Virtual, Augmented and Mixed Reality: what benefits for SMEs?

ABSTRACT

SMEs constitute the backbone of the EU economy. Their ability to succeed and generate both employment and growth is increasingly dependent on their capacity to innovate. The outbreak of Covid-19 has further forced business to reflect on how technology might spur creativity and how stronger involvement with and acquisition of innovation might affect businesses and survival. Virtual reality and other form of virtual alternations of surroundings such as Augmented reality and Mixed reality have the potential to have a lasting impact on SMEs. Diminishing cost associated with Extended Reality and improvements in its performativity have created a window of opportunities for SMEs making available technology previously accessible to bigger enterprises. Extended Reality has the potential to contribute to product development, training, marketing and problem solving while also favouring sustainable development and improving labour safety. Policy should focus on increase XR awareness in SMEs. Diffusion of Extended Reality is also contingent on the ability of R&D teams to enhance cultural specificities in XR products and allow SMEs to take full advantage of their potential.

Introduction

Small and Medium Enterprise (SMEs) are key to growth and job creation in the EU (see European Commission, 2020). Policy-making discourses on SMEs consistently focus on innovation as a key determinant for success. It is within this context that "Extended Reality" (XR)[1] can constitute a valuable technological tool in supporting competitiveness. XR has the potential to be a game changer in facilitating business, competitiveness and economic growth while increasing the possibility of sustainable development and labour safety. Diminishing cost in technology associated with XR well position SMEs to rip off the benefits of these new technologies. Furthermore, improvement in software and hardware quality in the XR domain increase the performativity of virtual technology and generate the potential for new opportunities.[1]

The XR extends to multiple forms of reality which can be virtual (VR), augmented (AR) and mixed (MR) with each of them performing different functions. They all lead to some form of "technologization of human perception" (Chaudhary, 2019, p. 454). Arguably the most well know from of XR is VR, which is 'high-end user-computer interface that involves real-time simulation and interactions through multiple sensorial channels' (Burdea and Coiffet, 2003, p.3). VR performs a substitution function by replacing "true" reality with a computer-simulated one (European Commission, 2017). AG, instead, explicates primarily an enhancement function. It allows for the overlay of digital information and content on the "real" environment improving knowledge and control of the surroundings (see European Commission, 2017). A final form of XR, MR allows for both the overlaying and the anchoring of virtual elements to reality (see European Commission, 2017). It performs an integrative function allowing for the interaction with virtual objects "loaded" into reality (see Billinghurst and Kato, 2007). With the changes triggered by Covid-19 pandemic, the slower pace of business activities, and the

[1] Originally performance of XR was not satisfactory also negatively affecting perceptions of the relevance of XR also for business activities.

increase demand for digitalisation, XR might represent a valid aid for product development, marketing, training, and problem solving.

XR applications: Virtual, Augmented and Mixed Reality

XR has multiple applications in business and the potential to represent a valid aid for SMEs on two distinct levels: efficiency and quality of working relations. VR facilitates product design and simplifies validation practises (Ecorys, 2017). Visualisation of 3D or CAD [i.e. computer aided design] models in virtual potentially increase the ability to quickly respond to changing needs in the market and clients' preferences (Ecorys, 2017; Seth, et al., 2011). This allows for a more effective buyer-supplier communicative interaction by intervening on production processes and identification of preferences through experiencing virtual manifestation of the product in a timely manner. This would reduce the need for physical prototype leading to a reducing of waste (Ecorys, 2017). XR affects problem-solving and training. By overlaying information to existing objects AG and MR allows for the identification of defective devices. In particular, 'information overlay may be used by remote collaborators to annotate the user's view, or may enhance face-to-face conversation by producing shared interactive virtual models' (Billinghurst and Kato, 2007, 266) and facilitate problem-solving. A more interesting opportunity unleashed by XR is its ability to influence training on a more fundamental basis by providing an "objectified" platform to handle over-confidence problems. The Overconfidence Effect (OE) is the by-product of individuals' bias in the projection of one-self, which lead to a mismatch between objective competences and assumed individual competences. This is particularly relevant since '[r]esearchers have offered overconfidence as an explanation for wars, strikes, litigation, entrepreneurial failures, and stock market bubbles' (Moore and Healy, 2008, 502). The way XR operate (i.e. by introducing experimental and immersive learning) would allow to objectify at least some OEs and better handle problems triggered by bounded rationality.[2] By undertaking the training, the problem could be potentially resolved by acquiring evidence on one's skills while having the chance to develop competences. This is not to argue that XR is panacea for all work-related difficulties, but we suggest it might offer a valid aid to improve interpersonal working relations and collaboration. Also, XR in training would allow to improve safety on the workplace by adequately training personal before performing riskier tasks in a safer learning environment in virtual.

Marketing is best suited to benefit from XR and remain key for the SMEs' success. XR allows for improvements in Face-to-Face (F2) marketing and in digital marketing. For instance, XR affects byer-seller relations by making possible for prospective buyers to visualise the entirety of the supply without having to select products from limited samples. This is particularly relevant for marketing. It allows SMEs to better express their creativity without incurring in additional costs. It equally allows buyers to have clearer understanding of the offer reducing information asymmetries. Furthermore, in addition to the F2F marketing as transformed by XR, we also see changes in digital marketing, which are primarily related to personalisation. In the virtual world, we experience personalisation in two different forms: personalisation of product experience and personalisation of experience. The usefulness of XR is also embedded in the relatively "simplicity" in the use of apps which overlay the digital object into the existing surrounding. XR can rely on smartphones to operationalise different degrees of virtual simulations allowing for personalisation of product experience. It is, in fact, possible to visualise how a piece of furniture might fit on one's home or try on a piece of clothing in different colours without living the house. Similar Apps already in use by big companies such as Ikea and MAC but are a resource for SMEs as well given the increasing more limited cost of implementation. Personalisation of experience in VR can operate on the knowledge level or the sensorial level. The first typology might be achieved by appealing to cultural and historical

significance of a production process or a product. VR can be utilised as a story telling experience where consumers (see Ecorys, 2017) can, for instance, experience the different phases of wine production (both in streaming or recorded) according to individual curiosity and the history of tradition behind such production processes.[3] XR make it possible to personalise consumers' experience through virtual construct adjustments. VR can easily allow to adjust visualisation and provide different sensorial experiences according to consumer preferences. The colours and sound elements in a virtual show room might be adjusted to respond to consumer inclinations, increase comfort and make the overall experience unique.

What policy initiatives?

To rip the benefits of XR SMEs face a number of obstacles. We focus on two that might be particularly relevant for them in the context of XR: latent obstacles and culturally embedded XR.[4] The most impairing obstacle is latent. It concerns the overall lack of XR awareness in SMEs and the potential that XR technology might unleash. Initiatives to increase XR awareness should be deployed to face such obstacle. *Crescere in digitale* [Growing in digital] was a programme established in 2016 by the Italian Ministry of Labour, Google, and UnionCamere (i.e.) to reduce youth unemployment. The programme (still running at the time of writing) offers 50-hour online training course on digitalisation for under 30s who were classified as NEET (i.e. Not in Education, Employment, or Training). The programme included six-month internships in enterprises in order to improve their level of digitalisation while offering youth employment. The cost of the internship was born entirely by the government to avoid any further burden for enterprises. According to available data, the programme so more than 100 subscribers, 6.366 enterprises participated into the project with 9.111 internships offered and (Italian Ministry of Labour, 2017). The plan also included an employment bosun if the company decided to hire after the competition of the internship (Barbieri, 2016). Similar training activities could be extended to XR so to bring into the SMEs world further knowledge on the most recent technological innovation. Benefits of such country-based training programmes could be further expended by linking them to the activities of the Enterprise European Network (EEN). Launched by the European Commission, the EEN constitutes the largest support network for SMEs in the world aiming at improving innovation through cooperation between research and business and by facilitating business partnership for SMEs. Training on XR sponsored by countries could be further developed in cooperation with the EEN and better connect the acquisition of digital skills with innovation demand in SMEs and internship programmes. Such initiative could completement other programmes already in place in the EU such as Erasmus for Young Entrepreneurs. There is a further problem concerning the dissemination of technology and the acquisition of necessary digital skills. Government policies tends to favour "disintegrated" action plans, aiming to facilitate either the purchase of hardware and software or the subsidy of training courses. Such type of public intervention prevents optimisation of both public and private investment. By making conditional the financing (or tax relief) of new technology to the provision of in-house training programmes, companies would be encouraged investment both in new technology and training in digital and virtual skills. This would eliminate the critical issues affecting a disintegrated approach favouring a widespread spread of technology and skills at the enterprise level.

Globalisation and diffusion of communication technologies can simplify networking and the ability of SMEs to thrive. Provision of relevant XR apps by specialised SMEs to other small business is dependent on market knowledge and the ability to suggest products that respond to the need of the international and domestic market. The majority of SMEs remains mostly inward looking (Muller et al., 2018) but they might benefit from XR to increase their international presence. The use of XR should leads us to consider the benefits of "techno-

localisation", which we define as the ability to provide innovation through technology that are informed by the cultural context within which the products originate. Tradition and culture are an added value in commercialisation of products. Knowledge of such culture should lead providers of XR to offer XR products that can take advantage of such cultural specificities. Innovation managers could be central figure in SMEs involved in R&D in XR. Although programming knowledge remains central to provide quality product, there is an equal necessity for business strategy to think of and deploy successfully XR solutions. The necessity of culturally embedded technology is key to further allow SMEs to benefit from innovation and "exploit" their uniqueness. A case in point is the valorisation of the "made in" tag, for instance, in the construction of a virtual showroom that allow for the visualisation of products expression of a consolidated tradition or competences (e.g. agri-food, clothing, interior design, etc.) and can be visualised through the downloading on an app in a few seconds. For instance, the Oculus app store provide immediately access to apps that could be easily downloaded by millions.

XR harbours enormous potential. But although 'a new world has come into existence' [ ] 'it exists only in fragments' yet (Mumford, 1934, p.5). The ability to use such technological potential harvested in XR to support economic growth and sustainable development is also dependent upon tailored policy programmes focused on increasing awareness, connecting competences with business demand and the ability to use XR to valorise culture and tradition so to confer competitiveness to SMEs.

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NOTES

[1] XR is 'an umbrella term used to describe immersive technologies that can merge the physical and virtual worlds' (Marr B, 2019).

[2] De-personalization in this context appears useful to avoid the identification of overconfidence problems by staff through individual errors, which would potentially have spillover effects on work activity and inter-personal relations in the workplace.

[3] It is important to clarify that the boundary between F2T and digital marketing remains fluid. For instance, story-telling experiences in XR can take place only in the digital space where buyers and sellers are located in distinct places or F2F (through the use of headset in loco) to give customers more awareness of the product that the client is willing to buy.

[4] Lack of investment is a key problem. A number of policy initiatives have been undertaken to face such obstacles such obstacles such as EU and national funding, tax breaks, etc. Here we focus on problems, which have been considered as a result of the working experience in the Italian Ministry of Labour from 2014 to 2018.