-being will be at the center of expanded and shared decision-making processes. In the future we explore, and to which we contribute, no one is denied to access resources and goods, in their own interest and that of the community.

This work went on to reveal a strong focus on the key issues of inclusiveness, ecology and energy sustainability that underpin communities that prioritize relationships of equity among individuals and respect for the environment. The study was developed by a team of researchers from the Politecnico di Milano, with the collaboration of industry experts and key stakeholders, in order to broaden the field of vision and include solicitations from multiple domains, as required by foresight methods. In continuity with what has already been done by the Center for Technology Foresight, the goal is not to provide accurate predictions about the future, but to outline the picture of opportunities that unfold over a medium-term time horizon. The ultimate goal is to raise awareness around major changes in society to help build a better world.

Ferruccio Resta

Rector

5 key findings on the future of communities

How will people live and interact in 2035? In searching for an answer to this question, some relevant messages repeatedly emerged during our activities and workshops, representing features shared by alternative visions of future communities and the priorities to look at in the long-term horizon. Although some of these concepts might be recognized as mainstream, their innovativeness lies in the awareness that only if individuals join forces and create synergies can they be achieved, boosted by the **urgency to share** and a **new meaning and value of time**. These two elements represent the common denominator that triggers the further development of future communities. In particular:

- **The urgency to share.** In the past, sharing was a choice, now it is a necessity. Individuals are gaining awareness of the need to come together, through bottom-up communities, to take advantage of available resources, given their scarcity or intangible nature. Communities are thus the means to faster connection and collaborate, to be able to exploit and increase resource value, joining forces to proactively solve harmful situations seeking answers to personal or societal problems.
- **The meaning and value of time.** Time used in communities to share one's experiences, resources, or to facilitate the accessibility of services will be an indispensable source of individual satisfaction. Time is envisioned not to become a scarce resource, where despite the plenty of it, individuals

are eager to get the maximum out of it. It thus turns into a valuable resource and a means for inclusiveness and equal opportunity, making the most of it without wasting any minutes for the benefit of oneself and the entire ecosystem.

Based on these two assumptions, the key findings that emerged from the foresight process are as follows:

- **Community resiliency to resource scarcity.** Sharing resources becomes a way to collaboratively overcome shortages through continued democratization of accessibility to services and critical resources. Energy management remains a crucial point to ensure the implementation of innovations and adoption of new technologies.

- **Knowledge dissemination and acquisition.** People of all ages demand the possibility to easily have access to lifelong learning. Educated citizens are crucial to comprehend technological and systemic changes. Communities become the platform for sharing acquired knowledge to transfer wisdom and avoid the loss of lived experiences.

- **Preserving and nurturing personal uniqueness through digital tools.** AI, metaverse, and matching algorithms enable individuals to enhance their uniqueness, find and obtain the resources they need to learn and get what they miss. The recommendation algorithm will govern the development of the network, proposing individuals with shared interests and diverse backgrounds, thus generating matches by complementarity and similarity.

- **Hyperlocal dimension to support global empathy.** Communities will establish a bottom-up approach to improve social welfare through the development of an extended

FIGURE A
Initial conditions
and key insights

social network for mutual support. The geographic dimension considers micro-communities, where digitalization guarantees a global resonance. These communities are considered at the scale of a city neighborhood, a small rural area, or just a group of houses.

- **Mutual assistance on holistic well-being.** Removing the stigma of loneliness and isolation has turned into a priority for the whole society by removing it from the shoulders of families alone. Communities can provide services to improve the quality of life and ensure care support, guided by the willingness of individuals to perceive a new meaning of time devoted to support the others.

SPARKS OF CHANGE

Urgency to share

Meaning of time

KEY FINDINGS

Community resiliency to resource scarcity

Knowledge dissemination and acquisition

Preserving and nurturing personal uniqueness through digital tools

Hyperlocal dimension to support global empathy

Mutual assistance on holistic well-being

Methodological note

This booklet is the result of activities carried out during a five-month period that, starting from research and analysis of industry literature and data, has involved a set of experts through interviews, workshops, and survey. We collected their opinions and encouraged conversations on different visions of the future, debating assumptions, ideas, and concerns to jointly elaborate plausible trends of evolution. We engaged 22 faculty members from various departments of Politecnico di Milano, whose expertise falls in diverse areas related to communities, and 6 outside experts from companies and public administrations.

More in detail, desk research activities gathered evidence and drivers of change associated with STEEP (Social, Technological, Economic, Environmental, e Political) forces to serve as a guide to expand the area of research and reframe the landscape under analysis. By means of a technology scanning activity we collected an overview of prominent technologies and innovations that have been identified as possibly disruptive in recent foresight studies and will possibly affect how we will interact and be engaged in the future.

Internal experts have been initially engaged in individual interviews to gather their expertise and personal vision of communities today and in 2035, and later contributed to the process during three in-person group workshops. These workshops led to the construction of multiple collective community scenarios: leveraging on four alternative futures, the participants diverged in future reflections to later converge for the identification of the elements that have been identified as the future communities' foundations, their motivations and characteristics, and possible requirements and risks for stakeholders.

A survey has been also distributed to a broader audience, involving other faculty and PhD candidates, to unveiled relations and the expected impact of technologies, and communities' scopes in achieving the envisioned smart and inclusive communities' paradigm. In parallel, outside experts have been interviewed to collect different and additional viewpoints, unveiling implications related not only to technology but also to the STEEP factors.

Bibliography and linkography:

<https://www.foresight.polimi.it/sic/references.html>

Why care about the future of communities?

How people will live and interact in the future is a question of paramount importance. How people come together to find answers to their specific needs has continuously been influenced by evolutions in the social, economic, technological, political, and environmental spheres, the so-called STEEP forces.

Certainly, Covid-19 accelerated the attention towards diverse issues, from individual well-being to environmental concerns, stimulating rethinking of urban and rural lives worldwide. Furthermore the Russian-Ukraine crisis expedited the quest for the energetic transition and synergies towards resilience and sustainability. Looking at 2035, the widespread introductions of technological innovations, even simple ones, and the adaptation of the urban environment towards a more human-centered perspective could push to higher quality and sustainability in our future lives, towards an overall well-being.

Social trends suggest a growing concern towards the individual sphere regarding mental stability, physical conditions, and achievements of personal satisfaction. These, combined with a change in demographic patterns with longer expectations of life and transformation in family structure, place communities as critical players in services' provision and adoption. Digital tools fasten communities gathering and unlock new experiences

for individual enhancements thanks to widespread sensors (in wearable devices or within buildings) and growing power in algorithms, where empowered artificial intelligence (AI) or blockchain can exploit new connections and meaningful services.

Through data exploitation, people should be matched both by commonalities of needs and complementarity of expertise. Unfortunately, these effects may vanish if not supported by policies to fight the rising social divide and uneven access to opportunities.

To enable communities to increase their impact over people's lives, they claim freedom in being informal groups that can rapidly adapt to societal and world changes. Because of their supportive nature, most communities will be closer to the third sector, yet repudiating overly stringent constraints that can limit their flexibility in creating synergies with actors from diverse fields.

The social structure generated through these communities forges a resilient society capable of overcoming economic or climate crises together through a closer sense of civic duty and mutual support.

The fluidity of the covered areas and the pervasiveness of communities open the opportunity to spread and test new business opportunities, such as new financial models (e.g., crowdfunding and microfinancing) to meet traditionally unprofitable targets but also scarce resource-sharing solutions (e.g., energy communities) to cope with the increase in energy demand, its costs and move towards higher sustainability.

The future of communities, their proliferation, and the spread of good practices are strongly linked to the ability of politicians to operate in agile ways to keep up with the dynamism of society's needs. Along this landscape scanning, to frame the topic of interest and gather a first overview of what to consider when talking about communities, some areas frequently emerged where communities could play a significant role. In particular,

SOCIAL

- Social street
- Community search
- Mental awareness
- Flexible working habits
- Living lab experimentation
- Perception of loneliness
- Independent learning

TECHNOLOGICAL

- Decentralized medicine
- Empowered AI
- Micro-credentials
- Big data
- Knowledge platform
- Rise of computing power
- Individual health monitoring
- Accessible interfaces
- Sensors everywhere
- Digital identities

ECONOMICAL

- Local economy
- Open-source idea generation
- Value redistribution
- Eco-consciousness

ENVIRONMENTAL

- Sharing economy
- Resource management
- Urban sprawl

POLITICAL

- 15-minutes neighborhood
- Decentralized knowledge
- Local-based support services
- Digital rights
- Decentralized governance
- Mega cities
- Urban re-configuration
- Stakeholder engagement
- Smart rurban

based on the interests and competences of the involved experts from Politecnico di Milano, ten community areas prominently emerged as relevant when looking at 2035 (see Figure J). They clearly constitute a small portion within the plethora of possible community areas, however they serve as spotlights of the overall reality of communities in 2035, allowing to draw considerations that can be extended to broader contexts. During the process, to contextualize discussions and considerations, four so-called **Hero communities** have been sketched, actualizing all emerged relevant elements and aspects. Similarly, they aim at being examples of future smart and inclusive communities for well-being in 2035.

Different possible scenarios have been explored to unveil the relations with the topic under analysis and related emerging technologies to further specifies characteristics, requirements, and risks associated with smart and inclusive communities of 2035, putting them also into relation with the United Nation Sustainable Development Goals (SDGs).

Technologies

These 17 technologies are the ones that emerged from the activities and the list of 300 technologies that the Center of Technology Foresight previously collected by analyzing the results of previous studies addressing disruptive innovations with the potential to impact the future of our society (https://www.foresight.polimi.it/survey/download/210520_Technology_Foresight.pdf)

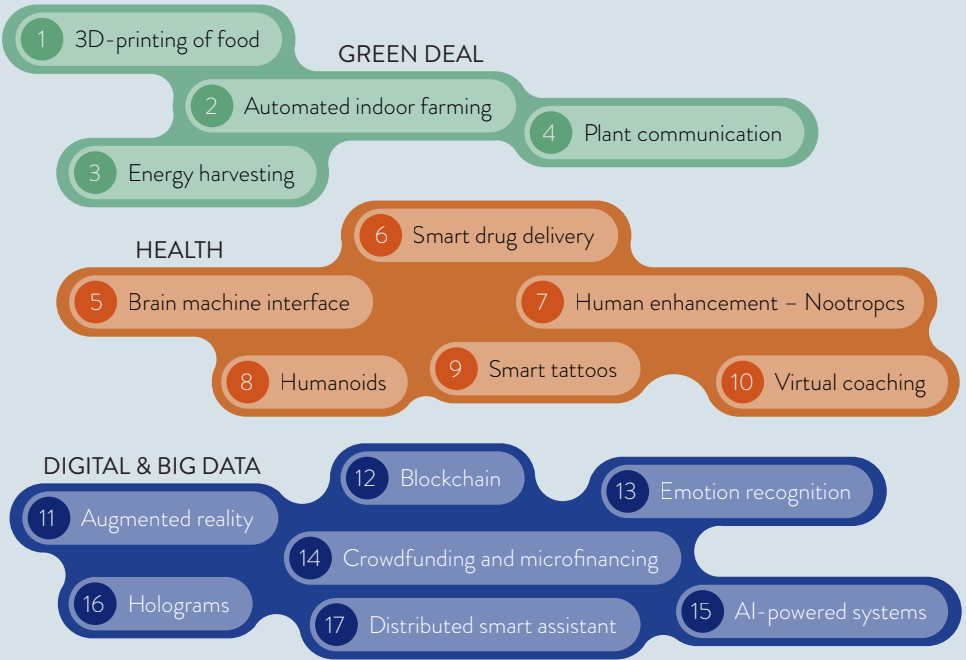
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A rich set of technologies and technological innovations emerged from the activities and interviews as key elements for the future of communities.

They have been clustered into three groups, namely **Green deal**, **Health**, and **Digital & Big data**. The classification is motivated by the influence that each technology is expected to have on communities' activities; sometimes it will enable new interactions between individuals, or it will generate new information, serving as catalysts for community creation.

GREEN DEAL

- 1 3D printing of food.** 3D printing is the technology that builds 3D objects by adding layer-upon-layer of material, whether the material is plastic, metal, concrete, or food. 3D printing of food offers new possibilities for the individual and communities, such as customized nutrition, shared recipes, and food waste reduction; it could guarantee equitable and sustainable access to healthy food even for remote communities.
- 2 Automated indoor farming (precision agriculture).** It is a solution to secure agriculture from environmental and climate threats by harnessing advances in indoor robotics



to create stable climate condition, also optimizing resource usage. Machines perform classical farming tasks such as raising seedlings, replanting, and harvesting as well as animal husbandry. It could trigger social changes in rural communities and start new business and social models.

3 Energy harvesting. It refers to the conversion of energy that is easily available in the environment into practical, typically small, quantities of electricity, promising a variety of limited-costs systems requiring minimum or no maintenance. Energy communities can serve as means for an ecological transition and to contrast climate change by empowering people to interact with the energy market as prosumers.

FIGURE C

Technologies and technological innovations emerged as key elements for the future of communities

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- 4 Plant communication.** It refers to communication between plants and other organisms: research teams are exploring ways to use plants as sensors. The collected data could yield potentially important innovations. Communities of artists and engineers alike are experimenting by combining the capabilities of plant, human and machine. Research about the understanding of plant communication is still in its infancy.

HEALTH

- 5 Brain machine interface.** A brain machine interface (BMI) is a direct communication pathway between the brain and an external device. It can both collect information from and feed it into the brain, for example by restoring a lost sense and enabling the brain to interact with the environment. BMIs could be used by communities as practical assistive devices for people with communication and assistive technology needs.
- 6 Smart drug delivery.** It is a technology aimed at increasing the efficacy and absorption of a drug, while decreasing its side effects. Transdermal drug-delivery devices equipped with sensors are programmed to release drugs when detecting a specific body conditions. This new treatment method will facilitate therapy adoption as well as reduce time spent in hospitals, improving quality of life for patients and care-givers.
- 7 Human Enhancement – Nootropics (biohacking).** Human enhancement can be described as the natural, artificial, or technological alteration of the human body to enhance physical or mental capabilities, also using substances called “nootropics”. It can improve the quality of life and well-being not only of individuals but also of the communities they live, in enabling everyone to contribute at their maximum potential. A possible thread might come from a rush towards a misuse of this

technology to exceed natural limits endangering individuals and communities as a whole.

8 Humanoids (social robots). Humanoids are machines designed to resemble humans in form and features, regardless of their intended use. They can provide both emotional and physical support by keeping company, assisting in moving, or performing activities on behalf of the patient. In the future, social robots could be of help for communities of elderly with cognitive impairments, offering psychological and physical support, keeping them active and improving their mood, as well as assist communities of students with autism and dyslexia.

9 Smart tattoos. They represent an all-in-one sensing platform. They consist of wearable epidermal skin electrodes enabling real-time and simultaneous sensing of both environmental stimuli (pressure, touch, or proximity) and physiological data (heart rate, breathing, blood alcohol and oxygen content, muscle activity, emotions). Their usage could support interactive telemedicine and patient treatment systems in communities living where medical services are not accessible.

10 Virtual coaching. It refers to the coaching and training of a person through a video conferencing service or digital avatar through real-time interaction. It aims at optimizing the user's life by transforming cognition, affection, and behavior towards a stated goal. Virtual coaching technologies applied in the healthcare system can support the patient by delivering feedback and health-related knowledge, while their versatile adoptions in motivation field can induce the elderly community into active lifestyles.

DIGITAL & BIG DATA

- 11 **Augmented reality.** Augmented Reality (AR) means overlaying computer generated contents on our perception of the real world (currently through mobile apps or AR headset, plus sensors and dedicated software). This technology in the community context can be found in social networks, gaming, and education. It can increase inclusiveness by enabling people with cognitive or physical disabilities to experience the world through immersive experiences, where the community plays the role of facilitator and supporter in AR adoption.
- 12 **Blockchain (e.g., micro-credential, digital badges).** It is a technology that can be used to organize a network to keep trusted records among people who do not know each other. Using the blockchain, digital data can have an owner recognized by everyone in the network. It can be used in the future to create trust in new communities, by proving ownership as well as enabling information security. In the field of education, it could enable trust by issuing micro-credentials and digital badges to certify the accuracy of knowledge obtained and disseminated.
- 13 **Emotion recognition.** Emotion recognition traditionally concerns with detecting emotions by applying advanced image processing algorithms to images of the human face. Recent developments have extended the field to include other means of gauging emotions (text analysis, tone of voice, heartbeat and breathing patterns, etc.) and even extending them to other species. It can foster community building by providing an additional layer of information during physical and digital interactions that can facilitate trust.

14 Crowdfunding and microfinancing. It refers to the use of small amounts of capital from many people to finance a new business venture. Easy accessibility of large networks of people through social media is used to connect investors and entrepreneurs through dedicated websites. Beyond fundraising activities, crowdfunding stimulates cooperation and engagement. These new financial methods can overcome the unavailability of economic support in unprofitable markets or solutions, which, in most cases, is what communities and people in need are looking for.

15 AI-powered systems. Artificial intelligence (AI) is used to analyze large amounts of data in various practices through machine/deep learning algorithms, increasingly been adopted for processing multiple sources of data, including images, video, audio, and text. AI-powered systems can for example be used to engage local communities in developing plans or solutions for pressing societal and environmental concerns, to exploit the full potential of a local-based (or global) community facilitating engagement and participation.

16 Holograms. Holograms are used to display 3D images in a realistic manner without using glasses. Optimistic scenarios predict only a few years until the next generation of holographic products (such as 3D holographic displays, acoustic holograms for ultrasound imaging and touchable holograms) becomes widely available. They could be used in the future to change the digital experiences of virtual activities for both the individual and the communities.

17 Distributed smart assistant. It is a widespread sensing architecture within buildings that, relying on a system of sensors, enables the collection of information about people's behavior, environment, and building performance.



Foto di Polina Zimmerman su Pexels

Along the process, the experts of Politecnico di Milano envisioned several communities' scenarios, tackling diverse areas of interest, that they considered most beneficial in the future role of communities. As a result, four diverse smart and inclusive communities are presented in the next page to provide an overview about how people will live and interact in 2035, identified as heroes: Support services, Human care, Resource sharing, and Personal growth.

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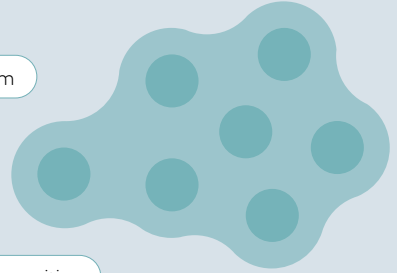
The technology can be targeted to collect information about people who are frail or require direct care to ensure a timely response in the event of an accident, alerting the nearby community that provides assistance, in light of a new and distributed care service. This technology can thus ensure distant relatives the ability to care for their loved ones.

Support services: THE EXTENDED FAMILIES SERVICES

Communities mean a network of individuals who decide to dedicate time to share with others to provide services to people at risk of loneliness. Badges and micro-credentials smooth the trust-creation process to fasten the development of a global network of mutual help.

Main technologies:

- 1 All the Health area technologies
- 15 AI powered system
- 12 Blockchain
- 13 Emotion recognition



Impacted SDG:

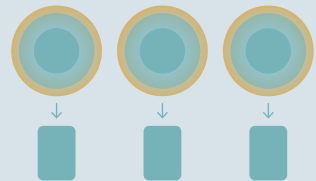
- #3 Good Health and Well-being
- #11 Sustainable Cities and Communities
- #5 Gender Equality
- #10 Reduced Inequality

Human care: CO-EMPOWERMENT OF HUMAN CARING

Communities mean the empowerment of mutual care by leveraging digital power. The algorithm takes the role of caregiver by sponsoring best practices, matching the proper cure, and collecting data. Here, emotions are placed at the center, where individual uniqueness is enhanced through personalized and emotional assistance.

Main technologies:

- 10 Virtual coach
- 6 Smart drug delivery
- 8 Humanoids (social robots)
- 15 AI powered system



Impacted SDG:

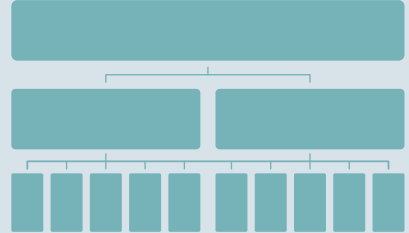
- #3 Good Health and Well-being
- #11 Sustainable Cities and Communities
- #5 Gender Equality
- #10 Reduced Inequality
- #9 Industry, Innovation and Infrastructure

Resource sharing: CO-WORLD(ING)

Community means collaboration in resource management. Sustainability is achieved in smaller groups, where extra resources are shared among people, known previously, where efficiency in resource exploitation is a primary concern.

Main technologies:

- 12 Blockchain
- 15 AI powered systems
- 14 Crowdfunding and microfinancing



Impacted SDG:

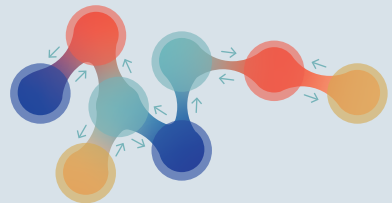
- #11 Sustainable Cities and Communities
- #12 Responsible Consumption and Production
- #10 Reduced Inequality
- #3 Good Health and Well-being
- #1 No Poverty
- #17 Partnerships to achieve the Goal

Personal growth: GREAT LOCALS FOR GREAT GLOBAL

Communities mean continuous exchange of expertise to nurture knowledge development through digital talent networks. People share their skills to find complementarity of knowledge to sublimate personal expertise and fostering diversity.

Main technologies:

- 15 AI powered systems
- 12 Blockchain
- 17 Distributed smart assistant

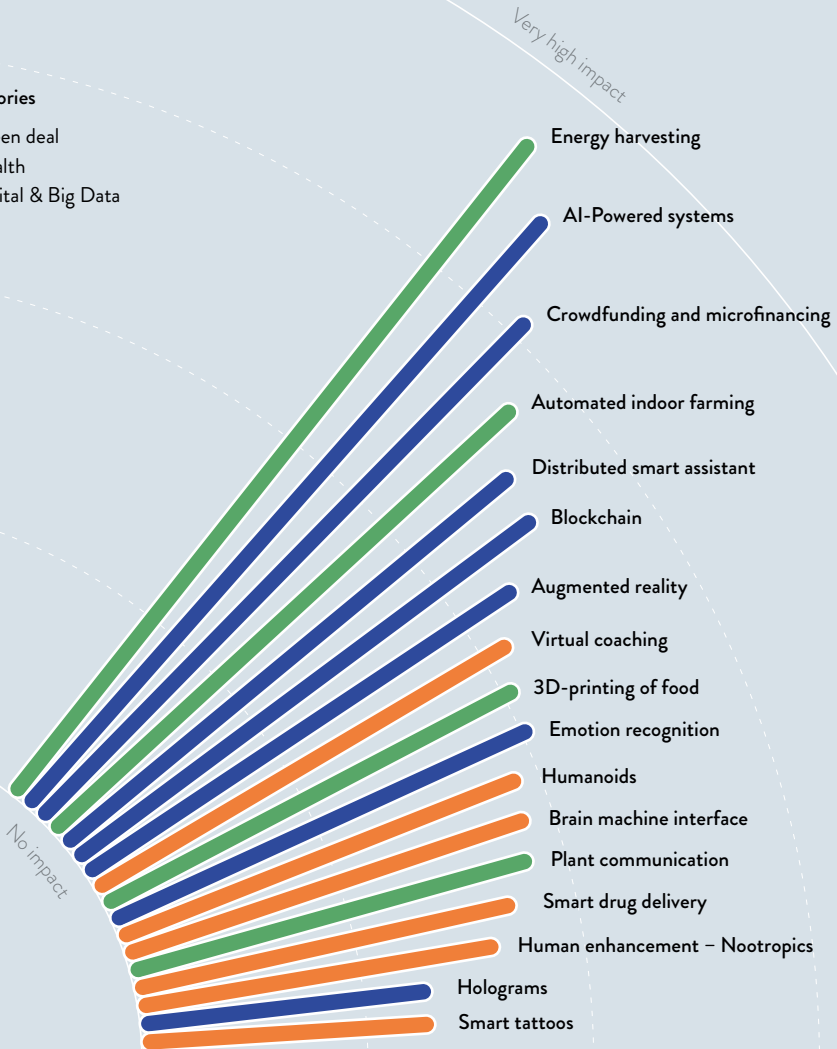


Impacted SDG:

- #4 Quality Education
- #17 Partnerships to achieve the Goal
- #10 Reduced Inequality
- #3 Good Health and Well-being
- #8 Decent Work and Economic Growth
- #9 Industry, Innovation and Infrastructure

Categories

- Green deal
- Health
- Digital & Big Data



Expected impact of technologies

FIGURE D

Technologies' expected impact on all SDGs.

A survey has been carried out to explore the expected impact of such selected set of technologies and technological innovations in the future with respect to the community context. Experts, outsiders, and PhD students had to critically identify the key technologies for the envisioned and desirable Smart and Inclusive Communities for well-being in 2035, and then evaluate how each technology impacts on the SDGs.

The survey guided the participant through a progressive approach. Starting from the selection of one of the community areas and the identification of 5 SDGs, the participant was invited to explore the relationship between the SDGs and the proposed 17 technologies by providing an evaluation on their impact (extremely positive, positive, neutral, negative, extremely negative). The process allowed to gather more focused information, although quantitatively slightly unbalanced.

Figure D reports for each technology the expected absolute impact on all SDGs. Technologies in the **Digital & Big data** group are expected to have a stronger absolute impact; technologies in the **Health** group possibly will have a limited impact; and technologies belonging to the **Green Deal** group seem to have differentiated expected impacts. Indeed, the selection of the community area of interest at the beginning of the survey might have affected somehow the framing and reasoning behind the possible impact of the technologies, but only marginally. As an example, **Plant communication** has been identified as a technology with possibly little impact on all SDGs because none of the areas

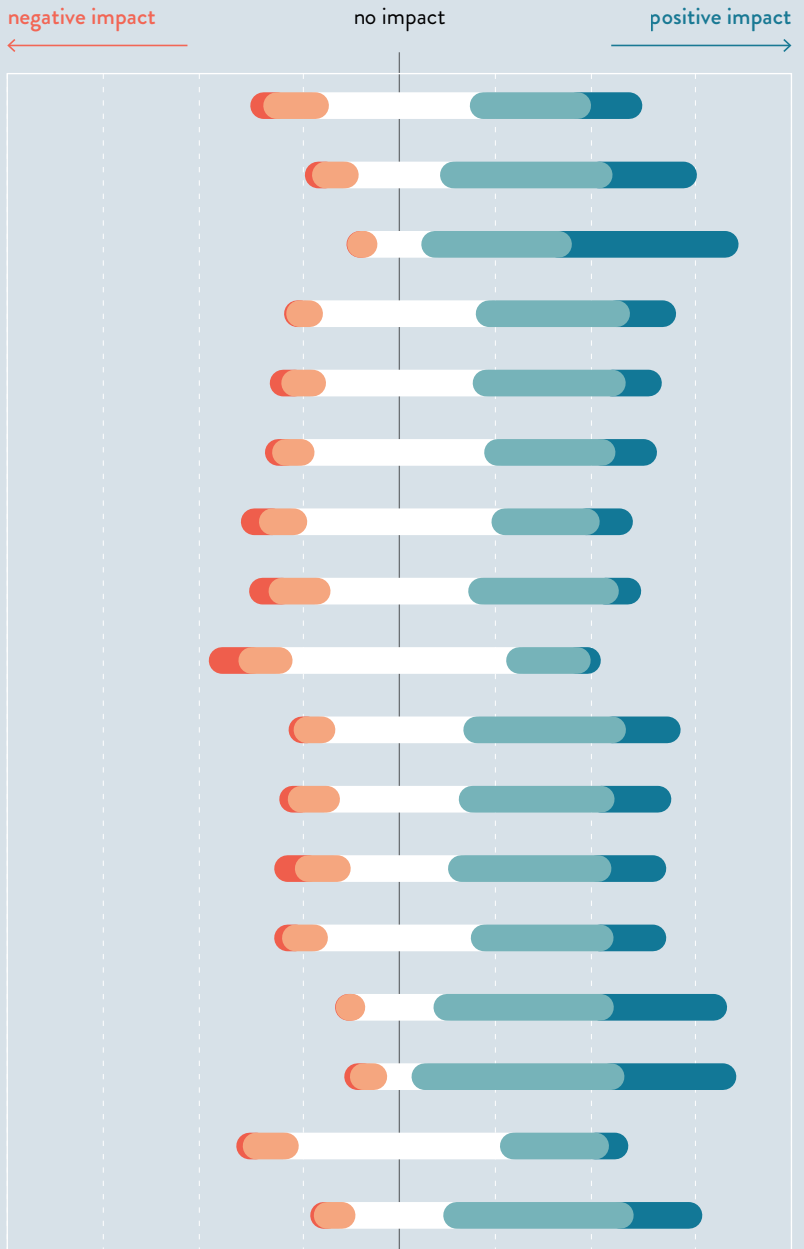


FIGURE E

Percentage distribution of impact for each technology on all SDGs

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hinted its exploitation. Conversely, **Energy harvesting** is expected to have a strong impact across all areas, even if it was not the focus of all areas.

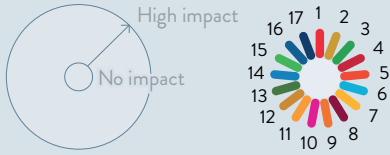
Figure E reports, for each technology, the cumulative net impact across all SDGs. For all technologies, the dominant impact is either positive or neutral; the first 5 technologies at the top of the chart are expected to have a clear positive impact, while for the remaining ones the neutral impact seems to be predominant.

The relationship between the areas of interest and the identified individual SDGs as most impacted/relevant is reported in the chart in Figure F.

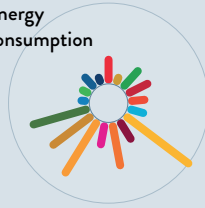
For each community area, the chart shows how many participants chose a particular SDG, expressing how impactful they considered one or more SDGs relative to the community area they selected at the beginning of the survey. The size of the circles and the intensity of their color are directly proportional to the number of people who chose the relevant SDG after selecting the community area. Indeed most participants focused on the **Energy consumption** and **Eco activism** areas of interest/competence, as they actually emerged as dominant elements during the workshops.

These results have also been related to the outcomes of the experts' activities during the workshops, when working on the four representative Hero Communities. The experts were challenged with the identification of the most impacted/relevant SDGs for that kind of community, and to frame these communities to the initial community areas.

Impacted SDG by community area



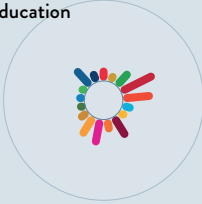
Energy consumption



Eco activism



Education



Human care



Local synergies



Heritage art preservation



Free time enhancement



Food ecosystem



Disability support

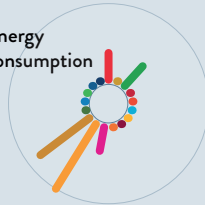


Elderly support



Impacted SDG by community area when working on the four representative Hero Community

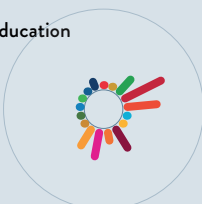
Energy consumption



Eco activism



Education



Human care



Local synergies



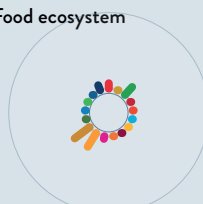
Heritage art preservation



Free time enhancement



Food ecosystem



Disability support



Elderly support



FIGURE F

Impacted SDG by
community area

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When moving the focus on the SDGs and community areas survey participants voted the most, it can be noted that the most selected SDGs are Sustainable cities and communities and Responsible consumption and production, related to a greater sensitivity to the community areas Energy Consumption and Eco Activism. Indeed, by analyzing the impact of individual technologies for each selected SDG in relation to a single community area (as shown in figure H) it is possible to observe that:

- in general, all technologies were rated to have a positive impact with similar ratings for the selected community area-SDG groupings;
- three technologies (Crowdfunding and microfinancing, AI Powered systems, Energy harvesting) appear to have extremely positive prevalence of impact in all the case studies analyzed;
- There are a few technologies (Smart Tattoos, Emotion recognitions, Holograms and Human enhancement) for which the majority of the participants express a neutral impact, with some limited negative and positive opinions.

FIGURE G

Impacted SDG by
community area when
working on the four
representative Hero
Community

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In general, technologies are expected to have a positive impact on the SDGs when analyzed in relation to the selected community area, with a limited number of negative possible effects on specific area/SDGs combinations. This might relate to the fact that some technologies are inherently biased toward an SDG while, in limited cases, hinted a marginal relevance with respect to the community areas thus resulting in a limited impactful element.

FIGURE H

Percentage distribution of
impact for each technology
and SDG area on specific
community areas
(on the next page)

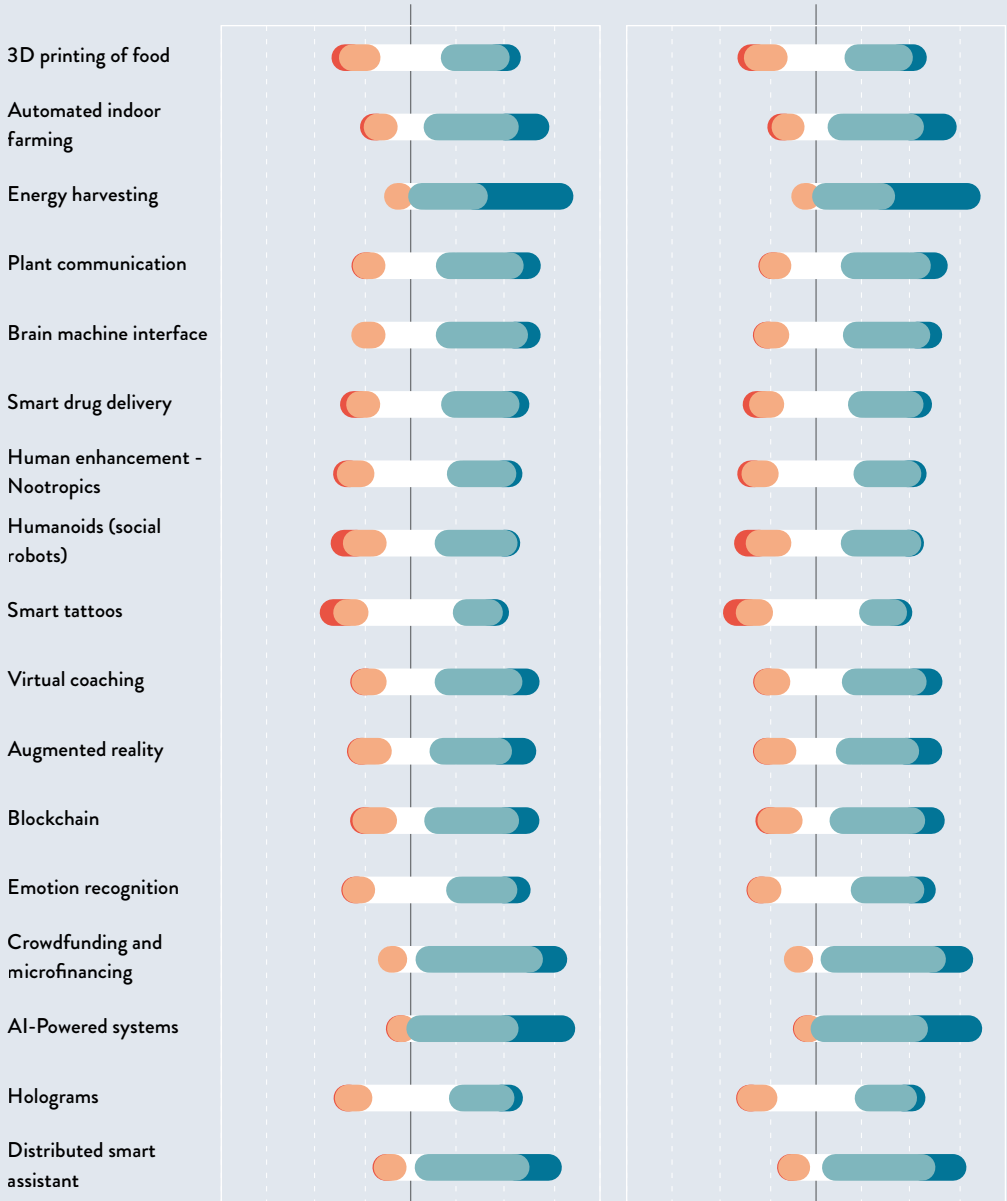
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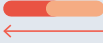


Percentage distribution of impact for each technology and SDG area on specific community areas.

ENERGY CONSUMPTION

SDG 11 – Sustainable cities and communities

SDG 12 – Responsible consumption and production



Color indicates the impact:  negative impact  no impact  positive impact

ECO ACTIVISM

SDG 11 – Sustainable cities and communities

SDG 12 – Responsible consumption and production

3D printing of food



Automated indoor farming



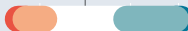
Energy harvesting



Plant communication



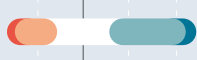
Brain machine interface



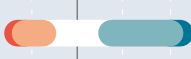
Smart drug delivery



Human enhancement - Nootropics



Humanoids (social robots)



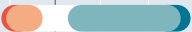
Smart tattoos



Virtual coaching



Augmented reality



Blockchain



Emotion recognition



Crowdfunding and microfinancing



AI-Powered systems



Holograms



Distributed smart assistant



3D printing of food



Automated indoor farming



Energy harvesting



Plant communication



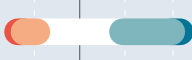
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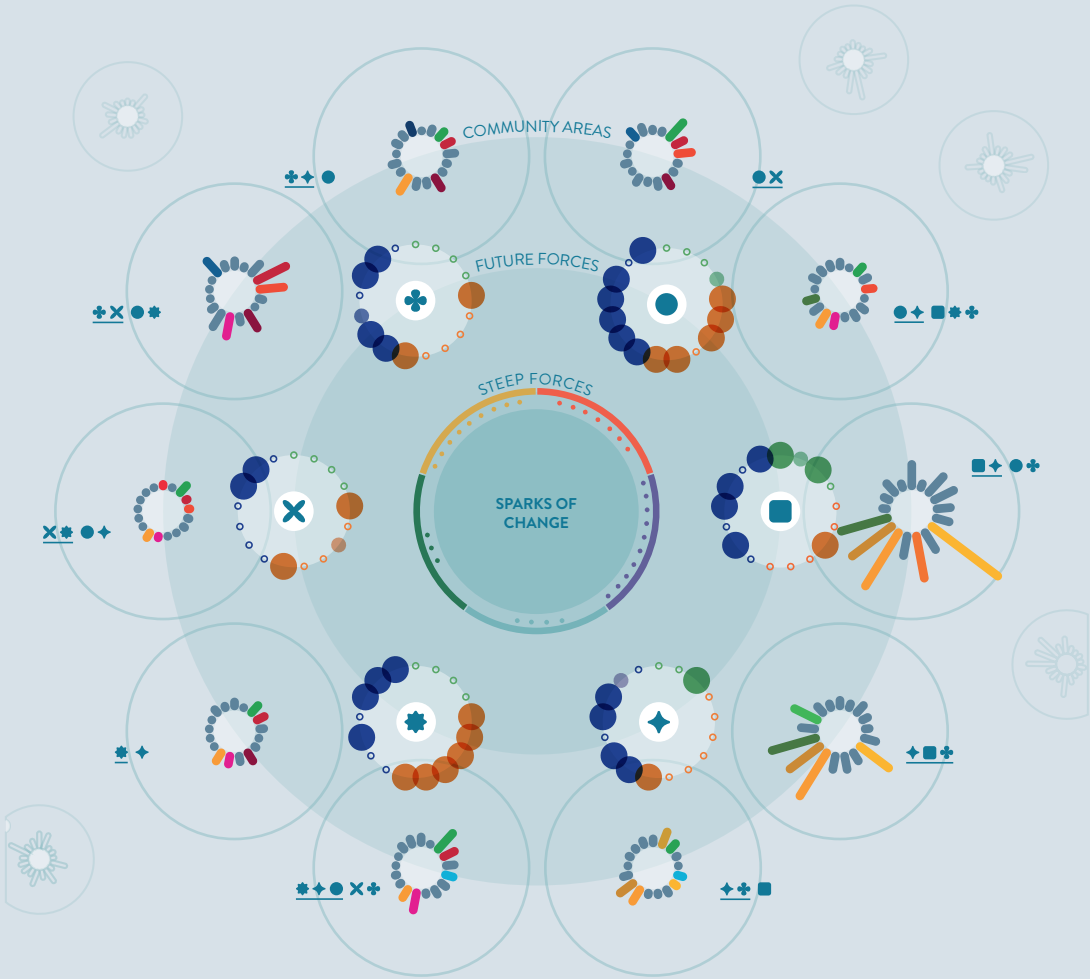


Holograms



Distributed smart assistant





Emerging future forces

FIGURE I

Comprehensive and integrated view of the study, represented with full details of the attached poster

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Future communities in 2035 is a complex multi-facet ecosystem that goes beyond the definition of the scope of each community. It considers a multitude of aspects that, combined, create an intricate network of connections whereby it is impossible to look at (or even influence) one topic without conditioning another. Besides the various forces that could impact communities in 2035, **six future forces** have been recurrently highlighted by internal and outside experts as crucial when considering the future of communities. By envisioning these future forces, the experts also presented the two **sparks of change** mentioned at the beginning, the starting points that create the conditions for people. Although many of these considerations are grounded in a urban context, the city dimension is neither a constraint nor referring to Italy. Also, these forces are presented with positive nuisances, however, this does not imply that these aspects do not have (or are likely to have) negative effects on the future of communities.

1 Data-shaped communities

→ **Trends:** big data (exploitation and security), rise of computing power, digital identities, decentralized governance, sensors everywhere, empowered AI, community search, digital rights.

Data availability will not risk shortages: knowing individuals' preferences, vital parameters, and needs will become easily attainable information that can be matched with one another to boost people's experience. AI power can bring a group of people together based on commonalities, or complementarity, of needs to fasten the time to obtain what they want. Examples of data shaped communities are the ones for elderly support (alerting to the right moment to helping people in need) or supporting citizens' participation spreading information and gathering people's ideas.

2 Synergies to overcome bottlenecks

→ **Trends:** sharing economy, open-source idea generation, eco-consciousness, knowledge platform, resource management, value re-distribution, stakeholder engagement

Citizens want to raise their voices and be active agents of change in the local-national environment. Communities' platforms for sharing personal expertise allow innovations and research born in a local dimension to be distributed on a global scale. The risk of shortages of a large number of tangible and intangible resources spurs people to share best practices and solutions to reach a global optimum (e.g., in energy sector). This fruitful exchange of knowledge induces citizens to join forces to create solutions that governments or businesses are not investing in.

3 Morphosis of city boundaries

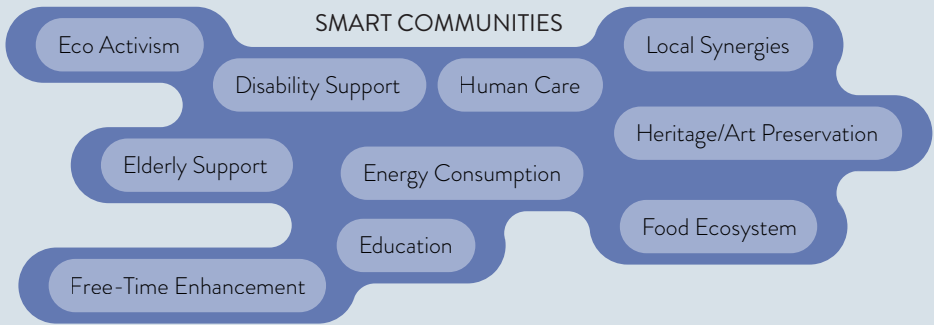
- **Trends:** 15-minutes neighborhood, rise of mega cities, urban re-configuration, urban sprawl, smart rural, social street, flexible working habits, local economy

National geographical boundaries lose their importance due to digital relations. The widespread digital connectivity gives a second chance to abandoned places and revitalizes the social offer attracting new users. Connections among local groups and public administrations put the basis for the generation of new typologies of mega-cities, formed by a conglomerate of 15 minutes neighborhoods and smart-micro territories. All of this induces a new way to experience the city: searching for proximity connections and groups belonging through digital tools. Communities will thus be influenced by the ongoing urban morphosis and, as a counter-effect, they will themselves shape geographical evolution.

4 Boundaryless caring services

- **Trends:** local-based support services, decentralized medicine, Individual health monitoring, sensors everywhere, security search

The recent pandemic shed light on the fragility of national health systems. People start to advocate the need to care holistically about human well-being, where the conjunction of digital tools and communities' support is the trajectory for the future. People understand their role in solving the lack of local-national services, moving towards scattered communities with mutual support, delivering both mental and physical help. The elderly and fragile are the primary target for caring services and innovations, by being, in most cases, well equipped with digital skills to leverage hybrid interactions.



5 Awareness on the inner sphere

→ **Trends:** mental awareness, perception of loneliness, digital identities, living lab experimentation

Community relations are critical in enabling the search for personal identity, discovering individual strengths and uniqueness, and supporting self-acceptance of physical and mental limits. Digital tools (e.g., metaverse, virtual groups) fastened these inner-centered relations, enabling younger generations to break down societal taboos and speak freely about their problems by advocating a change of attitude among generations to combat unfounded prejudices. The adoption of digital and hyper-realistic avatars is, on the one hand, the solution to gain enough protection to discuss personal topics, on the other, a mean to see new sides of oneself personified. Adding the geographical-local dimension, community relations recreate a safety net of contacts (which replaces distance from possible far away family members), thus increasing the perception of safety by overcoming loneliness.

FIGURE J

Key community areas

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6 Lifelong education for individual satisfaction

→ **Trends:** democratization of knowledge, knowledge platform, independent learning, micro credentials, accessible interfaces

The world is a rapidly changing environment where the competencies of today may not be sufficient to face future challenges. Either driven by the work environment or spurred by personal goals, people are searching for persistent and targeted learning experiences. Regardless the age, continuous learning is one way to nurture resilience by growing confidence in facing unexpected events. Communities are a thriving network for sharing experiences and expertise, also complicit in people's enormous desire to disseminate their acquired knowledge to keep up to date on the latest technological or social trends.



Participants to interviews and workshops are listed below.
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