

General Assessment of Industry 4.0 Awareness in South India—A Precondition for Efficient Organization Models?

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11.1 Introduction

As a consequence of business and social evolution during recent years, several topics emerged and gained tremendous attention. Megatrends such as climate change, globalization, technological progress, demographics' dynamics, or mass customization are undoubtedly challenging for society. In reaction to the very volatile and complex business environment, various strategic initiatives took place all over the world, for example, Germany's "High Tech Strategy 2020", "Made in China 2025"

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or the USA's "Industrial Internet Consortium" (Ramsauer 2013), to keep pace with exponential technological development and reach sustainable growth. These concepts aim to develop and implement modern strategies (Industry 4.0) to achieve higher effectiveness, competitiveness, sustainability, and to produce higher value-added (Kiel et al. 2016) with emphasis on minimizing the negative impact on the environment. To add on, extensive possibilities covered by Industry 4.0 could improve enterprises' costs management (Lasi et al. 2014; Posada et al. 2015; Calero Valdez et al. 2015). We consider, among many others, Industry 4.0 as crucial from both the social and manufacturing sector's point of view in the foreseeable future. However, as Hofmann and Rüsch (2017) stated, "the concept of Industry 4.0 still lacks a clear understanding". Such unclear interpretations and misunderstandings could be even more pronounced in emerging economies lacking proper educational and informational level, which could lead to even wider discrepancies between developed and emerging economies' business and social environment.

Conducted research presented in this chapter aims to estimate and analyse informational base and general awareness about Industry 4.0 in the area of South India. Authors argue that sufficient knowledge is an important presumption for the successful development of an effective organization and network models in the future environment, especially from a SMEs perspective. We find papers among the literature using questionnaire-based surveys, addressing mostly readiness of industries or SMEs to Industry 4.0. However, there is a lack of literature covering the informational level, attitudes, and expectations of potential employees, in general, the same as within the examined region. This chapter concerns

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the important perspective of inhabitants as potential workers regarding Industry 4.0 in less developed regions, which goes hand in hand with the development of effective strategy from an employers' perspective. Main motivation for such research stems from the lack of existing literature examining such perspectives. We argue that potential workers' attitudes represent the key aspects regarding transformation towards innovative future technologies, while recent studies are mainly oriented on SMEs, not their backbones-employees. The objective of presented research is to determine the state of art of general awareness and expectations in mentioned region, which could help employers and policy makers to conduct proper policies in order to prepare students and potential workforce to Industry 4.0 environment. The questionnaire was created using information from previous industry visits and consultations with entrepreneurs, students, and employers in the mentioned region. Issues expressed by respondents are summarized and the most attention-dragging findings are highlighted.

The chapter is further organized as follows: Sect. 11.2 provides a literature background, Sect. 11.3 describes problems concerned, where issues necessary for further research are stated. Section 11.4 provides a methodology description, while in Sect. 11.5 we present obtained results. Section 11.6 concludes.

11.2 Literature Review

Over the past years, we faced a strong advance of technology among almost all sectors. New business propositions and applications within the business systems were enabled given the new technologies. As Thestrup et al. (2006) stated, the collection and management of both physical and virtual data gathered from users, sensors, or devices, emerged. So-called Internet of Things—IoT (Brock 2001, firstly used the term IoT) then means worldwide network of such objects communicating and operating through standardized communication protocols. However, IoT became recognized after the ITU1 report (ITU 2005), describing IoT as the ability to connect everyday objects, meaning that both people will be able to communicate with objects, the same as objects will be able to communicate among themselves. The prerequisite to such communication is advanced wireless technology (identification technologies and sensors). Logically, IoT can be diversified to Industrial IoT and Commercial IoT, while I4.0 expects all those parts to be interconnected and communicating.

To simplify, the goal of IoT infrastructure, as an essential part of Industry 4.0, is to enable participants (people and objects) to be more flexible, to react appropriately and autonomously, thanks to the information sharing network. Harbor Research (2011) suggests, that two major strands of technological development emerged at the beginning of the twenty-first century; first is mentioned IoT and secondly, "Internet of People" (IoP or social networking). These interconnected devices, processes, machines, products, etc., will have a significant impact on the enterprise's life cycle, efficiency, functioning, and consequently to the broader economy (Safar et al. 2018).

To conclude, Sundmaeker et al. (2010) define the IoT as an integrated part of "Future Internet", or a "dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual 'things' have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network". Internet of Things is already partially adopted by households, with the aim of creating a "smart house", even though not every gadget is appropriately connectable yet (Cui 2016). The same problem can be observed among enterprises, especially SMEs. It is assumed that the main obstacle becoming "smart" both for households and industries will be funding, along with insufficient education and knowledge (Safar et al. 2018).

Such interconnected objects and subjects are just prerequisites for the so-called 4th industrial revolution, where cyber and physical levels should merge (Lasi et al. 2014). The term Industry 4.0 points to the 4th industrial revolution and was first presented on Hannover-Messe (one of the biggest international trade fairs oriented on new and smart technologies) in 2011, while it also indicates initiative of German government to improve the environment in manufacturing sector using new technologies (information about the concept were brought up in 2014 at the World Economic Forum in Davos) (Standhagen et al. 2017). According

to BITKOM (Germany's digital association, founded in 1999 as a merger of individual industry associations in Berlin, representing more than 2,500 companies in the digital economy, among them 1,000 SMEs all 400 start-ups), the 4th industrial revolution will allow control over the entire life cycle of the product and value stream, therefore redefine organization entirely. concerning efficiency-oriented on cost-savings and complexity reduction, Modrak and Bednar (2015) conclude that the 14.0 environment will initiate mass customization mainly because of the ability of each entity throughout the value stream to communicate and identify itself. All of these visions and concepts are meant to be environmentally, economically, but mainly socially sustainable. Leaving now a technical standpoint, we emphasize non-technical aspects of proposed changes within the industries. Such transformation should bring new organization models, that should reflect both business perspective and state of mind of potential customers and workers.

As Slusarczyk (2018) suggests, the 4th industrial revolution differs from previous revolutions, because it will apply to all aspects of everyday lives, as a consequence of the environment, where information will be exchanged between objects, between people, and between people and objects. In other words, based on real-time data exchange and horizontal and vertical integration of production systems are the main pillars of I4.0 (Thoben et al. 2017), along with cybersecurity, autonomous systems, the capability of analysing large data sets, virtual reality, and cloud computing. Undoubtedly, such changes would require managerial decisions firstly, due to inevitable initial costs linked to such new technological equipment. Schröder et al. (2015) leave the open question, whether it is even worth to implement I4.0, especially for SMEs, despite the consensus we find among authors describing reduced costs and more efficient processes and the environment as a consequence of I4.0. We argue that such dynamics within the industries should be examined deeply, and various elements of sustainable development, not only economic point of view should be evaluated (Kovacs 2018; Eberhard et al. 2017). The opposite of mentioned cost-saving and costreducing is initial need for significant financial expenditures, that are on many occasions out of reach for companies, especially SMEs (Soltes and Gavurova 2014). Either way, to move on with such disruptive changes is conditional by the development of adaptable network and organization models. Secondly, we argue that proper informational basis of the knowledge, attitudes and expectations of inhabitants, mainly potential workforce, is inevitable for such managerial decisions, while existing literature addressing mentioned issue is rather scarce.

Another very important social aspect of such a smart environment is how intelligent machines will affect the labour market (Eberhard et al. 2017; Dallasega et al. 2019, 2020; Woschank et al. 2020). This topic can be being examined from two perspectives, firstly by describing requirements towards workers in I4.0 (Eberhard et al. 2017; Dallasega et al. 2020; Safar et al. 2020), secondly by examining the standpoint of workers and their outlook or current state of mind (Eberhard et al. 2017; Wolter et al. 2015). We argue, that unless a reasonable level of awareness and basic knowledge of Industry 4.0 related concepts and inevitable parts is reached, it will be hard to successfully move towards a smart environment, especially in the case of less developed regions. Insufficient information base of eligible workforce represents an obstacle for potential employers oriented towards I4.0. Inadequate information and knowledge could also lead potential employees towards wrong or misjudged conclusions or attitudes. Probably the most crowded thought is that bringing in the intelligent machines would steal jobs, again, especially in less developed regions with the less qualified, manually involved workforce. Consequently, lack of sympathy towards any modernization steps could hold potential progress off-according to Statista (2019), countries without any problems with unemployment (e.g. Germany, USA, Japan) report the highest numbers of installed industrial robots per 10,000 employees. Again, wrong or insufficient knowledge of workers could lead to negative acceptance of incoming transformation towards Industry 4.0, while we still have no sufficient evidence about state of art of this problem, especially in emerging countries. To add on, as Ramingwong and Manopiniwes (2019) put it, investments in R&D go hand in hand with well informed and educated employers and consequently impact the organization models.

11.3 Problem Description

The emerging economies should leverage their advantages, such as huge markets, attractive conditions for manufacturing, fast-growing economies, and a mainly larger labour force with more favourable demography (Iyer 2018). Admitting that Industry 4.0 will primarily affect the manufacturing sector, we face significant discrepancies among countries and regions. Despite the estimate that India will be the world's fastest-growing economy in following years (World Bank 2018) within the manufacturing sector that could hit 1 trillion US\$ in 2025 (IMR 2020), we doubt the ability of successful transformation towards Industry 4.0, hence, we find India and its regions important to examine to 4th industrial revolution (Chandran et al. 2019). For example, having Germany-technology and manufacturing leader, however with an ageing population and lack of labour force; and on the other hand, emerging country as India-suffering from technological gaps, which put India to a level of Industry 2.0 as Iyer (2018) concludes, on the contrary, with strong demography.

There is also the political will to spur manufacturing sector, translated into initiatives such as "Digital India" (Goswami 2016), "Skill India" (2020), or "Make in India", with aims to (among others) create sufficient skill sets within the urban poor and rural migrants for inclusive growth, or to increase technological depth in manufacturing to increase domestic value addition. In addition, there is mentioned demographic factor—India has the best demographic dynamics, with approximately 60% of the population age between 15 and 59 (Directorate of Intelligence 2019). Open question remains, are citizens and workers ready for such development in the foreseeable future? Are they ready for emerging organization models within businesses?

We accept, that within such huge country significant disparities among particular regions exist, hence we applied our research only in Southern part of India (authors were physically present in the state of Tamil Nadu during data collection). South Indian region includes several states and union territories (Kerala, Andaman and Nicobar Islands, Tamil Nadu, Pondicherry, Andhra Pradesh, Karnataka, Telangana, Lakshadweep Islands), which in combined counts for 19.31% of the geographical area of the whole India. With over 250 million people, South India represents around 20% of the country's population (Census 2011). As of 2016, the economic growth of South India was around 17%, compared to 8% growth of whole India, while the GDP of South India accounted for 30% of total Indian's GDP. Some specific industries are even more important from overall perspectives, such as cotton production (48% of India's entire cotton production comes from South India) or agricultural production (36% of whole state's production comes from South India).

Same as for other countries and regions, main employers are SMEs. Unfortunately, as Iyer (2018) states for India's industrial policy in general, it is old, and in lack of critical technology. Many enterprises in this area are old and have long-lasting tradition-especially for those the transformation lies upon the success of new network and organization models. Despite the established reputation and customers created, they are equipped with insufficient and old devices or machines. Internet access and computer equipment within industries in this region are also rather poor. Since the majority of the research has been conducted in the field of needed modernization, especially concerning the SMEs to successfully transform towards Industry 4.0, we would rather point at the necessity of having potential labour force ready for such transformation. It is therefore considered that awareness of I4.0 needs to be continuously expanded and promoted, as confirmed by several authors (Safar et al. 2018; Matt and Rauch 2020; Burgess 2002; Kagermann 2015). Even if obtaining new machines and gadgets would be economically viable, will there be enough sufficiently educated workers or customers? Throughout the literature we find papers addressing similar problems within different regions, f.i. concluding that qualified specialists are often not satisfied with the salary, which causes their outflow in favour of richer economic regions, leaving almost no people able to operate such modern machines (Ingaldi and Ulewicz 2020). We argue, that unless some basic level of knowledge regarding addressed issues is reached within the population, the ability to become competitive in an Industry 4.0 environment is rather limited.

11.4 Methodology

The research was conducted in the area of South India, where industries operate in several segments, with a majority representation of SMEs. This survey-based study aims to examine the level of awareness and general consciousness of Industry 4.0 among South Indian students, workers, entrepreneurs, in other words, a broad spectrum of citizens. We expect that proper analysis of gathered responses could provide us with unique and valuable knowledge of the current state of mind of local citizens, along with their current level of internet/connection requiring gadgets/platforms, and further serve as a guide for finding a suitable implementing strategy for new technologies in such areas.

Results presented in this chapter concern opinions and knowledge of inhabitants living, studying, working, or doing business in the previously described area (Table 11.1). For obtaining responses, a questionnaire was used, and data collection took place from December 2019 to

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Profile	Ν	%	Profile	Ν	%
Gender			Age		
Female	147	26.1	25 or below	466	82.6
Male	417	73.9	26–35	57	10.1
			36–45	24	4.3
Status			46 and more	17	3.0
Student	438	77.7			
Employed and Entrepreneur	105	18.6	Residential place		
Houseperson and Retired	7	1.2	Andaman and Nicobar Islands [*]	12	2.1
Unemployed	14	2.5	Andhra Pradesh	6	1.1
			Karnataka	10	1.8
Education			Kerala	14	2.5
Higher Secondary and below	181	32.1	Lakshadweep Islands*	4	0.7
Bachelor	256	45.4	Pondicherry [*]	9	1.6
Master	67	11.9	Tamil Nadu	507	89.9
Doctorate, Medical, Law degree or higher	60	10.6	Telangana	2	0.4

Table 11.1 Profile of respondents

Adapted from Safar et al. (2020) Note *Union territory February 2020. As advised by several authors (Schwarz and Hippler 1987; Schuman et al. 1981), we used fixed-choice questions, to maintain time efficiency and difficulty of evaluation. The questionnaire was distributed within several traceable ways during the stay of authors in Tamil Nadu. The sample contains 564 unique responses (after removing incomplete and inappropriately filled responses—respondents' answers were checked to confirm all required questions had been answered in a prescribed manner). Respondents were notified in advance that providing answers to this questionnaire are anonymous. All answers provided will serve only for research purposes, and no personal details will be required or stored.

We divided the questionnaire into four main parts (Fig. 11.1). In the first part, we focused on the social status of the respondent, education, and the place where the respondent currently works, studies, or stays. In the second part, we were interested in respondents' basic internet communication and usage of social communication applications. In the third and main part, we looked at the awareness of Industry 4.0 in general among respondents. We asked about key terms such as cloud solutions, mass customization, Internet of Things, Industry 4.0, smart manufacturing, smart cities, etc. In the fourth part, we intended to examine what the I4.0 could bring to the south Indian region from the responders' perspective.

Several scales were used due to the substance of the question (full text of the questionnaire and scales of answers is provided in Appendix A). Questions addressing previous experience and general awareness about key terms were scaled binomially (*yes/no*). Other questions addressing



Fig. 11.1 Stages of survey (Adapted from Safar et al. [2020])

south India region were scaled as of 5 levels: "not at all important/no"—1; "slightly important/rather no"—2; "no opinion" (due to lack of information/knowledge, referring also to "I do not know")—3; "fairly important/rather yes"—4; "very important/yes"—5. Supplementary questions regarding usage of social media, email, or e-commerce had specific scales examining the frequency of usage.

To analyse responds, we used tables of counts and percentages for the joint distribution of two (severe combinations) categorical variables. We used custom and contingency tables, statistical testing, and generated bar graphs for easier data presentation. Pearson's chi-square test was performed to test the independence between the row and column variables. Pearson's chi-square test requires a large sample. The main rule regarding the sample size is that not more than 20% of expected cells should be less than 5 and none of the expected cells should be less than 1 (Agresti and Kateri 2011; Armitage et al. 2008). If the relationship was significant, consequently we used z-test to compare the proportion of column pairs to each other (adjusted by Bonferroni correction) according to the social variables and variables reported by Industry 4.0 areas. For 2×2 tables, we used Fisher's Exact test. The column proportions test shows whether the ratio in one column is significantly different from the ratio in the other column. The test assigns a letter key (A, B, C) to each category reported in column variables. The definition of each comparison of column proportions is discussed in the following section. All statistical outputs were processed in the IBM SPSS Statistics v25.0.

Further, we will concentrate on presenting the most attention dragging outcomes and dependencies from responses, which were statistically proven as significant.

11.5 Results and Discussion

In order not to confuse respondents and avoid misinterpretations, we provided short descriptions of possibly unknown terms related to our scope (presented in Appendix A). The questionnaire, in its actual form, is composed by thirty-four questions divided into four main areas, mentioned above.

11.5.1 General Awareness, Age and Education

Firstly, we asked our respondents, if they ever heard about key terms related to the 4th industrial revolution. As presented in Fig. 11.2, the term "mass customization" is not known by almost 60% of respondents, while, which is more important, the term "Industry 4.0" is unknown to 49.6% of respondents. Rather than focusing only on simple percentage points-presentations of answers observed, we examined and focused mainly on dependencies between key answers on a statistically significant basis, as presented further in this chapter.

Before examining key aspects of this survey, we took the first step examining dependence between age, education, and such awareness. In all tables below the Chi-square statistic (χ^2) and the *p*-value is presented for each row question, as an inevitable assumption for further column proportions comparison. χ^2 refers to Pearson's Chi-square statistic value, obtained by the Chi-square test in SPSS, which tests the hypothesis that two variables (row and column) are independent. *p*-value refers to the significance value, which has the information we are looking for. The lower the *p*-value, the less likely it is that two variables are unrelated.



Fig. 11.2 Awareness in general regarding I4.0 related terms (Adapted from Safar et al. [2020])

When the significance value is less than 0.05, we can conclude that there is a relationship between two variables. To understand the relationship between row and column variables we examine the crosstabulation tables with results of the column proportions tests. As we mentioned in the previous section, the column proportions test shows whether the proportion in one column is significantly different from the proportion in the other column. The test assigns a letter key (A, B, C) to each category reported in column variables. We used three significance levels: 0.05^{*}; 0.01^{**}; 0.001^{***}. Column proportion tests are performed by z-test and tests are adjusted for all pairwise comparisons within a row of each innermost sub-table using the Bonferroni correction (see Sedgwick 2012). Below we provide Table 11.2, where the statistically significant relationship between answers "No" to above-mentioned general awareness questions and education "Upper Secondary and lower" can be observed. We find this in line with basic logic that ongoing and deeper education opens possibilities and provides information about new approaches and cutting-edge trends. Similarly, we find a logical relationship within our answers, that higher education (Doctorate, Medical or Law degree or higher) goes with a higher age of the respondent. However, we consider the fact, that 46.4% (45.3%) of the group "Upper Secondary and lower" answered, "No" when asked about "Cloud solutions" ("Internet of Things"), as a result of teaching plans that are not updated sufficiently, not the respondents' inability to learn about possibilities linked to I4.0.

In Table 11.2, the column proportions test assigns a letter key, (A) or (B), to each category of question Q10-Q17. (A) refers to the answers "*No*" and (B) to the answers "*Yes*". The row variables are "*Age*" and "*Education*", which have four categories of answers. The two-sided asymptotic significance of Chi-square statistics adjusted by Bonferroni correction is less than 0.05^* in all comparisons except of comparison between "*Age*" and "*Mass Customization*" (*p*-value 0.100). The *p*-value (0.000^{***}) is less than 0.001, therefore statistically significant. For the column proportions test associated with the age group "25 or below" and the answers to question Q10, the B key appears in the column "*No*".

Thus, we can conclude that the proportion of respondents aged "25 or below", who answered the question Q10 about cloud solutions negative, is greater than the proportion of respondents answered the question

Table 11.2	Awar	reness	vs age	s and e	educatic	u											
		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Before	now, ha	ive you	ever hear	n abou	t the									Do you any pr experie with lo l4.0 co	u have evious ence oT or ncept?
		Cloud Solutio far?	os su	Mass Custom so far?	ization	Interné Things far?	st of so	Industry concept far? (so-calle (so-calle 4th Industri revoluti	4.04.0edalon)	Smart Manufac so far?	turing	Smart - so far?	lities	5G so	far?		
		۶ م ۲	Yes (B)	No No	Yes (B)	°N (₹	Yes (B)	No No	Yes (B)	9N (A)	Yes (B)	on (A	Yes (B)	°N (₹	Yes (B)	ه N ک	Yes (B)
Х ² р-иё	alue	31.512	0.000***	6.251	0.100	33.499	0.000***	44.270	0.000***	24.811	0.000***	27.827	0.000***	18.893	0.000***	15.197	0.002**
Age 25 - be	or elow	в				8		в		8		в		в		в	
26-3	35		A				٨		٨		A		A		٩		
36-7	45						۷		۷		٨		۷		۷		۷
46	and		۷								٨						A
т Х ² р-va	alue	11.945	0.008**	8.559	0.036*	28.072	0.000***	35.004	0.000***	19.037	0.000***	53.918	0.000***	20.402	0.000***	8.560	0.036*
Education Upp Se	oer econdar	a ⊳		в		в		в		в		в		в		в	
ar	pu																
Bac	helor				4										A		
Mas	ster		A		:		A		A		A		A		A		

	Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
	Before	h wou	ave you	ever hea	d abou	it the									Do yo any pi experi with 1	u have evious ence oT or
	Cloud Solutic far?	os suc	Mass Custom so far?	ization	Interne Things far?	et of so	Indust concer far? (so-cal (so-cal 4th Indust revolu	ry 4.0 ot so led rial tion)	Smart Manufa so far?	icturing	Smart so far	Cities	5G so	far?		
	°N (₹	Yes (B)	on (A	Yes (B)	% ସି	Yes (B)	°N (₹	Yes (B)	9 (S	Yes (B)	No (A	Yes (B)	°N €	Yes (B)	on (S	Yes (B)
Doctorate Medical or Law degree or higher					ß				ß			А	ß			
Adapted from 5. Results are based appears in the c sided asymptotic 0.001***. Tests a correction.	afar e d on tv atego : signi re adj	t al. (2 vo-side ry with ficance usted 1	020) ed tests the la of the for all	. For ea arger cc e chi-sq pairwise	ch sig blumn uare s com	nifican propo tatistio parisor	it pair, irtion. c. Sign ns with	the ke X ² ref ificanci in a r	y of th ers to e level ow of	e categ Chi-squ for up each in	ory wi lare st per ca nermo	th the atistic. se lett sst sub	smalle <i>p</i> -valu ers (A, table u	er colur le refe , B, C): using t	mn pro rs to t 0.05* the Bo	portion he two- : 0.01**; nferroni

Q10 positive (aged "25 or below"). The same results are listed between the respondents aged "25 or below" and other questions except for Q11 regarding mass customization. For the tests associated with "*Education*", the results indicate the same in the case of "*Upper Secondary and lower*" education for all questions Q10-Q17.

We would like to highlight the relationship between the age group "25 or below" and answers "No" to general questions. In absolute terms, 56.0%, and 41.4%, respectively, of the group "25 or below" answered "No" to questions addressing Industry 4.0, and IoT, respectively. We consider this as a very poor informational level especially within the young and flexible group of workers entering labour market. On the contrary, 79.8% (46.6%) of this group is using WhatsApp (Facebook) almost daily, therefore, we cannot explain this level of awareness as a result of insufficient conditions for obtaining information or being digitally isolated. Motyl et al. (2017) surveyed more than 460 students at three different universities in Italy about the Industry 4.0 concept. The authors point out the importance of the digital behaviour of young people, whose relationship with the digital world and services are very important for their further social, but also economic development, ultimately for the development of the region or country. We agree with the authors that in today's environment it is important to empower a broader knowledge of the general I4.0 concepts and bring well-structured action plans into the educational process. These conclusions should emphasis, on the one hand, the role of education, and the SMEs on the other, which are dependent on an educated workforce in the terms of I4.0 and IoT.

11.5.2 Expectations of Importance for SMEs

The second part contains information about the importance of several aspects of doing business from the perspective of respondents, considering SMEs. We present Fig. 11.3 with questions Q18, Q21, Q22, and Q23. We observed a relatively high proportion of responses without any clear opinion regarding each question, while almost one-quarter of respondents consider investing in the training of workers as "*Not at*



Fig. 11.3 The answers to the questions Q18, Q21–Q23 (Adapted from Safar et al. [2020])

all important", while almost 40% of respondents considered business transformation towards smart manufacturing as very important.

In Table 11.3 below, each column refers to the awareness question mentioned above, and each row refers to questions regarding IoT, I4.0, smart manufacturing, e-commerce, and investing in workers' education.

We then expected the row questions (Q18, Q21–Q23) and column variables (Q10–Q17) would suggest some proportional relations. The fact is, that almost in all situations (where the questions Q18, Q21–Q23 were answered "*No opinion*", respectively, "*I do not know*"), the proportion of respondents, who answered the questions Q10–Q17 negatively is greater compared to the proportion of participants who responded positively to these questions. We argue that such statistical evidence of an inability to form an opinion or express expectation stems from an obvious lack of information. On the contrary, the proportion of respondents, who answered the questions Q10–Q17 positively is greater compared to the proportion of respondents, who answered the questions Q10–Q17 positively is greater compared to the proportion of respondents, who answered the questions Q10–Q17 positively is greater compared to the proportion of respondents with negative answers, if we are considering answers "*Very important*" or "*Fairly important*" regarding questions Q18 and Q21–Q23. A possible and logical explanation could

Table 11.3 et al. 2020)	Awarene	SV SS	import	ance o	f mod	ern er	Jvironr	nent (of doi	ng þu	siness I	regarc	ling SI	MEs (¿	adapt∈	ed froi	n Safar
		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Before	now, ha	ve you e	ver hear	d abou	t the									Do you any pr experié with lc 14.0 co	u have evious ארכ ד or ncept?
	,	Cloud		Mass		Interne	if of	Industry concept far? (so-calle 4th	: so	Smart		t s					
	I	solutio far?	05 50	so far?	zation	far?	20	revoluti	al on)	so far?	cruring	so far		5G so	far?		
		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes (a)	No	Yes	No	Yes
		ŝ	(1)	£	(a)	ŝ	(a)	ŝ	6	£	(1)	3	(a)	3	(n)	£	(1)
X ²	<i>p</i> -value	125.083	3 0.000***	61.415	0.000***	42.886	0.000***	71.854 (0.000***	59.146	0.000***	53.016	0.000***	50.778	0.000 ***	* 47.945	0.000***
Q18. In your opinion, is	Not at all					B				B							
loT and	importa	nt															
Industry 4.0	Slightly importa	t															
concept	No	ß		в		в		в		в		в		в		в	
implementat	ion opinion																
important	Fairly		A				٩						A		A		
TOF SOUTH	importa	nt															
SMEs?	Very importai	nt	۷		۷		۷	`	ব		۷		٩		٩		٨
X ²	<i>p</i> -value	71.830	0.000**'	16.292	0.003**	13.077	0.011*	28.767 (000 ^{***}	31.763	0.000***	70.570	0.000***	46.957	0.000***	* 24.682	0.000***

	Do you have any previous experience with IoT or 14.0 concept?	ies 5G so far?	s No Yes No Yes (A) (B) (A) (B)	B B B A A B B A B A B A A A A A A A A A	(continued
Q15		Smart Citi so far?	No Yes (A) (B)	B B 55.685 0.0	
		rt nufacturing ar?	Yes (B)	A A 73 0.000**	
Q14		Sma Man so fi	8 g	20 70 ***	
Q13		Industry 4.(concept so far? (so-called 4th Industrial revolution)	No Yes (A) (B)	B B B 18:905 0,00 18:905 0,00	
Q12	d about the	Internet of Things so far?	No Yes (A) (B)	B A 17.773 0.001***	
	u ever hear	mization r?	Yes (B)	4 0.004**	
Q11	have you	Mass Custo so fa	N (A	** 15.1 7,17	
	e now,	H ions so	Yes (B)	0000 00000 0 0 0 0 0	
Q10	Befor	Cloud Soluti far?	0 (A)	Not at all important Silghtly important important Fairly important important p-value 36.36	
				Q21. In your opinion, how important is for South India's SMEs to invest in training their workers for new ?	

	ð	10	Q11		Q12		Q13	Ø	14	Q15	2	Q16		Q17	
	L C					4								Do yo any pr experi- with L	u have evious ence oT or
	ň	etore now, r	lave you	ever nea	ra apout	ne								14.0 00	incept?
							Industry	4.0							
						• •	concept far2	ß							
							so-called								
	Ū	oud	Mass		Internet	of	4th	S	nart						
	Sc fa	olutions so Ir?	Custom so far?	ization	Things s far?		Industria revolutio	2 S 2 ≤	lanufacturin) far?	g Smë	art Cities far?	5G so	far?		
	z	o Yes	No	Yes	No No	e,	No Ye	×	o Yes	2	Yes	٩	Yes	No	Yes
	(/	v) (B)	(A)	(B)	(A) (I	3) ((A) (B	(/	(B) (B)	(A)	(B)	(A)	(B)	(A)	(B)
Q22. In your	Not at				В			В		в					
opinion,	all														
how	important														
important	Slightly	٩							۷				۷		
is for	important														
SMEs in	No B		8			-	в	В		8		в		в	
South	opinion														
India to	Fairly				٩				٩		A				
approach	important														
smart Manufacturi	Very 19? important	۷		٩			٩				٩				A
v2	_	*000 0 000 .		***		***		***							

		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Before	ų "wou	ave you	ever hea	Ind abo	ut the									Do yo any p experi with 1 14.0 c	u have revious ence oT or oncept?
		Cloud Solutic far?	os suc	Mass Custom so far?	nization	Intern Thing far?	et of s so	Indust concel far? (so-cal 4th Indust revolu	ry 4.0 ot so led rial tion)	Smart Manufa so far?	cturing	Smart so far	Cities	5G so	far?		
		No A	Yes (B)	N (A	Yes (B)	N (A	Yes (B)	۶ م	Yes (B)	୧	Yes (B)	ବୁ ହି	Yes (B)	ବ ସି	Yes (B)	on کې	Yes (B)
Q23. In your opinion, how	Not at all import	ant.										۵					
important is e-	Slightly importe	ant			٨		٩										
Commerce for South	No opinior	8		в		B		8		B		в		в		в	
India's SMEs?	Fairly import	ant	۷						A		۷		A				
	Very import.	ant	۷		۲		A		A		A		A		٨		٩
Note "No o the categor to Chi-squar for upper c each innerr	oinion" / with tl e statist sse lette ost subt	refers ne smi ic. <i>p</i> -vi irs (A, iable u	to "l (aller cc alue re B, C): using ti	do not olumn fers to 0.05*; he Bon	know" propor the tw 0.01**; ferroni	. Resu tion a o-side 0.00	ults are ppears ed asyr I ** . Té ection	t base in th nptoti ests ar	d on tv ie cate ic signi e adju	vo-side gory w ficance sted fo	ed tests vith the t of the or all p	. For large chi-sc airwis	each s er colu quare : e com	ignific mn pl statist Iparisc	ant p roport ic. Sig ons wi	air, th cion. X nificar thin a	e key of ² refers nce level 1 row of

11 General Assessment of Industry 4.0 ...

be, that respondents realize the importance of successful transformation of the industries due to previous, at least basic, knowledge about questioned aspects. Special attention was given to the possible relations between answers "Not at all important" to questions Q18, Q21-23, and questions Q10-Q17 that were answered as "No". The proportion of respondents answering questions Q12, Q14, and Q15 as "No" that also answered Q22 (regarding approaching smart manufacturing from SMEs perspective) as "Not at all important" was significantly higher than the proportion of respondents answering Q12, Q14, and Q15 as "Yes". This brings us to the conclusion, that a better informational level should provide workers and customers with better tolerance towards emerging changes in business and network models throughout SMEs. In total, 10.3% of respondents answered Q22 as "Not at all important", 14.4% answered "Slightly important" and 24.1% answered, "No opinion" (or "I do not know"), which makes together 48.8%. We can observe a similar relationship between answers "No" to Q12 and Q14 and answers "Not at all important" to question Q18 addressing the importance of implementation of IoT and I4.0 from the SMEs perspective. Also, the relationship between respondents answering Q13 regarding I4.0 as "No" and Q21 addressing investing in training workers answering as "Not at all important" is alarming. This could be seen as a lack of information about inevitable changes in the coming years which translates into unclear visions concerning the crucial role of appropriate education and training for current and potential employees. This is backed up by the evidence in Coşkun et al. (2019), Benesova and Tupa (2017), and Schuster et al. (2016), through which the authors conclude that proper education and requalification is necessary especially regarding current dynamics throughout the industries.

Responds to the questions Q19, Q20, and Q25 are presented further in Fig. 11.4. The respondents were able to choose one of five options: "No"; "Rather no"; "No opinion" (referring also to "I do not know"); "Rather yes"; "Yes". In each of these questions, we can see a high proportion of respondents who replied all questions with the "No opinion" ("I do not know"). In Q19 it was more than 32% of respondents, in Q20 more than 33% and in Q25 more than 21%. This again points towards a lack of information resulting in the inability to form an opinion



Fig. 11.4 The answers to the questions Q19, Q20–Q25 (Adapted from Safar et al. [2020])

regarding the issue. On the other hand, the answers "No" and "Rather no" opened further questions that we attempted to examine. Within the age group "25 or below", more than 16% of respondents think that IoT concept will be ineffective for South India's SMEs. Almost 34% of the respondents within this group reported "No opinion". Examining the performance of this group also on other questions, we observed nearly 17% of the respondents claiming the SMEs in South India are not ready to implement IoT and I4.0 concept, and as many as 36% of the respondents were unable to make a judgement. For more than 27% of the respondents aged "25 or below", the I4.0 concept is personally unimportant. More than 24% of respondents from the whole sample do not consider the IoT and I4.0 concept as important from a personal point of view.

These results are further examined against general awareness in Table 11.4. Similarly, we applied the column proportions test. For each combination of testing, we also point to the value of the asymptotic significance statistic (*p*-value), which in all cases is less than 0.05^* level and thus variables are related. This table includes also a comparison

		Q10		Q11		Q12		Q13	U	214		Q15		Q16		Q17	
			<u>ک</u> ۱													Do you any pr experié with lo	u have evious ence oT or
		betore	now, n	ave you	ever ne:	ard abo	ut the	:								14.U CO	ncept <i>:</i>
								Industry concept : far? (so-called	4.0								
		Cloud Solutio far?	ns so	Mass Custom so far?	ization	Interni Things far?	et of so	4th Industrial revolutior	,	smart Manufac o far?	turing	Smart so far?	Cities	5G so	far?		
			\	Q Z	202		222				, , , ,		No.		,, X	ON No	202
		(A)	(B)	(A)	(B)	<u></u>	(B)	20 20 20 20 20 20 20 20 20 20 20 20 20 2		P A	(B)	R ((B)	6 (S	(B)	<u>२</u> रि	(B)
X ²	-d oulex	52.087	0.000**`	55.046	0.000**	, 28.232	0.000***	41.303 0.4	7 *** 000	t5.401	0.000***	17.383	0.002**	55.819	0.000.0	, 72.579	0.000.
019. In vour	No																
opinion, is	Rather				A												
loT and	ou																
14.0	No	в		в		в		в	ш	~		в		в		в	
concept	opini	on															
cost- effective	Rather		A												A		
for South India's SMEs?	Yes		۷		٩		A	A			٩		۲		۷		٩
X ²	ط. ا	52.379	0.000**'	16.323	0.003**	48.810	0.000***	* 37.977 0.1	000*** 2	16.488	0.000***	35.185	0.000***	59.091	0.000.0	* 31.707	0.000**

217	Do you have any previous experience with IoT or 4.0 concept?		Vo Yes A) (B)				۲	26.082 0.000***	(continued)
6		so far?	Yes (B) (ш	۲	۲	657 0.004 ^{**} 2	
010		50	₽ ₹		8			* 15.	
		art Cities far?	Yes (B)				٩	733 .000**	
Q15		Sme	°5 ₹		8			** 73.7	
		acturing ?	Yes (B)			٩	۷	0.000*	
Q14		Smart Manuf so far	ه کا		в			** 44.201	
		ustry 4.0 cept so called ustrial	Yes (B)				٩	.76 0.000*	
Q13	.	Indu conic far? (so-ic lath Indu revo	ବୁ ହି	æ	8			* 45.4	
	bout the	rnet of 1gs so	Yes (B)			٩	٩	166 0.000**	
Q12	ard a	Inte Thii far?	₽ ₹		в			** 44.4	
	u ever he	mization ?	Yes (B)				٩	0.000*	
Q11	have you	Mass Custor so far	9 (S		в			** 26.645	
	re now,	d tions so	Yes (B)				۷	55 0.000*	
Q10	Befo	Clou Solu far?	°N (S		a io			52.3	
				No Rather no	No opini	Rather yes	Yes	<i>p</i> − valu€	
				Q20. In your opinion, are South	India's SMEs	ready to implement	loT and l4.0 concept?	X ²	

		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
	1															Do yo any pr	u have evious
																with lo	oT or
		Before	h ,won s	iave you	ever hei	ard abo	ut the .	:								14.0 co	oncept?
								Indust conce far? (so-cal	rry 4.0 pt so led								
		Cloud Solutic far?	os suc	Mass Custom so far?	ization	Intern Things far?	et of so	4th Indust revolu	rial tion)	Smart Manufé so far?	acturing	Smart so far?	Cities	5G so	far?		
	I	No No	Yes (B)	on (A	Yes (B)	on (s	Yes (B)	۹ (ج	Yes (B)	oN (A)	Yes (B)	o (A	Yes (B)	°N (₹	Yes (B)	ବ ହି	Yes (B)
Q25. In your	No					в		в				в					
opinion, is loT and l4.0																	
concept	;																
implementati important for you	5																
personally?																	
	Rather		۷														
	ou																
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	Rather		۷				۷		٨		۷				۷		
	yes																

		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Before	a now.	lave you	ever hea	rd abou	ut the									Do you any pro experie with Ic 14.0 co	u have evious :nce oT or ncept?
		Cloud Soluti far?	os suo	Mass Customi so far?	ization	Interne Things far?	et of so	Industi concep far? (so-cal 4th Industi revolu	ry 4.0 Dt so led rial tion)	Smart Manufa so far?	cturing	Smart so far?	Cities	5G so f	ar?		
		No (A	Yes (B)	No (A	Yes (B)	on (A	Yes (B)	ବୁ ହି	Yes (B)	۹ ام	Yes (B)	ୁ ସ	Yes (B)	N (A)	(es B)	°N €	Yes (B)
	Yes		A		4		۷		A				A				A
X ²	<i>p</i> - value	ء 17.69	6 0.000 ^{**}	* 8.219	0.016*	4.596	0.100	8.943	0.011*	4.793	0.091	40.112	0.000***	15.174 (0.001***	2.905	0.234
Q34. In your opinion,	° Z Z	Ω.			٩			B				88		в			
uo you see any Smart City in South	opin Yes	<u>E</u>	A						A				A		4		
India in next 10 years?																	
Adapted fro Note "No o	m Saf	ar et a "refe	al. (2 <mark>02</mark> rs to "	o l do l do	t know	". Res	sults ar	e bas	ed on	two-sic	led test	ts. For	each s	ignific	ant pa	air, the	e key of

the category with the smaller column proportion appears in the category with the larger column proportion. X^{-} refers to Chi-square statistic. *p*-value refers to the two-sided asymptotic significance of the chi-square statistic. Significance level for upper case letters (A, B, C): 0.05^{*}; 0.001^{**}; a. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction

of the answers to question Q34, which is focused on whether respondents expect any Smart City in South India within the next 10 years. In proportional testing, we found that in three cases (Q12, Q14, and Q17), the *p*-value is higher than the confidence level 0.05^* (0.100; 0.091; 0.234). In such cases, we consider these variables as independent.

We highlight a high portion of "*No opinion*" ("*I do not know*") answers observed within the set of questions Q19, Q20 and Q25, related to answers "No" (questions Q10–Q17). A similar pattern was observed and described in Table 11.3. One concern could be potential complexness or difficulty of questions Q19 and Q20, therefore, forming a substantiated opinion could be harder for respondents. On the contrary, the inability to take a personal stance towards I4.0 or IoT we explain as lack of sufficient information, as described previously. Additionally, on a personal level, implementation of I4.0 and IoT (Q25) is not important for respondents answering Q12 and Q13. In total 24.3% (7.6%) of respondents answered "*No*" ("*Rather no*") to a question Q25.

Regarding question Q34, where respondents were asked whether they see any perspective of Smart City transformation within the region in the next ten years, almost 74% of the participants responded positively towards the idea of Smart City transformation. These responses seem to be rather overconfident, in contrast to other studies (Goswami 2016; Iyer 2018) examining the current state of the art in India. Putting this question in the context of questions Q10–Q17 results in similar outcomes as for previous sets of questions, where negative answers to Q10–Q17 are related to negative answers addressing Smart City. On the other hand, the proportion of respondents answering Q34 positively, that answered also Q10–Q17 positively, is higher on the statistically significant basis than the proportion of those who answered Q10–Q17 negatively.

11.5.3 Living Conditions Effects Expectations

Moving towards the next set of questions, Fig. 11.5 summarizes the performance of respondents regarding the questions Q27–Q33, and consequently their opinions on how the IoT and I4.0 will affect several aspects of their lives. The scale of responses used for this set of questions



Fig. 11.5 Questions Q27–Q33

consists of five levels: "Negative"; "Rather negative"; "No opinion" ("I do not know"); "Rather positive", "Positive". Same as for previously examined sets of questions, a high frequency of "No opinion" answers can be observed. More than 25% of respondents cannot express opinions or expectations of how the 4th industrial revolution will affect the social and economic aspects of their lives in the region. We observed more than 10% of respondents expressing the opinion that IoT and I4.0 could have a negative impact on each questioned aspect of their life. Examining only the age group "25 or below", more than 16% of respondents think that IoT and I4.0 will impact their living environment negatively. To add on, almost 30% within the same age group answered: "No opinion" ("I do not know").

On the other hand, over 25% of the respondents within the age group "25 or below" expect a positive impact of IoT and I4.0 on their living environment. Questioning expected impact on salaries, more than 26% of respondents aged "25 or below" expect the I4.0 will impact their salary positively. Conversely, nearly 15% of respondents within the same age group express an opinion, that IoT and I4.0 will have a negative impact. Almost 28% of respondents aged "25 or below" picked "No opinion" ("I do not know"). In general, 35% of all respondents believe that IoT

and I4.0 will have a positive impact on their personal life, while 27% of the total participants cannot express opinions or expectations of how the 4th industrial revolution will impact their personal life. Similarly, if the possible effect of IoT and I4.0 on the working environment is concerned, 27% of respondents answered: "*No opinion*" ("*I do not know*"). However, 11% of all respondents expect a negative impact of IoT and I4.0 on employment in the South India region, and nearly 32% have no opinion regarding the impact on employment. To add on, 12% of all respondents think that IoT and I4.0 will negatively affect the economic development of the South India region, while almost 26% of respondents answered: "*No opinion*" ("*I do not know*").

As for previous sets of questions, we observed in Table 11.5 and Table 11.6 the same pattern for dependences between answers "No" to general awareness questions and "No opinion" ("I do not know") to questions Q10–Q17. Similarly, for those respondents having prior information about IoT and I4.0 we observed rather positive answers to questions Q10–Q17. Conducting similar research in other regions could provide us with comparable data within the country. However, we find mainly company-oriented questionnaire-based researches also for other emerging countries, which is limiting our space for confrontation of obtained results.

Regarding questions addressing effects on community and salary, a higher proportion of respondents without prior information about IoT and I4.0 expressed "*No opinion*", and a higher proportion of respondents with previous knowledge about IoT and I4.0 expect a positive impact on the community they are living in and the salaries.

We observed that there is a higher proportion of respondents, who answered "No" to question related to IoT (Q12), expect a negative impact on their personal lives (Q29) than the proportion of respondents answering Q12 positively. We find it more interesting, that a rather negative impact on personal life (Q29) is expected from a higher proportion of respondents with prior knowledge of smart manufacturing (Q14). Similarly, a higher proportion of respondents already familiar with mass customization (Q11) expect a rather negative impact on their working lives. Rather a negative impact of IoT and I4.0 (Q31) expect a higher

<u> </u>		-	Q12		Q13	Q14		Q15	Q16		Q17	
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: *	(B)	(A) (B)	(A	(B)	(A) (B)	(A)	(B)	(A) (B)	(¥	(B)	٩ ٩	B)
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11 General Assessment of Industry 4.0 ...

		Q10	Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Before nov	v, have you	ever hear	rd abou	it the									Do yc any p experi with 1	ou have revious ience loT or oncept?
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	1	No Yes (A) (B)	on (A	Yes (B)	ବ ହି	Yes (B)	୧ ୪	Yes (B)	ବୁ ହି	Yes (B)	No (A	Yes (B)	ବୁ ସି	Yes (B)	°N €	Yes (B)
Rê	ather negative	0														
ž	o opinion	в	в		в		в		в		8		B		в	
Rã	ather positive											۷				
2 4	ositive	A 36 200 0 000	10 ^{***} 35 229	A 0.000***	10.655	A 0.031*	065.95	A 0.000**'	* 20.219	A 0.000***	23 360	A A 0000 4	38 176	A 0000**	, A2 99 *	A 1 0 000
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K. Tippayawong et al.

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		o far?	Yes (B)	٩	8 0.00
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		cturing	Yes (B)	٩	0.000
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	e now	ons so	Yes (B)	٩	2 0.000
Q10	Befor	Cloud Soluti far?	ବୁ ବି	o œ	23.99
	'	'	•	gative ther negativ ppinior ther sitive	alue
				P R R R	٩ ٢
				Q28. In your opinior what impact would IoT and	14.0 have on your salary? X ²

Table 11.	5 (contin	ued)														
	Q1	0	Q11		Q12		Q13		Q14		Q15		Q16		Q17	
	Be	fore now, I	have you	ever hear	d about	t the									Do you any pr experie with lo 14.0 co	r have evious nce T or ncept?
	so Cc far	oud Iutions so	Mass Custor so far?	ization	Interne Things far?	et of so	Industr concep far? (so-call 4th Industr revolut	y 4.0 t so ed ial ion)	Smart Manufa so far?	cturing	Smart so far	Cities	5G SO	far?		
	Nc (A)	Yes (B)	No A	Yes (B)	No (A)	Yes (B)	0N (A)	Yes (B)	No (A)	Yes (B)	0N (A)	Yes (B)	No No	Yes (B)	No (A)	Yes (B)
Q 29. In your opinion, what impact would IoT and I4.0 have on your personal Iife?	Negative Rather negative No B opinion Rather Positive Positive	٩	۵	٩		٩	۵	٩ ٩	۵	٩ ٩	ß	ح ح	۵	٩	۵	4

216 Q17	Do you have any previous experience with IoT or 4.0 concept?	iG so far?	Vo Yes No Yes A) (B) (A) (B)	5.497 0.000*** 13.098 0.011* B	(periation)
Q15 (Smart Cities so far?	No Yes 1 (A) (B) (* 46.071 0.000*** : B	
Q14		Smart Manufacturing so far?	No Yes (A) (B)	* 23.300 B	
Q13		Industry 4.0 concept so far? (so-called 4th Industrial revolution)	No Yes (A) (B)	* 20.012 0.000**	
Q12	ard about the .	Internet of Things so far?	No Yes (A) (B)	*** 10.322 0.035* B	
Q11	have you ever he	Mass Customization so far?	No Yes (A) (B)	** 23.305 0.000 B	
Q10	Before now,	Cloud Solutions so far?	No Yes (A) (B)	a7.731 0.000* e ive ive bive bive	
				X ² P- valu Q30. In Negat your opinion, what impact would loT impact impact vourd loT impact impact impact no on vourking life? Rather nega	

11 General Assessment of Industry 4.0 ...

Table 11.5 (co	ontinue	(pi														
	Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
	Befor	e now, F	Tave you	ever hear	rd abou	it the :									Do yc any p experi with 1	u have revious ence oT or oncept?
							Indust concer far? (so-cal	ry 4.0 ot so led	t							
	Soluti far?	ions so	Custom So far?	iization	Things far?	et 01	4 un Indust revolu	rial tion)	Manufa so far?	cturing	Smart so far	Cities ?	5G so	far?		
	0N (A)	Yes (B)	No (A)	Yes (B)	No A	Yes (B)	No No	Yes (B)	٥N (ح)	Yes (B)	No (A)	Yes (B)	ې ک	Yes (B)	°N (₹	Yes (B)
Rather posit	ive	A								A				A		
Positiv	e	A		A				٩				A		A		A
Note "No opin the category w to Chi-square s for upper case each innermosi Source Prepare	ion" r vith thu tatistic letters t subta d by a	efers tc e small <i>p</i> -valu s (A, B, hble usi uthors	o "I do ler colu Le refer C): 0.0 ing the	not kn« mn pro s to the 5*; 0.01 Bonfer	ow". F portio e two- [**; 0.(roni c	Results on app sided 201***	are bi ears in asympt a. Tesi on	ased of the c totic sig	n two-s ategory gnificar adjuste	ided te with t nce of t d for a	sts. Fo .he lar he chi ll pair	r each ger co -squar wise cc	signif lumn e stati ompar	icant propo stic. Si isons v	pair, th rtion gnifica vithin	ie key of X ² refers nce level a row of

K. Tippayawong et al.

Table 11.6	Awar	eness	vs que	stions (Q31, Q	32, an	d Q33										
		Q10		Q11		Q12		Q13		Q14		Q15	-	Q16		Q17	
		Before	h won	ave you	ever hea	rd abou	it the									Do you any pre experie with lo 14.0 col	r have evious nce T or
		Cloud Soluti far?	os suo	Mass Customi so far?	ization	Interné Things far?	et of so	Industry concept far? (so-calle 4th Industri revoluti	/ 4.0 ed al	Smart Manufac so far?	turing	Smart Ci so far?	ties	5G so f	ar?		
		No No	Yes (B)	No (A)	Yes (B)	0N (A)	Yes (B)	No (A)	Yes (B)	No (A)	Yes (B)	No Yi (A) (E	l se ()	No (A)	(es B)	No No	Yes (B)
X ²	p- value	18.76	2 0.001**	* 37.818	0.000***	13.151	0.011*	17.364 (0.002**	15.664	0.004**	50.336 0.	000	23.580 (.000.	29.795	0.000***
Q31. In your opinion, what	Negative Rather negati	e S. e		c	۷	c			۷	c	٩	c	-	ſ		c	
impact would loT and l4.0 have in	No opinio Rather positiv Positive	e n e	٩	20	۲	20	٩	2	٩	20		¥ ه		m	4	m	۲
general on your welfare? X ²	<i>p</i> - value	25.236	5 0.000 ^{**}	* 20.126	0.000***	20.314	0.000	41.497 (0.00.0	24.680	0.000.0	28.743 0.	***0000	29.366 (.000.	27.450	0.000***
																(cor	itinued)

Table 11.6	(conti	nued															
		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Befor	e now, h	ave you	ever hear	rd abou	ut the									Do you any pr experie with Ic I4.0 co	r have evious nce T or
		Cloud Soluti far?	or so	Mass Customi so far?	ization	Interné Things far?	et of so	Industr concep far? (so-call 4th Industr revolut	y 4.0 t so ed ial ion)	Smart Manufa so far?	turing	Smart so far?	Cities	5G so	far?		
		No (A)	Yes (B)	0N (A)	Yes (B)	on (A	Yes (B)	on (A	Yes (B)	on (S	Yes (B)	۶ N	Yes (B)	∾ ସି	Yes (B)	ه ک	Yes (B)
Q32. In your	Negative Rather	0				B					A				۲		
opinion, what	negati [:] No	e B		в				в		в		в		в		в	
impact would	opinio	ے ^م						<u>م</u>					٩				
loT and l4.0 concept	positive	۵ ۵	۷		۲		۲	1	۷		٨		< ∢		A		A
have on employme	Ŧ																
in your region?																	
X ²	d d	43.74	2 0.000**	* 18.121	0.001***	27.159	0.000***	40.205	0.000***	32.625	0.000***	62.107	0.000***	42.842	0.000**`	* 26.604	0.000***
	value																

K. Tippayawong et al.

		Q10		Q11		Q12		Q13		Q14		Q15		Q16		Q17	
		Befor	e now, F	lave you	ever hea	ird abou	ut the									Do yc any p experi with 1 14.0 co	u have revious ence oT or oncept?
		Cloud Soluti far?	ous so	Mass Custom so far?	ization	Intern Things far?	et of s so	Industr concep far? (so-call 4th Industr revolut	y 4.0 it so ed ial ion)	Smart Manufa so far?	cturing	Smart so far	Cities	5G so	far?		
		No (A	Yes (B)	No A	Yes (B)	on (A	Yes (B)	ه No (ک	Yes (B)	No No	Yes (B)	ବ ସି	Yes (B)	°N €	Yes (B)	N (A	Yes (B)
Q33. In your oninion	Negative Rather	0				в		в				в					
what impact	No			в		в		в		в		в		в		в	
would IoT and	opinio Rather positive	_ L											A			в	
l4.0 concept	Positive	J	٩		۲		٩		٨		٩		A		۲		۲
nave on economic developme in your	ť																
region?																	
Note "No the catego to Chi-squ for upper	opinion ry with are stati case let	it ref it the istic. ters	ers to smalle <i>p</i> -value (A, B, C	"I do n r colum e refers []: 0.05	to the to the *; 0.01*	w". Reportion	esults é n appea ided as 01*** a	are bas ars in t sympto	sed on the car otic sig	two-si tegory nifican djusted	ded tes with th ce of th for all	ts. For ne larg ne chi- pairw	· each Jer col square vise col	signifi umn p statis mparis	icant p propor tic. Sig sons w	bair, th tion.) gnifica vithin	ie key of K ² refers nce level a row of
Source Pre	pared t	up au	thors	בים		5	יוברווס	-									

proportion of respondents with prior information about mass customization (Q11), I4.0 (Q13) and smart manufacturing (Q14). Regarding employment (Q32), the negative impact is expected from the higher proportion of respondents without prior information of IoT (Q12) than from those with such information. On the contrary, we cannot satisfactorily explain the negative expected impact on employment from respondents with prior information of "5G" (Q16). Addressing economic development in the South India region in general, a higher proportion of respondents without prior information about IoT (Q12) and I4.0 (Q13) expect negative impact compared to respondents having such previous information.

Thus, we find the implementation of any I4.0 related features and organization or network models challenging from a non-technical point of view, if respondents' expectations are negative towards key aspects of their lives. On the other hand, throughout each set of questions, we observe a significantly higher proportion of respondents expecting rather positive impacts within questioned aspects, that have previous knowledge or information about key terms addressed in the first part compared to those without such information. To add on, respondents with previous experience with IoT and I4.0 expressed positive expectations with a higher frequency compared to those without such experience. On the contrary, we consider some responses to questions addressing Smart cities in South India (Q34), or readiness of SMEs for implementing IoT and I4.0 (Q20), as rather over-confident, considering current state of art not only in South India (Iyer 2018). Such observations could however stem from possible drawbacks as sampling error. Thus, we recommend further examination of the mentioned region because of its huge demographic potential. Possible improvement of the conducted research should be expanding the sample or expert surveys with representatives of employee associations and other social parties. Because of scarcity in existing literature, we also find contribution in examining other regions and emerging countries from presented perspectives.

11.6 Conclusions

In this chapter, we attempted to examine general awareness, opinions, and attitudes of South India's inhabitants towards the Industry 4.0 and its features. By conducting a survey, we gathered unique answers containing crucial information about the current state of art regarding addressed issues the same as future expectations. Besides simple counts of answers, we provided also testing of interdependencies between general awareness questions and several sets of questions addressing various issues.

The main findings suggest that general awareness is quite low (almost 50% of respondents have no prior information of Industry 4.0), which consequently leads to the inability to form any opinion regarding effects of such new trends on working and personal life, same as on living and business environment. Respondents with insufficient knowledge of IoT and I4.0 then tend to answer negatively regarding questions about possible effects on their lives or salary, or they are unable to form an opinion regarding addressed aspects. On the contrary, respondents possessing prior information or knowledge regarding IoT and I4.0 expressed positive expectations in general.

Based on examined interdependences, we argue that proper education and relevant information dissemination is non-technical, however crucial, to form an applicable organization and network models as a part of the transformation process of the current environment in South India towards Industry 4.0.

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