International Journal of Security and Its Applications
Vol. 9, No. 4 (2015), pp. 33-40
http://dx.doi.org/10.14257/ijsia.2015.9.4.05

Analysis on Supply and Demand Status of Information Protection of Human Resources in Korea

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Abstract

There were about nine hundred information protection human resources less in Korea in 2012 but this number is expected to increase to about two thousand, five hundred in 2015, widening the gap between demand and supply. This is more of a serious qualitative issue than a quantitative issue in terms of scarce resources. There is an average proficiency gap of 1.2 points out of seven points among the resources companies would like to hire. In particular, among the twenty-five knowledge and technology levels, fields such as cryptology only meet about 70% of the industry's expectation level.

To solve the quantitative supply and demand gap of information protection human resources, it is necessary to attract more human resources into the information protection industry through various training paths. Also, in order to enhance the qualitative fidelity level of the information protection resources, there is a need to foster customized talents that meet company demands by adjusting training curriculum according to proficiency differences.

Keywords: *Information protection human resources, quantitative gap in supply and demand, qualitative gap in supply and demand*

1. Introduction

Since the internet crisis on January 25th 2003, when the nationwide internet network was paralyzed, more attacks have taken place, most recently the DDoS attack on July 7th and many other personal information leakage incidents. In this regard, companies are making efforts to prevent information infringement incidents and personal information leakages by enhancing the level of information protection. These efforts are demonstrated in the compound annual growth rate(CAGR) of 11.5% of the information security industry from 2005 to 2010.[1] Also, the level of information protection of companies is expected to improve even more as the industry is forecasted to grow an average of 18.9% annually from 2012 to 2017. Such dramatic growth of the information protection industry is possible because the supply of information protection products and services can be created in a short period of time to fulfill demand.

In the meantime, demand for human resources that produce and operate related products and services will also increase following the rapid growth of the information protection industry. However, whereas demand of human resources is flexible, supply of human resources is inflexible. Therefore, supply and demand of information protection human resources will become a very critical variable for companies that intend to enhance their information protection level by producing and operating information protection products and services.

In this regard, this document aims to reflect on the supply and demand issue of information protection human resources from a quantitative and qualitative perspective and to discuss constructive countermeasures.

2. Current Status of Information Protection Human Resources

ISSN: 1738-9976 IJSIA

The Korea Internet Security Agency (KISA) conducted a survey on the status of information protection human resources targeting information protection companies in 2012. The survey classified information protection human resources into eight job groups and four levels. As of the end of 2011, a total of 7,634 information protection human resources were working in information protection companies. By level, there were 1,425 (18.7%) elite level, 2,063 (27.0%) high-level (27.0%), 2,185 (28.6%) intermediate level and 1,961 (25.7%) beginner level. By job, there were 846 (11.1%) for strategy and planning, 971 (12.7%) for information protection consulting, 584 (7.7%) for marketing and sales, 3,033 (39.7%) for R&D and realization, 1,489 (19.5%) for education and training, 80 (1.0%) for administration and operation, 454 (6.0%) for emergency response and 177 (2.3%) for evaluation and certification.

Table 1. Status of Information Protection Human Resources of Information Protection Companies

(unit : headcount)

Classification	Total	Elite level	High-level	Intermediate level	Beginner level
Strategy and Planning	846	87	171	532	56
	11.1%	10.3%	20.2%	62.9%	6.6%
Information protection consulting	971	137	235	277	322
	12.7%	14.1%	24.2%	28.5%	33.2%
Marketing and Sales	584	167	217	111	89
	7.7%	28.6%	37.2%	19.0%	15.2%
R&D and realization	3,033	688	888	673	784
	39.7%	22.7%	29.3%	22.2%	25.8%
Education and training	1,489	276	454	365	394
	19.5%	18.5%	30.5%	24.5%	26.5%
Administration and operation	80	15	21	24	20
	1.0%	18.8%	26.2%	30.0%	25.0%
Emergency response	454	28	43	144	239
	6.0%	6.2%	9.5%	31.7%	52.6%
Evaluation and certification	177	27	34	59	57
	2.3%	15.3%	19.2%	33.3%	32.2%
Total	7,634	1,425	2,063	2,185	1,961
	100.0%	18.7%	27.0%	28.6%	25.7%

The portion of high-level human resources was relatively high in numerous jobs in terms of scarce information protection human resources of information protection companies, but intermediate level human resources were especially insufficient in information protection consulting, administration and operation and beginner level human resources were scarce in emergency response. This indicates that there is a relatively high demand of information protection companies for high-level human resources.

Table 2. Status of Insufficient Information Protection Human Resources of Information Protection Companies

(unit : headcount)

Classification	Total	Elite	High-level	Intermedia	Beginner

			level		te level	level
Strategy and Planning	164	(13.2%)	54	72	22	16
		100.0%	32.9%	**43.9%**	13.4%	9.8%
Information protection consulting	258	(20.7%)	39	30	112	77
		100.0%	15.1%	11.6%	**43.4%**	29.8%
Marketing and sales	159	(12.8%)	22	73	37	27
		100.0%	13.8%	**45.9%**	23.3%	17.0%
R&D and realization	260	(20.9%)	26	105	93	36
		100.0%	10.0%	**40.4%**	35.8%	13.8%
Education and training	8	(0.6%)	0	4	2	2
		100.0%	0.0%	**50.0%**	25.0%	25.0%
Administration and operation	174	(14.0%)	13	46	60	55
		100.0%	7.5%	26.4%	**34.5%**	31.6%
Emergency response	200	(16.1%)	6	14	39	141
		100.0%	3.0%	7.0%	19.5%	**70.5%**
Evaluation and certification	23	(1.8%)	6	8	4	5
		100.0%	26.1%	**34.8%**	17.4%	21.7%
Total	1,246	(100.0%)	166	352	369	359
		100.0%	13.3%	28.3%	29.6%	28.8%

The level of information protection knowledge and technology that is required when companies that have information protection jobs hire such scarce information protection human resources, was assessed on a scale of seven points. Also, human resources that have carried out information protection work or have completed an educational institution which assessed their capability themselves on a scale of seven points. The results are shown in Table 3. It was observed that individual level of proficiency was below the level required by companies in twenty four areas excluding job ethics.

Table 3. Required Level of Knowledge and Technology by Information Protection Job

(unit : points)

Knowledge and Technology	Level required by company(A)	Individual proficiency level(B)	Difference (A-B)
Document preparation and presentation	5.6	5.2	0.4
Communication and leadership	5.9	5.2	0.7
Job ethics	5.7	5.9	(0.2)
Business issue diagnosis and solution development	5.5	4.7	0.8
Programming language (JAVA, C, C#, C++, PHP, etc)	5.7	3.8	1.9
Operating system (Windows, UNIX, Linux, Mac OS, Solaris, etc)	6.0	4.8	1.2
Database	6.0	4.2	1.8

Project management	5.8	4.9	0.9
Software engineering	5.8	4.3	1.5
IT governance	5.8	4.6	1.2
Information protection policy and security architecture	5.9	5.1	0.8
Access control and operation security	6.0	5.2	0.8
Application program security	5.8	4.6	1.2
Communication and network security	6.1	5.2	0.9
Risk analysis and management	6.1	4.9	1.2
Business continuity management	6.0	4.7	1.3
Information system security inspection	6.0	4.8	1.2
Digital forensics	6.0	3.9	2.1
Physical security	5.8	4.7	1.1
Human resource security management and educational training	6.1	4.9	1.2
Cryptology	5.9	3.8	2.1
Legal and compliance	5.8	4.7	1.1
Personal information protection and ethics	6.1	5.2	0.9
Related framework (certification, standard, process etc.)	6.1	4.7	1.4
New security environment (cloud computing, smart grid etc.)	6.0	4.4	1.6
Average	5.9	4.7	1.2

3. Supply and Demand Status of Information Protection Human Resources

The demand for supply and demand forecast of information protection human resources is calculated based on the sum of growth demand and alternative demand. Growth demand refers to the demand for human resources occurring from industry growth and alternative demand refers to the demand for human resources among the employed who have walked away from the information protection industry. For the forecast of growth demand, the annual average growth rate of KISIA's(2012) revenue, communication and broadcasting devices of the Bank of Korea(2011), computer and peripheral devices as well as employment coefficients of additional communication and information services were used. For the forecast of alternative demand, the human resource attrition rate by industry of the Korea Research Institute for Vocational Education & Training (2008) was used regarding the computer and office device manufacturing industry, electronic parts, image, sound and communications equipment manufacturing industry, additional communication and information services.

Growth demand for information protection human resources in 2012 was 1,104, and considering the number of employed which was 7,634 in 2011, shown in Table 1, the number of employed in 2012 was 8,737. Also, alternative demand is expected to be 96 in 2012, forecasting a total of 1,200 new demands for human resources. Under the assumption that the revenue growth pace of the information protection industry will continue until 2015, calculation of growth, alternative and new demand is shown in Table 4.

Table 4. Demand Forecast for Information Protection Human Resources

(unit : headcount, 1 billion KRW)

Year	Revenue	Growth demand	Alternative demand	New demand	Number employed
2011	1,458	-	-	-	7,634
2012	1,647	1,104	96	1,200	8,738
2013	1,993	2,020	110	2,130	10,758
2014	2,411	2,444	135	2,579	13,202
2015	2,918	2,958	166	3,123	16,160

The supply of information protection human resources is marked as the net increase amount of the concerned year on top of the current amount of supply. Supply channels for such human resources are formal and private educational institutions and inflow from other industries. Since the supply route that is identifiable based on objective data is the supply through formal educational institutions, this document discusses the supply of information protection human resources based on targeting students who have gone through formal educational courses.

According to the educational statistics annual report of KEDI for 2012, the total number of human resource graduates for information protection was 482, breaking down into 121 information protection specific bachelor's degrees, 256 bachelor's degrees and 55 masters and doctors degrees. Under the assumption that the industry will post an annual average growth rate of 21%, the number of graduates in 2015 is expected to surpass 1,001 persons. However, taking into account that the advancement rate of such graduate students into information protection jobs such as information security and physical security is 32.9% for specialized bachelors, 70.3% for bachelors, 70.6% for masters and doctors, the supply of new information protection related human resources in 2012 was 259. However, since employment with information protection companies is scheduled for contract-type master courses of KISA, the numbers have remained steady from 50 in 2011, 50 in 2012, 56 in 2013, 68 in 2014 and a projected 75 in 2015. When added with the yearly supply headcount of information protection human resources, the total supply of resources was 309 in 2012, 363 in 2013, 363 in 2013, 435 in 2014 and forecasted to be 526 in 2015 as shown in Table 5.

Table 5. Status of Supply of Information Protection Resources

Classification	Specialized	Bachelors	Employment contract type masters course	Masters and doctors	New supply
Graduates of	121	256	50	55	-
Advancement rate into information protection	32.9%	70.3%	100.0%	70.6%	-
New supply in 2012	146	310	50	67	309
2013	177	375	56	81	363
2014	214	454	68	97	435
2015	259	549	75	118	526

Comprehensively, the difference between supply and demand of information protection human resources will look like Table 6. As a result, it is projected that there was a total of 891 resources less compared to demand in 2012. According to the assumption that the information protection industry will keep its continuous growth pace of an annual average

growth rate of 21%, the difference will become even more severe so that in 2015 there will be a supply shortage of 2,598 compared to demand.

Table 6. Difference between Supply and Demand of Information Protection Human Resources

Year	Number of employed	New demand (growth + alternative)	New supply	Supply and demand gap (new demand - new supply)
2011	7,634	-	-	-
2012	8,738	1,200	309	- 891
2013	10,758	2,130	363	-1,767
2014	13,202	2,579	435	-2,144
2015	16,160	3,124	526	-2,598

4. Supply and Demand of Information Protection Human Resources

As shown in Table 6, it is expected that the difference in supply and demand of information protection human resources will expand and aggravate the quantitative shortage issue of human resources. This issue however is considered to be solvable through an inflow of resources from other industries through various educational courses.

In the meantime, the issue which can be observed in Table 3 is the qualitative issue of information protection human resources. To analyze this issue from the perspective of educational curriculum of formal educational courses, 25 undergraduate courses, 20 masters courses and 12 doctors courses have been researched. Curriculum educational courses were classified into 26 subject types, breaking down into 25 knowledge and technologies categories and one miscellaneous category shown as 'others' because it was difficult to be classified as can be seen in Table 3. Table 6 shows the difference between the level required by companies and personal proficiency level and also the portion of subjects in each course. It can be observed that areas such as information protection policy and security architecture, communication and network security have a relatively high portion of subjects compared to the differences in proficiency. On the other hand, areas like digital forensics, cryptology, programming language and data base have a relatively lower portion of subjects compared to the differences in proficiency.

Therefore, it is necessary to provide demand-tailored education by enhancing the qualitative level of information protection human resources supplied and by adjusting the portion of each subject according to the needs of companies that demand information protection human resources.

Table 3. Required Level of Knowledge and Technology by Information Protection Job

Knowledge and technology	Difference between level required by company and individual proficiency(points)	Portion of undergraduate course subjects(%)	Portion of master course subjects (%)	Portion of doctor course subjects (%)
Document preparation and presentation	0.4	1.4	0.9	1.9
Communication and leadership	0.7	1.2	0.4	0.3
Job ethics	(0.2)	1.3	-	-

Business issues diagnosis and solution development	0.8	3.0	4.8	1.1
Programming language (JAVA, C, C#, C++, PHP etc.)	**1.9**	**11.8**	**3.3**	**3.2**
Operating system (Windows, UNIX, Linux, Mac OS, Solaris etc.)	1.2	5.9	4.8	3.8
Data base	**1.8**	**4.5**	**4.0**	**3.5**
Project management	0.9	2.4	0.4	0.3
Software engineering	1.5	7.2	8.6	7.8
IT governance	1.2	0.5	0.8	0.3
Information protection policy and security architecture	**0.8**	**7.2**	**12.5**	**15.4**
Access control and operation security	0.8	7.9	3.9	5.4
Application program security	1.2	3.9	6.2	5.1
Communication and network security	**0.9**	**13.6**	**15.8**	**15.1**
Risk analysis and management	1.2	1.2	3.9	6.2
Business continuity management	1.3	0.2	0.9	1.9
Information system security inspection	1.2	0.5	2.1	1.4
Digital forensics	**2.1**	**3.6**	**4.2**	**3.0**
Physical security	1.1	1.2	1.2	0.5
Human resource security management and educational training	1.2	0.1	0.6	0.8
Cryptology	**2.1**	**5.8**	**7.9**	**12.2**
Legal and compliance	1.1	2.7	1.7	1.4
Personal information protection and ethics	0.9	1.3	1.3	0.8
Related framework (certification, standard, process etc.)	1.4	0.4	-	0.3
New security environment (Cloud computing, smart grid etc.)	1.6	1.0	0.3	0.5
Others	-	10.5	9.8	-

5. Closing

The growth potential and importance of the information protection industry is increasing with the emergence of various IT services. The annual average growth prospect of 18.9% from 2012 to 2017 reflects its need. However, to enhance the level of information protection through advancement of the information protection industry, it is essential to provide information protection human resources of good quality in a timely manner.

Currently the supply of information protection human resources cannot meet the growth demand of the industry and it is expected that the current gap between supply and demand will continue to widen over the long-term. Moreover, the qualitative issue of such overly scarce human resources is also a critical issue, meeting only about 70% of the level required by companies in areas such as forensics and cryptology.

To resolve this quantitative shortage of information protection human resources, it is imperative to increase the absolute supply of human resources by providing various information protection curriculum which meet the level required by companies by increasing the portion of education for necessary proficiencies to solve qualitative issues.

It should be taken into account that this document writes about the demand and supply issues of human resources centering around information protection companies and that there are limitations because proficiency of information protection human resources have not been analyzed by level. To carry out a more in-depth level of research to solve such issues, it is necessary to conduct a quantitative analysis of all organizations that have information protection jobs and to analyze proficiency by level required by companies as well as to reflect these needs in the nurturing of information protection human resources.

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