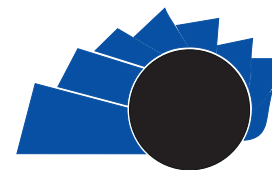




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Visión Electrónica

A CONTEXT VISION

Production engineering immersed in the creative economy

La ingeniería de producción inmersa en la economía creativa

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ABSTRACT

Currently, the production processes in Colombia are in a phase of continuous improvement, bringing together different specialties that seek to shape and potentiate a product or service, however it is necessary to considerably expand the panorama of possibilities to access the various branches of Creative Culture. From this perspective, entrepreneurship can generate added value that over time can become an opportunity for the sustainable development of the country. This article reviews the relationship between the Creative Economy and Production Engineering, explaining the potential of ideas from unconventional concepts and including them in business models that have managed to be pioneers in this new perspective, all of this through sustainable ideas, cultural heritage, administrative and pedagogical tools as well as emerging technologies.

RESUMEN

Actualmente los procesos productivos en Colombia se encuentran en fase una fase de mejoramiento continuo, reuniendo diferentes especialidades que buscan dar forma y potencializar un producto o servicio, sin embargo hace falta ampliar considerablemente el panorama de posibilidades para acceder a las diversas ramas de la *Cultura Creativa*. Desde esta perspectiva, el emprendimiento puede generar un valor agregado que a través del tiempo se pueda convertir en una oportunidad para el desarrollo sostenible del país. Este artículo revisa la relación entre la Economía Creativa y la Ingeniería de Producción, explicando el potencial de las ideas a partir de conceptos no convencionales e incluyéndolos en modelos empresariales que han logrado ser pioneros en esta nueva perspectiva, por medio de ideas sostenibles, patrimonio cultural, herramientas administrativas y pedagógicas y tecnologías emergentes.

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1. Introduction

Creative Economy understood as the economy area that involves processes that have as input the idea generation, on the creation, production, and distribution of assets and services, it is a concept that relates three important factors for entrepreneurship and innovation: Creativity, Culture, and copyright as an added value in Culture industry. The ONU (United nation organization) for Education, Science, and Unesco Culture defines Creative Economy as the industry “that combines the creation, production, and marketing of creative content which is intangible and cultural nature. These contents are protected by Copyright and they can take shape as asset or service”. [1].

Now, the economy with intellectual heritage is not something new in the cultural environment. John Howkins, author and british journalist considered as the Creative culture father, presents how to combine the process for creative areas with the business environment, on his book, “ The Creative Economy: How people make money from ideas” Published in 2001.

Howkings, centres his attention on creativity, since in ninety years themes like technology and information technologies took power leaving behind something that was for him the start line on business: The idea generation, Emphasizes Howkings, that creativity is not something new and the same can be said from Economy, what it is new is the nature

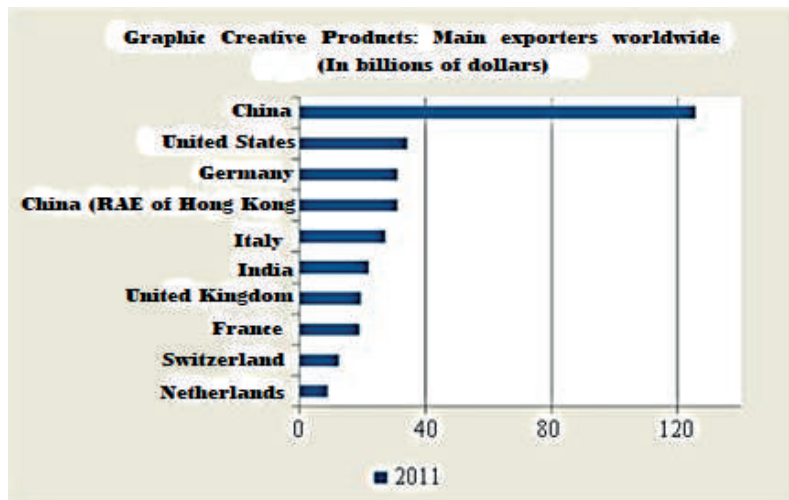
and the scope on its relationship between each other and how they combine to generate wealth and a wonderful value. [2].

Nevertheless, this relationship stimulates the creative industries and it them measures like any other one: Demand, price, benefit, and margin: Observing also, work, production, and productivity. [3].

According to the numbers published in the ONU conference about Marketing and development, UNCTAD in 2001, the worldwide trade of creative assets and services present an energetic raising between 2002 and 2011 in developed countries like China, USA, Germany, and others, Figure 1. The foregoing validates the perspective exposed by staff members of UNCTAD, who indicate that creative services keep growing as the economy based on this knowledge expands around the world.

On the one hand, it is important to mention that exists specialized agencies that are in charge of promoting and analyzing the scopes of this economy in different parts of the world; for example, there is the convention about protection and promotion of diversity of cultural expressions, adopted during the general conference of UNESCO in 2005, or the guide “Policies for creativity. Guide for development on cultural and creative industries” [5], that UNESCO published in 2010 in order to encourage those responsible of developing of creative industries policies in every country looking for a public intervention for this new economic model.

Figure 1. Main exporters on Creative products [4].



On the other hand, It is also found in 2013 the “ Inform about Creative Economy”, with this information the ONU program for development PNUD, it was proposed to stimulate the creativity and the innovation on the search of growth and sustainable development, equitable and inclusive for those developing countries [6]. Guides and informs as the exposed previously, they achieve to stimulate the creative emergent movement by rules that support the innovation and the development strategies and international cooperation; thanks to the labor of agencies like UNESCO and El Banco Interamericano de Desarrollo BID, that seeks to spread and finance the commercial integration in Latin America as in the world.

In terms of engineering production, that is another aim within this article, it could be defined, according to the Colombia Universia magazine publication as, a knowledge area that analyzes and evaluates the economy processes on assets and services production. It is in charge of establishing when exists deviations on the initial project and what kind of modifications will be necessary on tangible or intangible products that a company offers in order to achieve their goals. [7].

In August 2016, Colombia Universia, interviewed to production engineers Juan Gregorio Arrieta Posada and Leonardo Rodriguez, who work at Eafit University and EAN University, respectively, in order to obtain complementary data related to the production engineer skills. Now, it is going to be exposed sections of the interview as contributions to the definition of this engineering area; Juan Gregorio Arrieta mentions that production engineer “It is based on the technical knowledge of manufacture and materials that allow the comprehension in the function on productive processes”. Leonardo Rodriguez indicates that “It is planted engineering, the one that analyzes, manages quality and monitors the processes to improve them, understanding if it is about a chemical process, electronic, logistic, organizational, automatic or maintenance”. [7].

However, from a wider point of view, these intents to define, end up limiting the action plan of production engineer to the industrial and services market, passing by the valuable insights that areas like creativity and innovation can make to engineer fields; especially when you approach from a heritage and cultural perspective.

Taking this into account, the aim of this article is to extend the action plan of the production engineering in the creative area, understanding that, this profession is totally focused on the manufacture and services process and its study mainly, the area of creative and cultural industries is part of the essential basis for the sustainable development in the Country.

Among the principal factors that motivated the accomplishment of this investigation, it should note the interest to include the engineering mind and the industrial processed as factors of creativity, the usage of the cultural environment and heritage and the approach of the human talent. Secondly, the need to expose different professionals to engineering area, a range of diversity and possibilities of entrepreneurship in the frame of Creative Economy rules.

This paper begins with a short description on what it is Creative Economy; subsequently, it exposes company examples as Conceptos Plásticos and Mola Sasa, that allows understanding in a clear way the synergy materialization that exists between the production engineer and the Creative Culture, as well as the description for innovation methodologies for the creative industry, announcing the benefits for supporting this emergent industry in the Country. As a way to close it, it proposes some considerations in front of the importance of promoting cultural industries in connection with the field action of the production engineer.

2. Background: Orange Economy.

Speaking in productive terms and activities in the function that can be wealth potential generators and employment. We do not know that we are unaware of the valuable potential of these two concepts capable of promoting the worldwide economic growth and generate life quality to millions of people, These concepts **Culture**, and **Idea**.

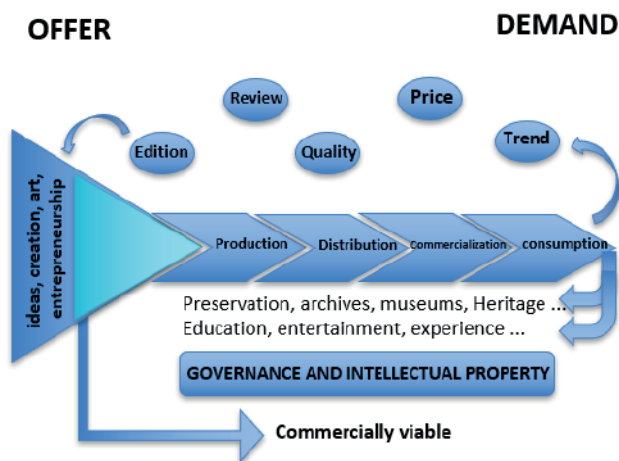
The above, evidence that currently, for example, the traditional concept of Enterprise that is defined as “Entity that controls capital and works as factors of production from industrial activities or commercial or the provision of services”. [8]. ”. On the other hand, the Creative economy proposes complement this definition adding that culture as a way to transformation, and the creativity and a way of innovation out of conventional. Thanks to this new comprehension, would imply those creative

industries based on economy rentable ideas, at the same time that provide and contribute to the environment-development in a cultural, artistic, intellectual and technological level to this society.

For example: Cirque du Soleil (Circus of the sun) would surprise to see how friendly it is with the environmental, while it offers a cultural contribution to thousands of people around the world, and at the same time generates over 800 million dollars on tickets per year [9].

Like this, from innovator ideas with a cultural perspective, can be found some that work with the ancestral heritage of the country, like its carnivals, festivals, craft and gastronomy shows, museums, libraries and archaeological centers. This development engine, based on the talent and heritage wealth of Colombia, has been called as Orange Economy, the concerned trading model, Figure 2, highlights different cultural factors that can contribute to the employment generation and sustainable development of the country.

Figure 2. Orange Economy Business model [9].



3. Materials and methods

It will be established the synergic model between Creative economy and production engineer.

Starting from two models, industrial and environmental and social named: Conceptos Plásticos and Mola Sasa; then it will be established an interpretation of the reflections for the final alternative model. Popper proposes that knowledge is relative, “The Scientific knowledge is simply not a true knowledge. It is open to be reviewed” [10], The

Scientific knowledge is simply not a true knowledge. It is open to be reviewed”, So, the next study case focus on the products of the human beings mind. These forms from the Popperian point of view is the thing we know as ideas or intellectual products, those that are acknowledged process exposed in order to be reviewed.

4. Study Cases

The Creative economy can admit that an engineer can and must be immersed in the innovator market models. The connection that is established in *Conceptos Plásticos*, enterprise project that transforms plastic residues on the interest social constructions generating not only a positive environmental impact but also an economic, cultural impact for society too. This company produces plastic blocks, through recollection, merging and injection of the waste; these blocks work as a *Lego Pieces* that are used to construct houses, obtaining that communities and families play with the concept of building their own homes, chelters and classrooms, community rooms and another kind of structures, see Figure 3.

Figure 3. Interest social house [11].



The founder, Carlos Andrés Mendez, who assures that he and his group “offer solutions of change, innovative and sustainable, of high environmental, social and economic impact, starting from recycling in order to improve life terms of vulnerable communities, generating products and alternatives focus on sustainable development” [11]. This being, also Colombian entrepreneurship, a model sustainable for every country.

So, bringing together, architectural knowledge and reusing plastic waste, it obtained innovate in construction themes for low-cost houses, with an alternative constructive system very friendly,

easy to assemble and construct. These houses, in addition, to be friendly with the environment have physic and mechanical properties that exceed the traditional ones, both in the wall and the beams. Oscar Méndez, “they are modular systems that allow implementing any kind of design that will last in time, with the sustainable features and capture emissions of CO₂ that any solar traditional system would try to match” [12].

Nowadays, Conceptos Plásticos count with a production plant located outside of Bogota, with a production capacity of about 200 tons monthly [13], the company had achieved to venture on the international market thanks to the relations that have established with multinationals.

On the other side, The Verbenal dreams project was inspired in Colombia, classified as one of the most unequal nations of the world according to the worldwide bank [14], it was found in a process to mitigate this change through social interest projects, that support displaced communities or invulnerability terms, based on creative ideas that count with innovative potential in the corporation area. The Ciudad Bolivar location, El Paraíso-Verbenal neighborhood (Bogotá, Col), take places a project with the Semillero UD social⁴ cooperation and the investigation group GIDENUTAS⁵ from Distrital Francisco José de Caldas University. This project seeks to put in service to the community derivative products from investigation and teaching, through enterprises of the technological base called Spin-off: these generate economic resources

Figure 4. Sustainable house [16].



4 Research Incubator of Universidad Distrital Francisco José de Caldas
5 Research group of New Social Application Technologies

to finance investigation activities, they work as a practice stage for students, contributing to generate employment, improving the life quality in involve communities. [15]

One of these companies Spin-off is “Ekomuro H₂O+”, formed by one entrepreneurship family that decide an environmental innovation initiative, encouraging to the communities to recollect rain waters, in order to mitigate the global warming changing effects [16]. The modules are made of 54 soda bottles and 3 litres that join each other through their lids. The rain waters access through the ceiling gatters, achieving its storage and storing around 162 litres [17], See Figure 4.

Since Verbenal Neighborhood does not count with any aqueduct, sewage, energy service, communal lounge, schools and medical centers close to them; this is why, investigation groups UD social and GIDENUTAS support the student’s investigation projects that look for improving communities with technological usage, sustainable terms, some of them are: Litro de Luz (Alternative natural illumination), Construccion Salon Comunal (PET recycled usage) See Figure 5. Casa con contenedores, Desarrollo de software (Manage business platform), and some others [18].

This kind of outstanding global ideas is necessary for a sustainable development. That is why, recycle is crucial, since the Production Engineer can be incorporated as recurrent activity in the curricula or from the developing plans of academic spaces.

Figure 5. Light litre and Community room wall [18].



Dave Hakkens, a Dutch designer, proposed a recycling plastic homemade machine design based on basic tools. Through a web portal, he shares the assembling instructions, this is formed by four machines, a plastic shredder, an extruder, an injection molding machine and a mold compressor, See Figure 6. [19]

Figure 6. Recycling plastic process [19].



In this website, you can find the steps to assemble and launch the productive process, also, Hakkens give some ideas to generate products by using this machine.

Figure 7. Recycled plastic products [20].



Another synergy model between the Creative Economy and the Productive Engineer is the accessories brand Mola Sasa, This company incorporates the tradition of textile industry with a modern craft vision. Mola is known as a clothing of Kuna communities of Darien region. Through design and representative elements from the Kuna community, it counts on strong craft roots, Mola Sasa achieves to make high-quality purses. The manufacture on this product it is formed by the craft traditional women of Darien region, who overlay several knit layers one above others, they shape unique designs that are made on freehand, these designs bring the Kuna Ethnic colors, Figure 8. This project achieves to preserve some of the cultural traditions that represent our Country. [21].

Figure 8. The Kuna community [21].



Business models lie this one, manage responsible social and environmental processes, besides than being sustainable, they also implement innovative and efficient methodologies that generate added value to the Creative Culture. this kind of handicrafts are defined as The production of useful goods, rituals, and aesthetics, are subject directly through the physical and social environment, that form a material expression from this culture of communities with an ethnic unity and fairly close; made in order to satisfy social needs, and they integrate as practical activity, art concept, and functionality and it also realize the knowledge from this community over the potential of each surrounding resource, knowledge is transmitted directly from one generation to another one. [22]

These aborigen handicrafts are found around the country, they represent an essential part of Colombian culture, both for the meaning value of creating with symbology a material expression of this ethnic communities and also meaning a great business opportunity that encourages entrepreneurs from the country to support Colombian cultural roots, national as international, with Artesanias Colombianas support, that in 2008 starts a national program of specific assistance, in order to resolve doubts about craft entrepreneurship at cultural level and open a market for those beneficiaries through fairs such as Expoartesanas, Expoartesanos and the Fourth national meeting for own Economies of Aboriginal communities in Colombia. (Ministerio de Comercio, Industria y Turismo) [23]. Figure 9.

Figure 9. IV National own economies from aboriginal community meeting from Colombia [24].



5. Creative methodologies in Engineering Production

The production engineer is an engineering arm in charge of manage, transforms and controls the resources of a productive system, turning problems in optimal solutions for the manufacturing process, for example, The Creative Economy seeks to promote this essential labor for Colombian companies combining innovation and culture on their productive and logistic processes. In this respect that one of the challenges for the Production engineer is that he has to be immersed in all transdisciplinary projects in areas of knowledge that are not inside his action field where it is necessary to venture. This is evidence of the need to think creative when is about advertising and marketing, however, the engineering knowledge is an excellent tool that impacts positively and innovative the market.

This is because the permanent intervention of information technology and communication, the internet is of crucial importance in order to companies adopt marketing strategies, creating a relationship Client–company that allows the interested ones to be part of the process and creating a product, it is appropriate then, due to the exposed before, introduce them in the investigation.

5.1. Crowdsourcing

According to Instituto Internacional Español de Marketing Digital, the crowdsourcing (Crowd–Multitude and Outsourcing–External resources) is used on business to obtain points of views and external agents to the creative process, publishing content on the social network or specific blogs. This management tool allow to the clients and external agents comment about they needs and the market's

needs, generating a mutual benefit once the product is on sale and lowering the probabilities that this launch fails. Involving the society on the decision making of a company, it allows a cultural supportive change no just in the relation with the client but with other companies too [25].

5.2. Concurrent Engineer

Another methodology that is taking force, is the concurrent engineer, this kind of strategy focus on the product life cycle. according to García (2004) technically it is define as: A systematic approach for parallel design and integrate the products and the related processes, including manufacture and support services, with the intention to developers consider, from the beginning of the project, all the life cycle elements of this product, from its conception until its elimination and recycle, including quality, cost, planning and user requirements. [26]

In summary, if this methodology is implemented successfully from the beginning of the productive cycle, the manufacture until the product launch, will be more efficient and economically viable. Implementing these techniques in one organization requires discipline and different knowledge areas support. This is why, Creative Economy supports the multidisciplinary work, understanding that an intersection knowledge inside a company means an organizational culture that creates added value to the company. This kind of methodologies and strategies are the ones that in a whole package will keep a sustainable development for the country, that's why knowledge and the management of this techniques are vital for the current industry, and consequently the formation of an engineer professional.

5.3. Creative formation

In order to bring an innovative idea, one that can become in a business model economically rentable, is necessary to have the attitude and aptitude from a creative person, or adjusted to a creative matrix, Figure 10. Besides of his own talents, and the knowledge from a technical and professional area, that shows an opening for cultural, heritage, ancestrals and technological knowledge so the opportunities would be endless on innovation terms, without the need to use the same manufacturer processed or traditional services to those who are accustomed most of the professionals This creative attitude allows the person to open a wider point of view, seeing infinite opportunities in order to achieve

innovations that will affect their environment and also will contribute greatly to culture, knowledge and environmental plus be aware, how the innovation triangle indicates, Figure 11.

Figure 10. Creativity matrix ad [27].

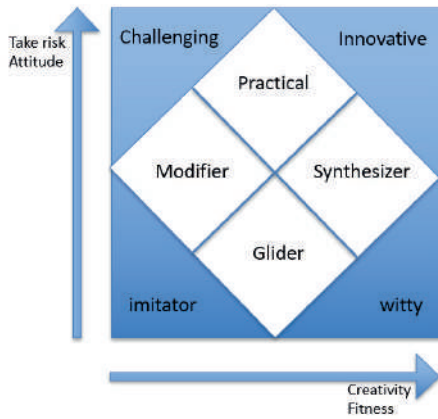
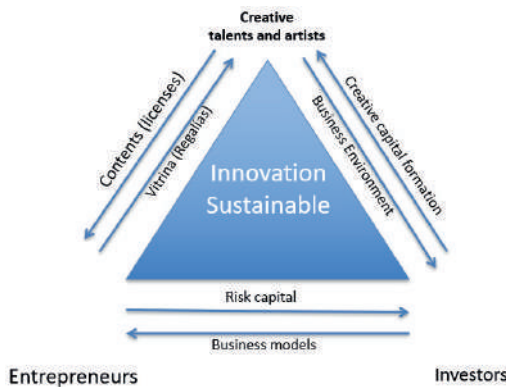


Figure 11. Innovation triangle [9].



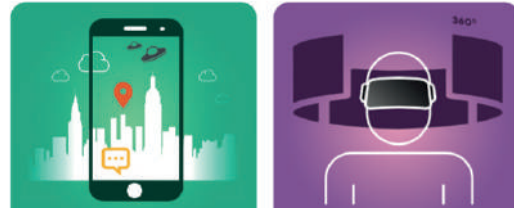
5.4. Emergent Technologies

On the other side, the emergent technological component in this model is expressed in the “Scientific inventions that can create a new manufacture or exploitation of resources shape, even it can transform already known inventions” [28]. The information and communication technologies TICs allow to experience diverse knowledge ranges in all developing area, it is necessary to know them in detail and incorporate them in the curriculums from Production Engineer, like a workshop of innovative alternative proposals in his production way; understanding that is not necessary create, it also can be redesign or reinvent it.

An example is the use of emergent technologies as *virtual reality*, *augmented reality*, and the *mixed*

reality, they propose an innovative way for this knowledge transference using the “stuff internet”, Figure 12.

Figure 12. AR, VR, MR and CI meaning [29].



In line with the exposed, you can find the entrepreneurship project IEC Discovery, which will be explained in detail later, it seeks to reform these processes with daily elements that create added value all together to any organization, starting for the planning of material requirements, where is look to generate a positive impact to the environmental and a considerable cost reduction, until connecting the logistic process to the final assemble product involving the client; so it will optimize the processes through an own method.

5.4.1. Augmented reality

The AR has achieved to develop a new technology that connects different study branches like education, and for industry express the labor training. When you combine the real world with the digital one, the modern companies implement industrial training in real time. These applications have amazing results, since they modify the learning techniques and improve the activity knowledge to do, the company “two Reality” are in charge of coming up with ideas and produce applications for AR it is an example of an organization that is specialized in design and produce applications for AR to enterprises in the industrial area. Selecting the proper technology for the project to develop. [30].

The augmented reality is truly bearing fruits of his application in productive and industrial environments. This technology has shown an effective technique as transference of knowledge tool. This converts it in a invaluable support for training processes for reparation or maintenance. [29].

In consequence, the creative industries are looking for how to make easy the learning systems through AR. It worths to recognize in equipcodes. com the application development allow students to visualize easily information about electronic circuits

for first semesters students. [31]. Besides, it offers diverse applications, since repairing bombs in real time until digital marketing [32]. This kind of applications have several years rounding the social networks, they need to put on practice in educational institutions in order to make easier and contribute to dynamism to the learning process. which can contribute to reduce the index of student desertion in the country.

These informatic programs can be used in formation as in industrial areas, they look to make easier and speed up the tasks in a efficient way, it brings benefits to the company and their teamwork. The production engineering must generate new corporate spaces, that raise business ideas both production area as in any engineering branch. Below, will be shown some examples of Augmented Reality and its potential. Figure 13 to 16:

Figure 13. AR applications for market [33].

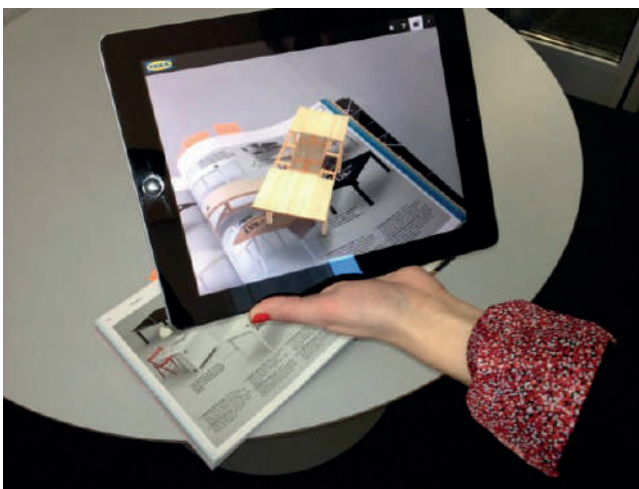


Figure 14. RA for iPhone [34].



Figure 15. RA for smartphones [35].

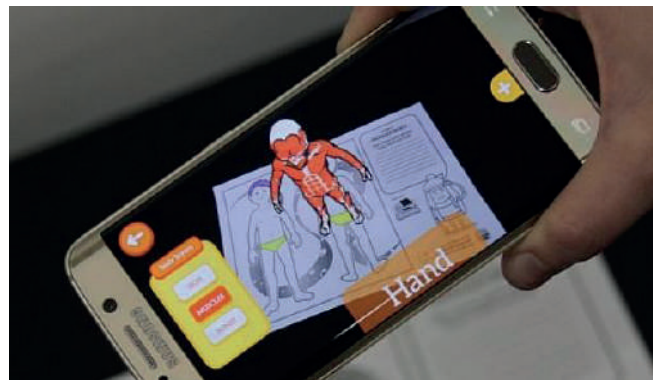
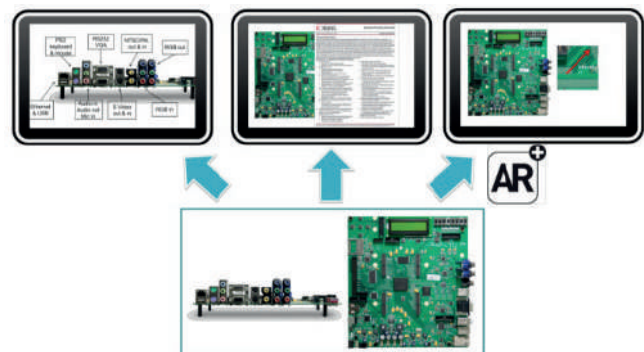


Figure 16. AR interface, electronic plaque [36].



5.4.2. Virtual Reality

Carrying on with the engineering information technology effect in production; is a VR system it is possible to identify software and hardware models joining the peripheral out; all of these combined to generate the immserve experience that it requires, through the hardware is possible to recreate limitless geometrical 3D models and programs for “ sensorial simulation (*visual, hearing, tactile*), besides than physical simulation (Camera virtual movement, collision detector, deformation estimated...)” [37]. The entrance and out peripherals as sensors and providers plus the computer, the geometrical 3D model, the treatment data software and simulation is, until now, the perfect synergyc package to offer endless sensorial experiences with potential to change the way to see the world, Figure 17 to 19.

“Create stages and virtual objects that are close to reality, and joining to our body through glasses that generate a feeling and immersion in the created space or having a closeness of the created object” [38]

Figure 17. 3D model motherboard [38].

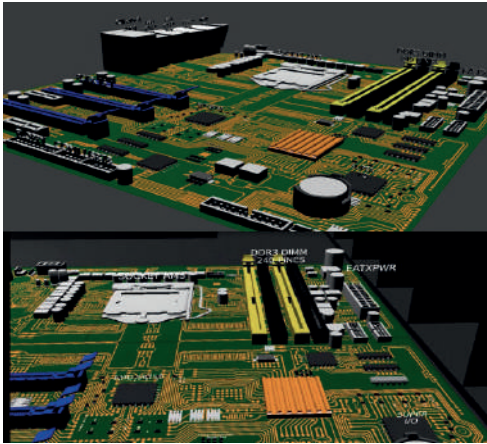


Figure 18. 360° height landscape [39].



Figure 19. VR in depression patients [40].



5.4.3. Mixed reality

The mixed or hybrid reality is the combination of VR and AR. Exists other kinds of informatics programs that seeks up to close the knowledge to thousands of people in the world. Tourists in Italy can access to guided visits to monuments and antique constructions just during summer, the rest of the year these constructions are permanently closed; this is

why El Museo arqueologico de Borriana, for example, has adopted to make these virtual visits through mobile apps [41]. These allow to visitants to be closer to virtual history and know details that in guidance visits can be omitted by accident. Companies like Augmented Reality Software ARSOFT from Spain, offer this kind of apps for different touristic interest points. Figure 20.

Figure 20. MR example for museums [42].



The following are examples for this kind of programs, currently. Figure 21 to 22:

Figure 21. MR Microsoft [43].



Figure 22. ZapBox mobile app⁶ [44].



5.5. IEC Discovery Universo Multisensorial (Digital model production for knowledge)

Under the service provider, the company offers a product that used as tool inside the activities: These VR visors made out of cardboard (One of the company philosophies is “*high technology–low cost*”, this referring to produce technology and resources low cost, through recycled materials such as cardboard), they produce them in mass regarding the demand. This is why IEC Discovery makes a creative convergence between the need to produce their main product and service provision, this one is based on a “preform” production (Visor VR Pre-assembly) in order to finish the assembly and that’s how a product final is obtained through pedagogic activities, “*Build your own space simulator*”, Figure 23, each participant (final client) can finish building his own VR and at the same time assume a creative and evolving experience. This solves a 40% of the productive time and processes and also implies an improvement for the assembly and storage space since the Preform just occupies 6% of space than the product final occupy. These creative productive processes promote the innovation in the way to produce, storage and transport. So, counting with an economic material and involving the final client in the construction of the final product, it reduces significantly the costs in several process parts. [45].

IEC Discovery defines itself as a perfect complement that the educational system needs, since as a communication scientific company uses emergent technology and diverse teaching methods different than the conventional ones, in order to make the learning involving. When they were starting as an entrepreneurship project they had a joyful and didactic approach, such as gaming design and

download apps. After a while the company found a new business opportunity in astronomy –the science of sciences–, was in boom thanks to the internet, and every time more accepted on education.

The astronomy is very useful at the moment of teaching people how works the world and everything that surrounds it. A project was created focus on people, the way to see their environment and the human development, incentivizing to young people to wide their perception of the world and what surrounds it. The principal IEC Discovery goal is to communicate to young people that on their minds is the potential to change the world, insinuating that them could be the next Bill Gates, Steve Jobs or Nelson Mandela, just if they want to.

IEC Discovery is a brand original business idea, appropriately hosted and successful, that also transform minds, promotes the critical and reflexive thinking. Generating employment they contribute to the environment development and at the same time generate utilities. Besides than the wide deployed logistic in all services provided, they use engineering to create their product, (RV visors), designing and programming the mobile apps that they use. IEC Discovery counts on 4 apps to pedagogic usage, developed by their programmer and designers team: “AR Nave”, Figure 24, “Planetario VR”, “Viaje VR” and “Newrona AR”. Each of them offers a new immersive and evolving experience in order to provide new ways to see the world and universe. some of them can be downloaded in Play Store or App store for free.

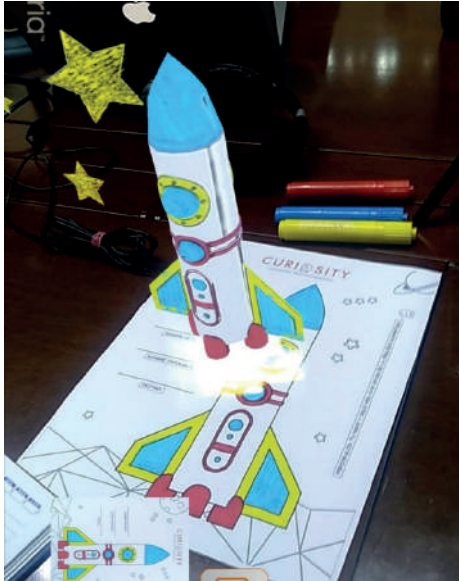
The business model exposed above, allows us to confirm that emergent technologies generate added value to creative industries due to the wide variety

Figure 23. RV visors [45].



of fields where can support different processes, making them ideal and creative. The 3D impression for metals is the quantic jump from materials and AR, they are examples of what these technologies can achieve in the current industry. [46].

Figure 24. Augmented reality [45].



6. Conclusions

Companies like Conceptos Plásticos, with its product besides being friendly with the environment, it generates a high social impact, Mola Sasa, with own designs that allow involving to Aboriginal communities in rentable business that achieve to grow the handicraft value; and IEC Discovery, that keeps to combine emergent technologies and education with an educational special approach, they are business models that highlight the importance of having creative industries in the world that contribute their knowledge in order to increase the movement of a not volatile economy that could become in the *Commodity* (product, merchandising) most strong in Latin America.

These examples are a sample from the variety that Creative economy promote, so, it is important to contemplate the different possibilities that exists outside the social and industrial conventionalism. Wide the Production engineers field action, implies to cross mental barriers and implement the resources and ideas no conventional usages, increasing the creation of companies and business ideas profitable that allow to feed industry using the potential on engineering, the culture, the heritage

and creativity, this way it is possible to create a universe that promotes new possibilities for the coming generations.

The engineering, besides being a promoting engine, contributes to improve the processes and ideas included in every area, even though these branches converge with Culture, the history and art to create atmospheres capable of transform minds and increase the development in different environments. These new atmospheres prompted by this innovatie profession, generate a change in the current economic model and it will spread the gear of the Creative Economy with the Production Engineer, even from pedagogic. Since the engineers developed an industrial mind, they do not count with methods or strategies to manage the creative organizations. However, they do count with the necessary skills to make these creative systems take power in the business environment, since they are in constant search for new knowledge that will cooperate in the perception and problem definition [47]. In order to achieve this, is necessary the Government support since they manage education in Colombia and through diffusers, entrepreneurship projects, programs and incentives that increase the creation of new companies, make more tangible the connection between creativity with engineer, both fields production as multidisciplinary where personal emotions play an essential roll.

According to the point of Observatorio Laboral para la Educación Knowing the opinion of young people that are initiating their professional road it is important since it helps to provide an educational area a light about the response from the advanced education institutions are responding, not just the personal projections from the student but the pertinence of education and the relationship to the productive area. [48].

This means that the educational sector must go hand in hand with the productive sector of the Country, both in Latin America as in the whole world, so it is necessary to include from the basis of education, methodologies to grow talent on young people offering innovative pedagogical models that allow them to contribute to the economy reducing the negative impact on the planet.

Now, it might be that the first change will consist on increasing the demand of people registered in the Engineer programs that the country offers; currently, advanced education institutions in the country offer

Table 1. Latin America universities that offer Production engineer.

Institution	City/ Country
Universidad Distrital Francisco José de Caldas	Bogotá / Colombia
Universidad EAN (Presencial/ Virtual)	Bogotá / Colombia
Universidad EAFIT	Medellín / Colombia
Politécnico Colombiano Jaime Isaza Cadavid	Medellín / Colombia
Universidad del Azuay	Cuenca / Ecuador
Escuela Politécnica Nacional	Quito / Ecuador
Tecnológico de Costa Rica	Cartago / Costa Rica
	Alajuela / Costa Rica
Universidad Privada Boliviana	Colcapirhua / Bolivia
Universidad de la República Uruguay	Montevideo / Uruguay
Escuela Superior de Ingeniería y Gestión de São Paulo (ESEG)	São Paulo / Brasil
Universidad Federal de Río de Janeiro	Rio de Janeiro / Brasil

Source: own.

93 engineer programs, but the demand to study these kinds of careers is pretty low. It expects that for the year in course 1,8000 signature software developers be doubled and the 39,000 employments related to TIC tripled per three, the most notorious fields are the engineers related to agriculture, the technology and electricity. [49]. That is why, is necessary to promote a continue improving in the study plan for engineers, including a cultural approach that will converge economy and industry.

In 2016, students from Federal del Rio de Janeiro University made an analyze from the study plan of the Production engineer, in order to find the knowledge fields that can be developed through organizational creativity. It concluded that leaving core disciplines (calculation, statistics, physics, and others), new disciplines can be implemented in order to have a different approach, that can be promoted through entertaining and being aware that is necessary a major freedom and flexibility in the process, without forgetting that measuring the quality of an intangible product is a pretty complicated process. [50].

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References

- [1] UNESCO, “Comprender las Industrias Creativas. Las estadísticas como apoyo a las políticas públicas”, 2013, [online]. Available: https://issuu.com/euclideshernandez/docs/comprender_las_industrias_creativas
- [2] Organización Mundial de la Propiedad Intelectual, “El motor de la creatividad en la economía creativa: entrevista a John Howkins”, [online]. Available: http://www.wipo.int/sme/es/documents/cr_interview_howkins.html
- [3] The Creative Economy, “The creative economy deals in ideas and money”, [online]. Available: http://www.johnhowkins.com/wordpress/?page_id=9
- [4] UNCTAD, “Según cifras de la UNCTAD, el comercio de productos creativos alcanzó un nuevo máximo en 2011”, 2013, [online]. Available: <http://unctad.org/es/Paginas/Pressrelease.aspx?OriginalVersionID=129>
- [5] División de Expresiones Culturales e Industrias Creativas, UNESCO, “Políticas para la creatividad. Guía para el desarrollo de las industrias culturales y creativas”, 2010[online]. Available: <http://es.unesco.org/creativity/sites/creativity/files/220384s.pdf>
- [6] UNESCO, “Informe sobre la economía creativa. Edición especial 2013. Ampliar los cauces de desarrollo local”, 2013, [online]. Available: <http://www.unesco.org/culture/pdf/creative-economy-report-2013-es.pdf>

- [7] Universia Colombia, “Por qué estudiar Ingeniería de Producción en Colombia”, Agosto 2016, [online]. Available: <http://noticias.universia.net.co/educacion/noticia/2016/08/29/1143075/estudiar-ingenieria-produccion-colombia.html>
- [8] Oxford Living Dictionaries, “Definición de empresa en español”, 2018, [online]. Available: <https://es.oxforddictionaries.com/definicion/empresa>
- [9] F. Buitrago, I.D. Márquez, “La Economía Naranja: Una oportunidad infinita”. Bogotá: Punto Aparte, 2013, pp. 26.
- [10] Popper, K. “El conocimiento de la ignorancia”, 1991, [online]. Available: http://www.medellin.unal.edu.co/~poboyca/documentos/Doc.%20Seminario%20I/EL_CONOCIMIENTO_DE_LA_IGNORANCIA.pdf
- [11] Luzardo, D. De Jesús, M. Pérez, “Economía naranja. Innovaciones que no sabías que eran de América Latina y el Caribe”, 2017, [online]. Available: <https://publications.iadb.org/handle/11319/8330?locale-attribute=es&>
- [12] Revista Dinero, “Firma colombiana recupera el plástico para construir viviendas de bajo costo”, febrero 2017, [online]. Available: <http://www.dinero.com/emprendimiento/articulo/conceptos-plasticos-construye-viviendas-de-bajo-costo-en-colombia/242425>
- [13] E. Medina, El Tiempo, “Colombianos crean casas con ladrillos de plástico reciclado”, febrero 2016, [online]. Available: <http://www.eltiempo.com/archivo/documento/CMS-16488356>
- [14] G.Narvaez, HSBNoticias.com, “La desigualdad social de Colombia”, octubre 2017, [online]. Available: <http://hsbnoticias.com/noticias/opinion/la-desigualdad-social-de-colombia-363560>
- [15] COLCIENCIAS, “Hacia una hoja de ruta Spin–Off. Un camino para la creación de spin-Off universitarias en Colombia”, 2016, [online]. Available: <http://www.spinoffcolombia.org/wp-content/uploads/2016/07/HACIA-UNA-HOJA-DE-RUTA-SPIN-OFF.pdf>
- [16] EKOMURO H2O+, “Quines Somos: Ecofamilia”, 2013, [online]. Available: <http://ekomuroh2o.wixsite.com/ecoh2o>
- [17] M. P. Rubiano, El Espectador, “La familia bogotana que quiere llenar el mundo de agua lluvia”, 2017, [online]. Available: <http://blogs.elespectador.com/actualidad/el-rio/la-familia-bogotana-quiere-llenar-mundo-agua-lluvia>
- [18] Verbenal Sueña, “Proyectos–Quick Win”, 2018, [online]. Available: <http://comunidad.udistrital.edu.co/verbenalsueña/>
- [19] OVACEN Periodismo al detalle, “Cómo hacer una máquina para reciclar plástico”, Agosto 2016, [online]. Available: <https://ovacen.com/como-hacer-una-maquina-para-reciclar-plastico/>
- [20] Precious Plastic, “From Plastic to Plastic Easy”. [online]. Available: <https://preciousplastic.com/en/creations.html>
- [21] R. Pacheco, “Mola Sasa: clutches con espíritu Kuna”, septiembre 2016 [online]. Available: <http://www.lustermagazine.com/mola-sasa-clutches-espiritu-kuna/>
- [22] N. Herrera, “Listado General de Oficios Artesanales”, 1989, [online]. Available: <http://artesaniasdecolombia.com.co/trazaartesanial/documentos/artesanias-colombia-listado-oficios.pdf>
- [23] Siart, “Programa Nacional de Asesorías Puntuales”, [online]. Available: http://www.artesaniasdecolombia.com.co/PortalAC/C_proyectos/programa-nacional-de-asesorias-puntuales_9426
- [24] Siart, “Llega el Cuarto Encuentro Nacional de Economías Propias”. [online]. Available: http://www.artesaniasdecolombia.com.co/PortalAC/C_ferias/llega-el-cuarto-encuentro-nacional-de-economias-propias_11107
- [25] Instituto Internacional Español de Marketing Digital. “Crowdsourcing: qué es crowdsourcing y cómo funciona”, [online]. Available: <https://iiemd.com/crowdsourcing/que-es-crowdsourcing->
- [26] R. García, “Ingeniería concurrente y tecnologías de la información”, 2004. [online]. Available: <http://ingenierias.uanl.mx/22/ingenieriaconcu.PDF7>

- [27] G. Castro, "El concepto de la creatividad", julio 2017. [online]. Available: <https://www.slideshare.net/Giovannycastromz/creatividad-empresarial-78346305>
- [28] F. Arciniega, "¿Qué son las tecnologías emergentes?", 2017, [online]. Available: <http://fernandoarciniega.com/que-son-las-tecnologias-emergentes/>
- [29] Tecnológico de monterrey, "Realidad Aumentada y Virtual", Diciembre 2017, pp.6. [online]. Available: <https://observatorio.itesm.mx/edu-trends-realidad-virtual-y-realidad-aumentada/>
- [30] Two Reality, "Agencia de Realidad Virtual y Aumentada: Expertos en desarrollo de realidad virtual, inmersiva y aumentada". [online]. Available: www.tworeality.com
- [31] F. Verona, "Circuitos electrónicos en Realidad Aumentada", Diciembre 2013, [[online]. Available: <http://blog.arcrowd.com/circuitos-electronicos-en-realidad-aumentada/>
- [32] Soloelectronicos, "Llega la realidad aumentada a los fabricantes de equipos", Noviembre 2013, [online]. Available: <http://soloelectronicos.com/tag/realidad-aumentada-en-electronica/>
- [33] Solutex Informática, "Implementación Realidad Aumentada". [online]. Available: http://www.solutekcolombia.com/servicios_tecnologicos/implementacion/realidad_aumentada.htm
- [34] K. Velázquez, "Apple trabajaría en realidad aumentada", 2017, [online]. Available: <https://marketing4ecommerce.mx/apple-trabajaria-en-realidad-aumentada/>
- [35] Revista Gestión, "Chromville, la realidad aumentada para smartphones", julio 2015. [online]. Available: Disponible en <https://gestion.pe/tecnologia/chromville-realidad-aumentada-smartphones-95305>
- [36] J. Lopez, E. Aetetxe, "Interfaz de Realidad Aumentada como herramienta de ayuda al aprendizaje en el campo de la electrónica", 2013, [online]. Available: https://www.researchgate.net/publication/282150116_Interfaz_de_Realidad_Aumentada_como_herramienta_de_ayuda_al_aprendizaje_en_el_campo_de_la_electronica
- [37] G. Vera, J.A. Ortega, A.B. Gonzalez, "La Realidad Virtual y sus Posibilidades Didácticas", Granada (España), Vol. 2, Diciembre de 2003, pp.3.
- [38] Semillero de Investigación Hardware Libre Grupo de Investigación I+D+T, "Realidad Virtual como Herramienta Didáctica en el Aprendizaje de Tecnologías", Risaralda, pp.1.
- [39] Clarin Buena Vida, "Realidad virtual, una nueva opción para tratar fobias y ansiedades", Abril 2015. [online]. Available: https://www.clarin.com/psico/realidad-virtual-opcion-fobias-ansiedades_0_SJms4WqvXe.html
- [40] Blogthinkbig, "La realidad virtual como terapia para diversos problemas de salud", Marzo 2016, [online]. Available: <https://blogthinkbig.com/la-realidad-virtual-como-terapia-para-diversos-problemas-de-salud>
- [41] Virtualama, "La Realidad Aumentada acerca el patrimonio de Italia al turista". [online]. Available: <http://www.virtualama.com/blog/realidad-aumentada-y-cultura/>
- [42] ARSOFT, "Turismo". [online]. Available: <http://www.arsoft-company.com/realidad-aumentada/turismo/>
- [43] La Vanguardia, "Así funciona la "realidad mixta" de Microsoft", Marzo 2016. [online]. Available: <http://www.lavanguardia.com/tecnologia/20160301/40122967080/microsoft-hololens-realidad-mixta-videos.html>
- [44] Xataka, " ZapBox es la versión económica de las HoloLens: "realidad mixta" al alcance de cualquiera", Noviembre 2016. [online]. Available: <https://www.xataka.com/realidad-virtual-aumentada/zapbox-es-la-version-economica-de-las-hololens-realidad-mixta-al-alcance-de-cualquiera>
- [45] IEC Discovery, "¿Qué es IEC Discovery?" . [online]. Available: <http://iec-edulab.com/>
- [46] E. Winick, "TR:10: Impresión de metales en 3D", 2018. [online]. Available: <https://www.technologyreview.es/s/10021/tr10-impresion-de-metales-en-3d>

- [47] A. Acevedo, C. Linares, “Modelo de conocimiento y creatividad en la ingeniería de procesos. Un enfoque popperiano para desarrollo de productos de la mente humana”. *Producción y Gestión*, pp. 42, octubre 2015.
- [48] Observatorio laboral para la educación, “¿Qué piensan los graduados?”. [online]. Available: <http://www.graduadoscolombia.edu.co/html/1732/w3-article-346742.html>
- [49] T. Lizarazo, “Preocupante déficit de ingenieros en Colombia”, Octubre 2015. [online]. Available: <http://www.eltiempo.com/archivo/documento/CMS-16402298>
- [50] V. Carvalho, G. Bouhid, “Creativity, Production Engineering and entertainment industry”. *Brazilian Journal of Science and Technology*, pp, 10-15, 2016. <https://doi.org/10.1186/s40552-016-0032-5>