
The Potential Impact of 3D Printing Technologies on Travel and Hospitality Industry

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ABSTRACT

Technology is moving so quickly, and in so many directions. Nowadays, the 3D printing technologies is a global trend, and as it evolves, the 3D printing technology is destined to transform almost every major industry, including the travel and hospitality industry and change the way of our life, work, and manage the future. thus tourism stakeholders and policy makers need to identify potentially technologies, and carefully consider their potential, before these technologies begin to impact travel and hospitality industry. This paper aims to examine the potential impacts of 3D technologies on travel & hospitality industry, data were collected through interviews with a sample of tourism stakeholders in Egypt.

Key Words: 3D Printing, 3D Technologies, 3D Digitization, Travel, Hospitality.

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Introduction:

Tourism is recognized to be very intensive towards information. Tourists need information before going on a trip to help them plan and choose between options of travel and hospitality services. In modern societies, time has become an infrequent commodity. Therefore, for many tourists their annual holiday represents a major sentimental investment that cannot easily be replaced if something goes wrong. Therefore, since tourists cannot pre-try the planned services or easily get their money back if the trip does not meet their expectations, access to relevant, accurate, credible, appropriate and timely information is essential to help them make a suitable choice. It is known that the greater the degree of perceived risk in a pre-purchase phase, the greater the consumer tendency to search for information about the travel and hospitality services (Tahayori and Moharrer , 2000).

Over the past ten years, it is evident that one of the main developments within the tourism and hospitality sectors has been the rapid growth in the use of Information and Communication Technology (ICT) (Baggio 2006). Table (1)

Table (1):Top 20 Countries with Highest Number of Internet Users on Nov 30,2015

Country	Population, 2015 Est	Internet Users Latest Data	Penetration (% Population)
China	1,361,512,535	674,000,000	49.5 %
India	1,251,695,584	375,000,000	30.0 %
United States	321,368,864	280,742,532	87.4 %
Brazil	204,259,812	117,653,652	57.6 %
Japan	126,919,659	114,963,827	90.6 %
Russia	146,267,288	103,147,691	70.5 %
Nigeria	181,562,056	92,699,924	51.1 %
Indonesia	255,993,674	78,000,000	30.5 %
Germany	81,174,000	71,727,551	88.4 %
Mexico	121,736,809	60,000,000	49.3 %
United Kingdom	64,767,115	59,333,154	91.6 %
France	66,132,169	55,429,382	83.8 %
Bangladesh	168,957,745	53,941,000	31.9 %
Egypt	88,487,396	48,300,000	54.6 %
Vietnam	94,348,835	47,300,000	50.1 %
Philippines	109,615,913	47,134,843	43.0 %
Iran	81,824,270	46,800,000	57.2 %
Turkey	77,695,904	46,282,850	59.6 %
Korea	49,115,196	45,314,248	92.3 %
Thailand	67,976,405	38,000,000	55.9 %
Top 20 Countries	4,921,411,229	2,455,770,654	49.9 %
Rest of the World	2,338,491,014	910,490,502	38.9 %
Total World Users	7,259,902,243	3,366,261,156	46.4 %

Source: Internet World Stats,2015

One of the main factors of competitiveness tourist markets and strategic tourism management is the Information and Communication Technology (ICT). This technology minimizes transaction and operational costs (Gursoy and McCleary, 2004). Now tourists can gain immediate access to relevant information about destinations throughout the world by Internet, mobile technology and wireless computing, which is greater variety and more in-depth than before (Buhalis and Licata , 2002).

In light of global competition and technological development, It began a three-dimensional printing technology show, in an attempt to satisfy the desires and needs of customers.

History of 3D Technology:

The three-dimensional printers (3D) is a form of additive to manufacturing technology where a three dimensional object is created by laying down successive layers of material. It is also known as rapid prototyping. The 3D Printer is a machine that produces physical 3D models from digital data by printing layer by layer, either designed by a CAD program or scanned by a 3D Scanner (Gaurav, 2013).

The inception of 3D printing can be traced back to the year of 1976 by using the inkjet printer. printing developed from printing with ink to printing with materials. In the decades since, a variety of applications of 3D printing technology have been developed. the following table (2) provides a brief history of the major milestones along the way of 3D printing technology.

Table (2): A brief history of the major milestones of 3D printing technology

Year	Phase
1992	Building Parts, Layer by Layer. The first SLA (stereolithographic apparatus) machine.
1999	Engineered organs bring new advances to medicine. The first lab-grown organ is implanted in humans.
2002	A working 3D Kidney
2005	Open-source collaboration with 3D Printing.
2006	SLS leads to mass customization in Manufacturing. The first SLS (selective laser sintering) machine.
2008	The first self-replicating printer. Diy co-creation service launches. Major breakthrough for prosthetics.
2009	DIY KITS for 3D Printers enter the marketplace.
2011	World's first 3D-Printed Robotic Aircraft. World's first 3D-Printed Car.

Collected by the authors.

3D printing could proliferate rapidly over the coming decade. Sales of personal 3D printers grew by 200 to 400 percent every year between 2007 and 2011 and it's estimated that 3D printing could generate economic impact of \$230 to \$550 billion per year by 2025 in the world. McKinsey Global Institute (2013) sorted and identified 12 technology areas with the potential for massive impact on how people live and work, and on industries and economies (Baggio, 2006). figure (1):

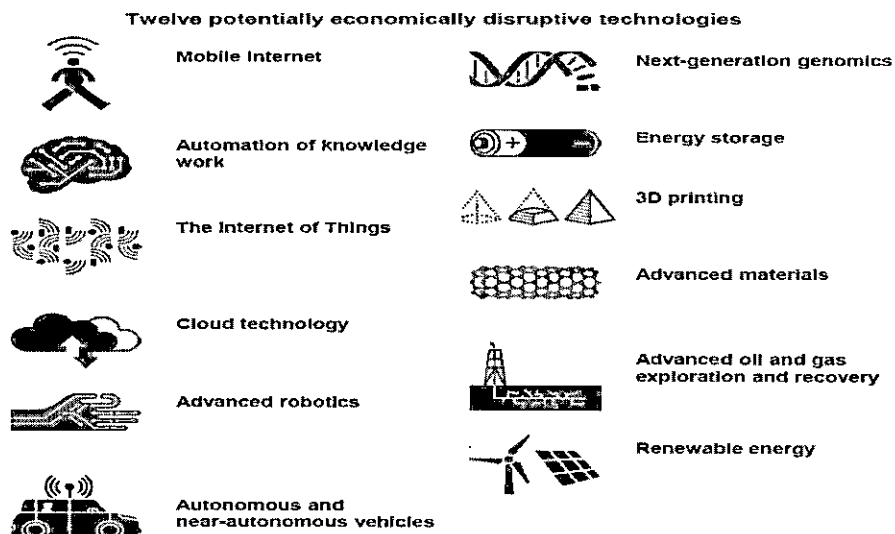


Figure (1): Twelve Potentially Economically Disruptive Technologies

Source: McKinsey Global Institute analysis, 2013.

3D Printing and Tourism and Hospitality Industry:

The travel and tourism sector is as insecure as any other to the forces of change that are being brought about by ongoing developments in the Information and Communication Technologies (ICT) field (Buhalis, 2002). In March 2014, Airbus and China's North Western Polytechnical University (NPU) have signed a cooperation agreement on exploring ways to further apply 3D printing technology in the commercial aviation sector in its next-generation A350 XWB. Airbus found their 3D printed parts weigh 30% to 55% less and use by 90% less material than their traditional counterparts, thereby significantly decreasing the energy consumption of the manufacturing process, needless mention making planes themselves lighter and decreasing fuel consumption (Air Bus, 2015). A traveler might simply board the flight without any luggage – and just buy all of the items on the cheap after arriving or just print his/her needed items (Gheorghe, 2014).

3D technology will change the hospitality industry, whereas the key to success in the hotel business lies in providing in a unique guest experience as the world's middle classes explode (Mc Aveyty, 2013). According to the Wall Street Journal (2015) 3D can provide hotels with compulsory sales tools, for example, hotel marketing can use 3D image in the advertising that will be more creative and commercial, through the top down views, which can be shown to customers through hotels booking. Actually 3D printing can achieve what hotels planners needs typically from the point of customers view such as the shape of building ; rooms and furniture . More than 3D models can be

updated again and again. Porter et al. (2015) asserted that one of the most 3D printing applications in hotels is the food industry. Which are known as additive manufacturing (AM), that still in the premature steps (Munoz et al., 2013) . Although food manufacturers have taken steps in this direction with- real world applications, inventors and manufacturers have experimented with printing food which is evolution in the technology of (AM) technique (Porter et al., 2015).

This technology helped hotels to convert entire production lines to printing most of what customers need and desire (Porter et al., 2015). Also (Wegrzyn et al., 2012) pointed out other benefit as , food 3 D printing include product differentiation . product customization, direct to – consumer relationships and creation of unique food formulations for dietary needs. The same applies to customized medical nutritional supplements and food waste reduction (Cotteleer et al., 2014).

Porter et al. (2015) indicated that there are two types for printing food , the direct printing and mold printing. The direct printing involves growing an object layer by layer through extrusion or binder jetting. While mold printing involves making a mold from different materials, then using it as a cast for the actual material. Direct printing methods considered as one of the most common (AM) process (Porter et al., 2015).

In the two methods hotels manufacture uses edible materials that allow the food makers to explore the customization of their mass produced "commoditized products" (Wegrzyn et al.,2012 and Munoz et al.,2013). Also Cotteleer et al. (2014) noted print food needs to applications, balancing standard of customization, capital requirements and precision, while Porter et al. (2015) added that the choice of (AM) technology relies on standards: quantity, time, cons taints, material, nature of materials, items which require varied materials and the different vast number of food.

Finally, if a company is trying to improve its competitiveness with little risk and limited change, AM can play an important role in addressing the speed and profit ability of its current operational model (Cotteleer and Joyce, 2012).

Methodology:

A quantitative research method was adopted in this study. So the data from this study were quantitatively analyzed. Quantitative data were analyzed with the aid of Statistical Package for Social Sciences (SPSS) version 17 and Excel Spread Sheet in Office 2007. Data were collected through tourism stakeholders(Tour operators and Hotels) in Egypt. A random sample of 56 of tourism and hotels stakeholders in Egypt were chosen for the interview. A questionnaire was designed for the purpose of achieving the research objectives. A questionnaire conducted based upon the Likert's 5-item scale. Questions were prepared to examine the attitudes (Point of View) of tourism stakeholders (Tour Operators and Hotels) towards the potential value and role of 3D Printing Technology in tourism and hospitality industry. The respondents were asked to answer on each item that was measured by a 5-point Likert scale ranging from 1= Strongly Disagree to 5 = Strongly Agree, and this questions will be analyzed using descriptive statistic.

Analysis and Results:**Attitudes of Tourism Stakeholders towards 3D Printing Technology in tourism and hospitality industry:****A- The attitudes of Tourism Stakeholders towards 3D Printing Technology in tourism and hospitality industry:**

This section of the research attempts to measure the attitudes of tourism stakeholders (Tour Operators and Hotels) in Egypt towards the value that could be derive from the usage of 3D Printing Technology in tourism and hospitality industry. The following table (3) shows the main variables that were used as indicators for the attitudes of tourism stakeholders towards 3D Printing Technology in tourism and hospitality industry.

Table (3) Variables of 3D Printing Technology role and value in tourism and hospitality industry:

Variables	Symbol
1- Reduce the cost of the aircraft industry.	X1
2- Reduce Time of flying.	X2
3- Decrease fuel consumption of means of transport.	X3
4- Provide new sources of employment.	X4
5- Reduce The Operational Costs.	X5
6- Protect of monuments and historical sites.	X6
7- Enhance the Firm's Potential of Value Creation.	X7
8- Reduce the cost of building hotels.	X8
9- Reduce the cost of meals in hotels.	X9
10- Reduce wastage of food at hotels.	X10
11- Convert entire production lines of hotels.	X11
12- Rapid rate of change in capabilities in terms of price.	X12
13- Rapid rate of change in capabilities in terms of performance.	X13
14- Recreate the world famous site with as much precision as possible.	X14
15- Improve productivity.	X15

B- Fitness of the chosen variables:

For measuring the appropriateness of the fifteen variables that were proposed to measure attitudes (Point of View) of tourism stakeholders (Tour Operators and Hotels) towards 3D Printing Technology in tourism and hospitality industry, T. Test, Std. Deviation and Mean Difference with %96 confidence interval of the difference were used as explained in table (4).

Table (4) : Statistical Characteristics and One-Sample Test

Measures	T	df	Sig. (2-tailed)	Std. Deviation	Mean Difference	%96 Confidence Interval of the Difference	
						Lower	Upper
X1	93,204	56	0.000	0,47	4,11	4,03	4,20
X2	60,106	56	0.000	0,68	3,80	3,67	3,93
X3	93,204	56	0.000	0,47	4,11	4,03	4,20
X4	86,831	56	0.000	0,58	4,66	4,55	4,77
X5	86,831	56	0.000	0,58	4,66	4,55	4,77
X6	86,831	56	0.000	0,58	4,66	4,55	4,77
X7	60,106	56	0.000	0,68	3,80	3,67	3,93
X8	93,204	56	0.000	0,47	4,11	4,03	4,20
X9	93,204	56	0.000	0,47	4,11	4,03	4,20
X10	60,106	56	0.000	0,68	3,80	3,67	3,93
X11	86,831	56	0.000	0,58	4,66	4,55	4,77
X12	86,831	56	0.000	0,58	4,66	4,55	4,77
X13	60,106	56	0.000	0,68	3,80	3,67	3,93
X14	86,831	56	0.000	0,58	4,66	4,55	4,77
X15	93,204	56	0.000	0,47	4,11	4,03	4,20

Likert Scale (1 to 5), Starting with “1” = Strongly disagree to “5” = Strongly agree.

Depending on table (4) results t. Sig. (2-tailed) equals $0,000 < 0,005$. Standard deviation of mean ranges from 0,47 to 0,68 which means that it's small and majority of mean differences range from 3,80 to 4,66 which means that most of variables of the attitudes of tourism stakeholders are far away from the scale of Strongly Disagree and near to the scale Strongly agree.

C- Distribution of frequency of Tourism stakeholders' attitudes:

Table (5) presents the attitudes (Point of View) of tourism stakeholders (Tour Operators and Hotels) towards 3D Printing Technology in tourism and hospitality industry in Egypt.

Table (5):Tourism stakeholders' attitudes measures distribution

Measures	1		2		3		4		5	
	No	%	No	%	No	%	No	%	No	%
X1			1	1,8	41	73,2	12	21,4	2	3,6
X2	3	5,3	1	1,8	45	80,4	4	7,1	3	5,4
X3			1	1,8	41	73,2	12	21,4	2	3,6
X4			1	1,8	25	44,6			30	53,6
X5			1	1,8	25	44,6			30	53,6
X6			1	1,8	25	44,6			30	53,6
X7	3	5,3	1	1,8	45	80,4	4	7,1	3	5,4
X8			1	1,8	41	73,2	12	21,4	2	3,6
X9			1	1,8	41	73,2	12	21,4	2	3,6
X10	3	5,3	1	1,8	45	80,4	4	7,1	3	5,4
X11			1	1,8	25	44,6			30	53,6
X12			1	1,8	25	44,6			30	53,6
X13	3	5,3	1	1,8	45	80,4	4	7,1	3	5,4
X14			1	1,8	25	44,6			30	53,6
X15			1	1,8	41	73,2	12	21,4	2	3,6
Average of Attitudes %	---	1,4	---	1,8	---	63,8	---	9	---	24

Likert Scale (1 to 5), Starting with "1" = Strongly disagree to "5" = Strongly agree.

According to this table (4), Tourism stakeholders in Egypt have positive attitudes towards 3D Printing Technology in tourism and hospitality industry in Egypt. The average of attitudes is %63,8 in the scale of agree.

D- The general impression of Key stakeholders about 3D Printing Technology in tourism and hospitality industry in Egypt:

Respondents were asked with close-ended question to determine their general impression about the value and role of 3D Printing Technology in tourism and hospitality industry in Egypt. They were asked to choose one choice of the choices (Poor, Fair, Good, Very Good OR Excellent), and their answers were analyzed using descriptive statistic. Figure (2) shows the descriptive statistic analysis

for the general impression of tourism Key stakeholders about value and role of 3D Printing Technology in tourism and hospitality industry in Egypt.

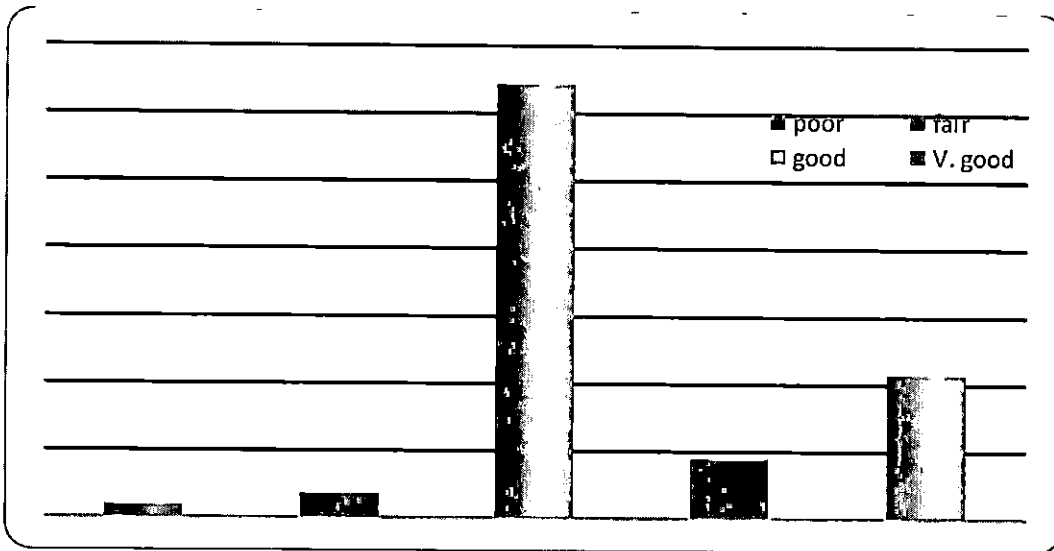


Figure (2):General impression of Key stakeholders about Value and role of 3D Printing Technology in tourism and hospitality industry in Egypt

According to the figure %64,3 of tourism key stakeholders have impression about the value and role of 3D Printing Technology in tourism and hospitality industry in Egypt in the scale of good, %8.9 in the scale of Very Good and %21.4 in the scale of excellent which show that the majority of tourism key stakeholders in Egypt do believe in the value and role of 3D Printing Technology in tourism and hospitality industry in Egypt.

Conclusion:

Tourism stakeholders (Tour Operators and Hotels) attitudes towards the potential value and role of 3D Printing Technology in tourism and hospitality industry in Egypt have been examined, and Likert scale analysis explains that Tourism stakeholders have strong positive attitudes towards the potential value and role of 3D Printing Technology in tourism and hospitality industry in Egypt, the average of the attitudes is %63,8 in the scale of agree.

Modern aircraft will use some parts of its components from 3D printed parts, to reduce the cost of the industry, energy consumption of the manufacturing process, to make planes lighter and decrease fuel consumption, and thereby reduce the transportation cost.

Preservation for the leading tourist attractions in the world, by printing a 3D Model to accommodate Increasing numbers of visitors, which preserves the original monuments.

In the hotels sector 3D will Reduce the cost of building; construction time; the cost of meals in hotels and wastage of food .

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الآثار المحتملة لتقنيات الطباعة ثلاثية الأبعاد في صناعة السفر والضيافة

ملخص البحث

تتحرك التكنولوجيا بسرعة في العديد من الاتجاهات. ففي وقتنا الحاضر، أصبحت تقنيات الطباعة ثلاثية الأبعاد إتجاهها عالمياً، ومع تطورها، تتجه تكنولوجيا الطباعة ثلاثية الأبعاد لإحداث تحويل محوري في كل صناعة رئيسية تقريباً، بما في ذلك صناعة السفر وتغيير طريقة الحياة، والعمل، وإدارة المستقبل. وبالتالي فإن أصحاب المصلحة في صناعة السياحة وصانعي السياسات السياحية بحاجة إلى تحديد التكنولوجيات المحتملة، والنظر بعناية إلى إمكاناتهم المتاحة، قبل أن تبدأ هذه التقنيات الحديثة في التأثير في صناعة السفر والضيافة. ويهدف هذا البحث إلى دراسة الآثار المحتملة لتقنيات الطباعة ثلاثية الأبعاد في صناعة السفر والضيافة. تم جمع البيانات من خلال مقابلة مع عينة من المستخدمين من صناعة السياحة والفنادق في مصر وتحليلها كميًا باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) لتحقيق هدف البحث.