

# Investigating Traceability Costs and Benefits in Food Supply Chain: Case Study in Serang City, Indonesia

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**Abstract** — Food demand is highly increased every year. Beside, consumers need a higher safety and transparency at the whole of food supply chain. Over the last decade, food safety and transparency had been significantly concerned by public and industry. Traceability is recognized as one of the critical instruments for assuring food safety and quality. In the business realm, the queries have been arisen from practitioners regarding perceiving costs and benefits of traceability system implementation. This study used sample of 30 food industries in Serang city, Indonesia, and analysed through path analysis. The result shown that perceiving the traceability both costs and benefits were relied on the traceability level implemented. Further, the respondents considered traceability costs in terms of material and label/packaging. In respect to specific benefits, food processors at the micro level were concerned on the market share and customer response.

**Key words:** *Food supply chain, traceability, traceability costs and benefits analysis*

## 1. Introduction

Small Medium Enterprises (SMEs) have an important and strategic role in the business. SMEs could survive when the severe economic crisis in 1997-1998 overflowed in Indonesia, yet those have been growing year by year.

**Table 1.** Total number of Micro and Small Enterprises in Indonesia 2010-2015

Year	Micro	Small
2015	3,385,851	283,022
2014	3,220,563	284,501
2013	2,887,015	531,351
2012	2,812,747	405,296
2011	2,554,787	424,284
2010	2,529,847	202,877

In 2015, as amount 5% the total number of micro enterprises improved compared with 2014. In

contrast, small enterprises had decreased started in both 2014 and 2015. This was affected by the movement of its business from small to big level. As one of the accelerators of Indonesian GDP, SMEs were accounted for 60.34% contributed to GDP in 2016, higher than previous year which only 57.84% [1]. Food sector is one of the accelerators contributing to Indonesian GDP. In the SMEs level, the total unit of micro level enterprises increased from 1,125,425 to 1,473,205 units [2]. The increase of food industries was relied on the food demand. However, as food demand increased, therefore consumers require a higher safety and transparency at the whole of food supply chain [3]. Hence, public and industry have significantly concerned on these issues [4]. Thus, such systems have been implemented to deal with these challenges. One of its systems is well-known as traceability. Traceability aspects have been recognized as a critical instrument for assuring food safety and quality [5].

Traceability is ability to trace the history, application or location of that which is under consideration [6]. This system is acknowledged as a practically trace and tracking the product from farm to fork. Since 2005, traceability system has been mandatory initiative for European food processors under EGFL (European General Food Law) No 178/2002 or in the US (Bioterrorism Act PL107-188). In Indonesia, traceability regulation is not straightforward as a traceability prerequisite. It is still involved in some regulations in particular food quality management such as halal food certification, and *Standar Nasional Indonesia* (Indonesian National Standard). This study concerned on traceability food supply chain in Serang city, Indonesia. However, the recent study focusing on implementing traceability in food supply chain in Serang city has been few, moreover, in specific traceability costs and benefits. The implementing traceability system in small and medium enterprises in Indonesian supply

chain is still limited and deal with barriers in the implementation [7]. It was affected by not only the level of adoption is still low among stakeholders in the supply chain, but either limited technology or legal framework which can enforce the practice of traceability.

Beyond as a merely food safety, traceability can also provide several benefits such as regulation, supply chain management, marketing, etc. As such, it is worth-mentioning that traceability is part of the food business system and thus has to be unified with logistic processes and good manufacturing practices. Though, in the business realm, decision-makers may not exhaustively understand the associated costs and/or benefits of traceability [9]. The implementing traceability costs are not relatively difficult to define, while, difficult to be measured. Numerous studies had summarized the kinds of traceability in specific costs. Variety of traceability costs such as equipment and software, changes in processes, training and on-going operating costs [10]. However, costs of traceability are depended on the characteristics of its firm such as regulatory environment, technology adopted, firm size, firm strategy and culture, characteristics of products and production processes, total number of information to be saved, as well as structure and complexity of the supply chain. Meanwhile, in terms of traceability benefits, these are also hard to be measured. Therefore, the adoption of traceability system in food supply chain has seemingly been weak. Nonetheless, few studies have addressed the measurement of costs and benefits of improved traceability [11].

Each company has different characteristics in terms of product complexities, production process complexities, and supply chain complexities. The firm characteristics describe the resources and situation of its company which determine naturally the traceability system implementation. This characteristic can be seen through several factors such as, regulatory imposition by government, type of quality management system, and several factors in supply chain stage. In particular government imposition, in fact, the firms implement voluntary law in force or even into the statutory of the traceability system, going beyond the law requirements [12]. Traceability system might rise up added-value as far as it goes beyond statutory norms. Thus, this study focused on whether or not imposition of implementing traceability by the government which represented by government imposition variable. Firm's traceability goals and its sources, such as adopted quality management systems (QMS) or firm size may effect on the balance of traceability costs and benefits [13]. Moreover, implementing the traceability system might be motivated by

complying with government regulations. When firms already have a QMS in place (e.g. ISO 9001:200) the cost of traceability will increased. In addition, either traceability costs or traceability benefits was depended on firm size [14]. Firm size can be measured with total asset, total sales or revenue. Each firm has different characteristic in nature of the products including harvest and packing location, diversity of supplier (DS), the raw materials are sourced (INPUT), and the stage of the product sold (DESTINATION).

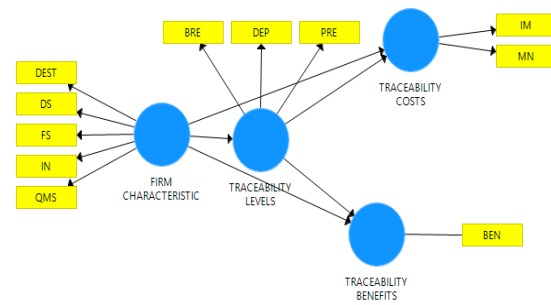
The firms expect efficiently implement and maintain the traceability system will perceive benefits over than costs. So, this study tried to convey what kinds of traceability system implementation or traceability level/capacity experienced by the food industries through empirical study. Some literature addressed that traceability level could be categorized into three levels, such as, breadth, precision, and depth. Breadth which intends to the level of attribute tracked and traced [6], and refers to what information is recorded for an individual input batch [3]. Traceability practices consist of data collection through the food chain [14], thus, its cost would be increase when operations are more complicated [13]. The complexity of food processing operations is referred to the way in which traceability records are stored by firm which practically unique, therefore, varying decisions with respect to the size of batches that are produced and food recall. Depth is how far back or forward the system can track the appropriate information. Thereof, to effectively run this matter, co-ordination forms, their complexity and the firm willingness to build long run relationships with other members of the chain, highly affect the opportunities to collect and manage information [12]. Shared information may distinct from strategic to tactical in nature, and from information concern on logistics activities to general market and customer information. Executing "Depth" simply could be seen in the recall process, in the case of small enterprises with shorter food supply chain, recall process is deficient costly and more effective [16]. Precision is the grade of assurance to identify a particular movement of good, a smaller unit analysis (such as individual cow or crate) will allow greater precision. Precision ordinarily defines as the smallest units that company can trace at the level input and output [3]. It pointed that precision as more directly related with cost, because of the larger interference of precision requirements with the flow of operation [3].

Determining costs and benefits of improved traceability through an empirical analysis is only a few studies. Those are also grossly lacking of

empirical evidence and quantitative evaluation. As such, in fact, traceability benefits are actually hard to grasp. It is caused by the strategic meaning [17]. However, traceability provides four potential benefits for business, including; Meeting regulatory requirement, recall and risk management: perception related to reduced risks; process improvements (efficiency and quality: improved customer service/response time), and supply chain operation [18]. In particular traceability costs both implementation and maintenance may have four categories such as time and effort (of workforce, administration and management), equipment, training, external consultant, materials, and certification and audit [3].

Recently, it has been little attention in the literature reviews regarding the analysis of the relationships between firm characteristics, the traceability level and costs and benefits of traceability [19]. This study will therefore examine whether or not the effect of firm characteristic on traceability costs and traceability benefits through traceability level which described as three dimensions such as precision, breadth, and depth by empirical analysis. Although, traceability is an essential catalyst of future system in food supply chain. There have been few researches in respect to traceability implementation experienced in Serang city, Indonesia. Also, paucity of research reflected the specific traceability both costs and benefits for both academics and practitioners. As literature reviews stated above, traceability costs and traceability benefits were influenced by firm characteristic associated to traceability level which is described as precision, breadth, and depth. Therefore, this study proposed hypothesis consist of:

- H1** = Firm Characteristic will effect on Traceability Costs
- H2** = Firm Characteristic will effect on Traceability Benefits
- H3** = Firm Characteristic will effect on Traceability Costs through Traceability Levels
- H4** = Firm Characteristic will effect on Traceability Benefits through Traceability Levels



**Figure 1.** Conceptual framework

Note: DEST (Destination), DS (Diversity of Suppliers), FS (Firm Size), IN (Input), BRE (Breadth), DEP (Depth), PRE (Precision), IM (Implementation), MN (Maintenance), and BEN (Benefits)

## 2. METHODOLOGY

This research used V-SEM (Variance-Structural Equation Modelling) PLS-path analysis by using SmartPLS 3. The study regarding traceability costs and benefits are still few and insufficiently grounded. Hence, for initial development and assessment phase of theory building, using PLS is advantageous. In addition, as a tough reason, path analysis used due to this study proposed the model that had exogenous variable (Firm Characteristics) connecting line with arrow at three endogenous variables (Traceability Levels, Traceability Costs and Benefits) with reflective indicators which aims to examine the effect both direct and indirect. Therefore, in respect to sample size, this study was appropriately used Path analysis (sample size less than 100 can be used for PLS) [20].

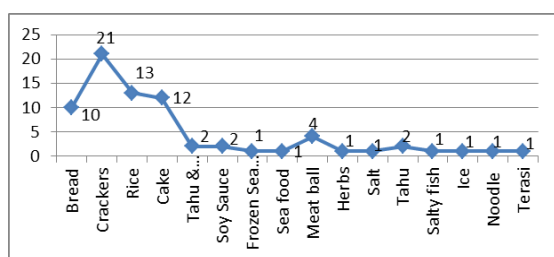
**Table 2.** Instrument Measurement [3]

Variable	Explanation	Measurement Scale	Value Scale
<b><i>Firm Characteristic:</i></b>			
Firm Size (FS)	Annual revenue categories (1: 0 - ≤\$22,300, 2: > \$22,300 - ≤ \$186,000, 3: > \$186,000 - ≤ \$3,700,000)	Rating scale	Min score: 1 Max score: 3
Input (IN)	Total number of different raw material types that are used in operation: wild, farm, and both. (Each reported raw material type adds a value of 1 to the score)	Ordinal scale	Min score: 1 Max score: 3
Diversity of Supplier (DS)	Total number of different regions from which raw materials are sourced: Serang city, Banten province, Java island, other island, Asean, Asia, EU/USA, other. (Each reported sourcing region adds a value of 1 to the score)	Ordinal scale	Min score: 1 Max score: 8
Destination (DEST)	Total number of different regions to which output is sold: Serang city, Banten province, Java island, other island, Asean, Asia, EU/USA, other. (Each reported destination region adds a value of 1 to the score)	Ordinal scale	Min score: 1 Max score: 8
Quality Management System (QMS)	Total number of food quality or safety assurance/management standard to which the firm is certified: Standard Nasional Indonesia/Indonesian National Standard, ISO 9001:2000 Quality Management System, ISO 22000:2005 Food Safety Management System, HACCP, MSC, ISO 14001 Environmental, IFS-International Food Standard, Others. (Each reported certification adds a value of 1 to the score)	Ordinal scale	Min score: 1 Max score: 8
Government Imposition (GI)	Whether or no imposition from the government in implementing traceability. Does a government (international, national, regional, provincial, or municipality) or a government agency impose the implementation of traceability system? (No: 0, Yes:1)	Ordinal scale	No: 0 Yes: 1
<b><i>Traceability Level:</i></b>			
Breadth (BRE)	Total number of information recorded for an individual input batch: supplier details, data an hour of product arrival, date of harvest, location (area) of harvest/farming, water quality classification, method of production, scientific name of the species, common name of the species, quantity, quality grading, others. (Each reported information recorded adds a value of 1 to the score)	Ordinal scale	Min score: 1 Max score: 11
Depth (DEP)	Ability to trace the input beyond the direct suppliers and buyer on a regular basis. The legal requirement is to be able to trace a product to the direct supplier of an input and direct buyer of an output. Are you able to trace your inputs beyond the direct suppliers and your outputs beyond direct buyers? (No: 0, Yes: 1)	Ordinal scale	No: 0 Yes: 1
Precision (PRE)	Ability to trace the smallest unit at the level input and output. Can you trace the smallest unit at the level input and output? (No:0, Yes:1)	Ordinal scale	No: 0 Yes: 1
<b><i>Traceability Cost:</i></b>			
Implementation (IM)	Overall implementation cost (1: Very low cost to 4: Very high cost)	Ordinal scale	Min score: 1 Max score: 4
Maintenance (MN)	Overall maintenance cost (1: Very low cost to 4: Very high cost)	Ordinal scale	Min score: 1 Max score: 4
<b><i>Traceability Benefit:</i></b>			
Overall Benefit (BEN)	Overall benefit (1: No benefit at all to 4: Great benefit)	Ordinal scale	Min score: 1 Max score: 4

In particular traceability costs and benefits. The survey also included a section set equal to 100 units to prop the result interpretation. How these 100 units delivered across the five categories of specific implementation costs, specific maintenance costs, and four categories of the traceability benefits.

### 3. DATA COLLECTION

Population of this study is food industries in Serang city, Indonesia. Serang city is geographically close to Sunda strait as an international sea line. Thus, transport of goods and services is easily accessing sea port. In land, it is supported by improving road infrastructure Serang – Palima – Pakupatan (in the city), Bayangkara – Cilaku – Pakupatan – Palima, Serang – Cilaku, south circle (TB Suwandi) – Sayabulu – Serang – Palima. The most important is improving the highway of east Serang – Sudirman, Serang – Cilegon (highway of west Serang), and Serang – Pandeglang. The circumstance of supply chain in Serang city basically cannot be separated with the improvement of supply chain both regionally and nationally. Anomaly occurred on food commodity, and then cause on high cost due to logistics system has not been involved in supply chain management cycle. There were 75 food industries which had labor more than 10 [31].



**Figure 2.** Total number food industries that had > 10 labor in Serang city, Indonesia

Purposive sampling was used in this research. The criteria on this research were food processors, those were located in Serang city, and had been operating in more than two years. The difficulty in collecting data had been occurred. One of the problems was the respondents believed that information of firm characteristics and traceability system was confidential, they were inconvenience to share. Nevertheless, there were 30 companies accepted to answer the questionnaire. Those were 21 cracker companies and 9 bread factories. The questionnaire was prepared in Bahasa Indonesia and was distributed by hardcopy.

## 4. EMPIRICAL RESULTS

### 4.1 Firm Characteristic

Almost 73% of the respondents had annual revenue below \$22,300. And the rest had revenue \$22,300 - \$186,000. The majority of the respondents were micro business level. On average 47% of the respondents had 5-19 employees, and with 43% of them were 20-99 employees. In total, 93% of the respondents have been operating the business realm > 5 years. However, 80% of sample manufactured product at least one “processed-food”. More than 60% of them supplied the raw material from Serang city, 23% from other regency such as Pandeglang and Lebak regency. Beside, approximately 37% had the only one supplier, 27% of them had 2 suppliers, and 7% had 5 suppliers.

All of respondents strikingly answered that no imposition at all by the government. An average, accounted for 50% had certified particularly in quality management, but it was not straightforward into traceability system. Some respondents were certified by halal certification, and *P-IRT* (home industry certification) as well as *BPOM* (food safety certification). While, sold under the company’s brand name to the final customers gave 67% observed. 13% of the respondents sold under licensing agreement for another brand name. In total, 20% of the respondents sold to buyer without any direct brand name involvement in contract. In total, 17% of the respondents sold to wholesale market, 23% to wholesale, 33% to local food shop, 3% to food service chain, 7% of them sold to restaurant, and to institution surveyed almost 7%, as well as 10% to others.

### 4.2 Traceability System

Almost 47% of the respondents recorded information of input, and the rest even did not record any information. Information which recorded consists of, supplier detail, data and hour of the product arrival, quantity, and quality grading. It was 63% of the respondents considered had ability to trace the smallest unit at the input and output level and with 37% unable to trace. The biggest number approximately 43% both level input and output is in one day production. In total, 80% of the respondents could trace-back beyond the direct suppliers on a regular basis, and with 20% of them were unable to trace-back. While 70% of the respondents could trace-forward beyond the direct buyer on the regular basis, and only accounted for 30% unable to trace-forward.



### 4.3 Traceability Costs and Benefits

In respect to traceability costs specific implementation, the biggest number approximately 40% of the respondents concerned on material category, and 22% to production line, supervisory staff and managerial /administrative time. In total 17% paid attention on purchase new equipment and software. Approximately 11% surveyed in particular certification, audit, and external consultation. In terms of traceability maintenance costs, almost 47% distributed to label/packaging category, and accounted for 21% to specific challenges, upgrade hygiene, and labeling legislation. On-going training for new staff reported as 22% of the respondents answer. In total 9% of the respondents notified to upgrades and service contracts. In addition, only 1% delivered to repeat audit/certification. The last, in specific benefits, the biggest percentage around 42% of the respondents focused on market share and customer response, and 38% perceived from reducing customers complaint, recall, and risks or product liability.

### 4.4 Measurement evaluation (outer) model

The correlation among indicator and its construct will be shown in the following figure.

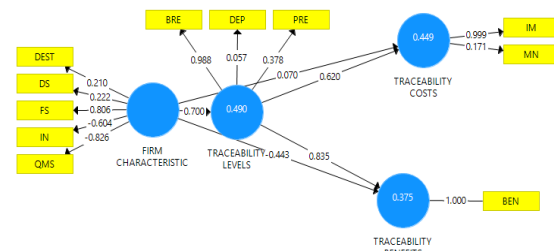


Figure 4. Path Model

Based on the outer loading above, Indicators which meet loading  $> 0.70$  are FS (0.806), BRE (0.988), IM (0.999), and BEN (1.000). Therefore, indicators  $< 0.70$  are IN (-0.604), DS (0.222), DEST (0.210), QMS (0.826), DEP (0.057), PRE (0.378), and MN (0.171), thus would be dropped-out from the model.

### 4.5 Hypothesis Test

In the following hypothesis analysis will only discuss in specific indicator which met significant of each construct such as, Firm Characteristics (Firm Size=FS), Traceability Level (Breadth=BRE), Traceability Costs (Implementation=IM), and Traceability Benefits (Overall Benefits=BEN). Path coefficients shown on Table 7 below then would be interpreted based on information obtained through survey.

Table 3. Path Coefficients

	Original sample (o)	Sample mean (m)	Standard error (sterr)	T statistics
Firm Characteristic $\rightarrow$ Traceability Cost	-0.185	-0.130	0.310	0.598
Firm Characteristic $\rightarrow$ Traceability Benefit	-0.281	-0.204	0.386	0.728
Firm Characteristic $\rightarrow$ Traceability Level	0.637	0.641	0.152	4.197
Traceability Level $\rightarrow$ Traceability Costs	0.800	0.756	0.221	3.619
Traceability Level $\rightarrow$ Traceability Benefits	0.670	0.595	0.304	2.206

#### 4.5.1 H1 = Firm Characteristic will effect on Traceability Costs

As a result, firm characteristics has no direct effect on traceability costs with coefficient parameter -0.185 and t-statistics 0.598 (t table significant 5%) lower than t-table 1.96. Therefore, H1 is rejected. Firm characteristics were not been found to significantly link to traceability costs. Moreover, it is noteworthy that firm characteristics were found to be only weakly linked with the costs.

This observation can be concluded that designing the traceability system at the industry level is intended to be applied in a "One size fits all" manner [3]. Traceability system implementation can be well-integrated based on the resources setting, objectives, or further stated as its traceability level with respect to information record-keeping, ability to trace at the smallest unit, and ability to trace to direct supplier or buyer. Then, it can perceive the traceability costs. Furthermore, the only firm characteristics cannot effect directly on the traceability costs. The result may occurred due to the respondents had lack of information about their firm characteristics in particular firm size, and the traceability systems as

well as knowledge how to implement it [25]-[15], or further measurement issue specially in implementation costs of traceability because of difficult to be grasped [27].

#### 4.5.2 *H2 = Firm Characteristic will effect on Traceability Benefits*

The coefficient parameter of firm characteristics  $\rightarrow$  traceability benefits is -0.281 with t-statistics as 0.728 (t table significant 5% = 1.96), t-statistics value lower than t table 1.96. Thus, there is no effect between firm characteristics  $\rightarrow$  traceability benefits. It is concluded that H2 is rejected. This result propped the prior research, ref. [11] refers that firm characteristics are not extremely correlated with any specific benefit due to measurement issue. Many benefits are difficult to assess [3]. The respondents deemed that traceability benefits will be perceived when traceability system has been well-operated. In respect to the firm size, the observation was accounted for 73% of the respondents had annual revenue below \$22,300, meaning that the samples are micro business level. It was clear that traceability benefits were more possibly to be perceived by larger firm [27]. This is the reason why the firm characteristics which reflected by micro size enterprises unable effecting on traceability benefits directly.

#### 4.5.3 *H3 = Firm Characteristic will effect on Traceability Cost through Traceability Level*

Based on the coefficient parameter value of direct firm characteristics  $\rightarrow$  traceability costs is -0.185. Whereas, firm characteristics  $\rightarrow$  traceability level at 0.637 with (t-statistics 4.197 > t table 1.96), and traceability level  $\rightarrow$  traceability costs is 0.800 with (t-statistics 3.619 > t table 1.96). While, the coefficient parameter value of indirect effect firm characteristics  $\rightarrow$  traceability level  $\rightarrow$  traceability costs is 0.637 x (0.800) = 0.510. Therefore, firm characteristics better indirectly effect on traceability costs due to the coefficient parameter value of indirect effect is bigger than direct effect. As a result, thus H3 is accepted. Traceability level that was reflected by breadth was found significantly to increase implementation cost of traceability [3]. It concluded that firms' incentives for implementing traceability system are straightforward to assess costs. Hence, it proved that traceability level varies greatly among operators depending on the business activity, stage in the supply chain, and applicable legislation.

This study observed that respondents recorded suppliers' detail, data and hour of product arrival, quantity, and quality grading at the level input.

Almost 40% recorded suppliers' detail. It proved that there were no lots of information type recorded. In terms of implementation costs of traceability, the biggest number approximately 40% of the respondents concerned on material category. Ref. [22] refers that traceability has brought about an increase in the costs of raw materials and greater flow information to be managed. Sum up, firm characteristics indicator that was presented by micro level companies, seemingly, could only record suppliers' detail, thus perceived implementation costs focused on material category. The respondents considered material category became burden was likely seen a tangible cost, thus, easily to be perceived. As such, cost disadvantage experienced by these companies size in implementing traceability system [25]-[26].

#### 4.5.4 *H4 = Firm Characteristic will effect on Traceability Benefits through Traceability Level*

The value of coefficient parameter between firm characteristics  $\rightarrow$  traceability benefits is -0.281. Besides, firm characteristics  $\rightarrow$  traceability level at 0.637 with (t-statistics 4.197 > t table 1.96), and traceability level  $\rightarrow$  traceability benefits is 0.670 with (t-statistics 2.206 > t table 1.96). While, the coefficient parameter value of indirect effect and the value of indirect effect firm characteristics  $\rightarrow$  traceability level  $\rightarrow$  traceability benefits is 0.637 x (0.670) = 0.427. As such, it can be concluded that firm characteristics can be better indirectly effect on traceability benefits. Therefore, it is believed that H4 is accepted. Ref. [14] refers that traceability benefits were depended on firm size. In addition, Ref. [3] confirmed that breadth was found to be significantly and positively related to the overall benefits of the traceability. This result shown that traceability practices consist of data collection through the food chain [14], also, information management which is included either in logistics or strategic issues [12]. A basic requirement for designing an effective traceability system is to determine the information which needs to be traced [19]. The matching of buyer's purchasing needs happens through the market and the choice of the product is made from time to time [12].

In total, around 47% of the respondents concerned on market share and customer response. This espouses Ref. [3] stated that traceability benefits in particular increasing market share or accessing new markets had been overly optimistic on the benefits side. Traceability has not only improved the overall quality of the product, but has also led to enhancement of the company image, and has guaranteed an increase in turnover and market share [22]. Contemporary food supply chain should adequately provide information that consumers and

other members need to know such as variety of food attributes, country of origin, and so on, then would increase consumer confidence in food to make good choice [24].

Ref. [15] refers that in the case of small enterprises, an efficient paper-based traceability system able to effectively trace product. This indicates that there is no need of introducing expensive and complicated traceability systems (for small producers). Furthermore, this study confirmed that micro-level-companies able to perceive traceability benefits through recordkeeping at the level input.

#### 4.6 Summary

Based on the result that presented above through hypothesis test, it may be concluded in detail that the indicator which represents firm characteristics was only firm size. In terms of traceability level, it was signified by breadth. Whereas implementation indicator had significantly represented traceability costs, meanwhile, indeed overall benefit presented as a representative of traceability benefits. As a last remark, firm characteristics had no effect directly on either traceability costs or traceability benefits. While, firm characteristics affected indirectly on both traceability costs and traceability benefits through traceability level. Further,

### 5. CONCLUSION

Based on the result, it proved that food industries in Serang city only sourced the processed food as raw material rather than wild or farmed. The majority of the respondents obtained raw material from Serang city. It can be stated that the distribution of the raw material would not need a long time. So the companies could easily manage the stock for production. It is also strongly seen that most of the food industries in Serang city had only one supplier. Therefore, it could easily manage the information by keeping the data of the supplier at the input level. Additionally, food industries in Serang city sold the product under the company's brand name to the final consumer. This can be concluded that the companies conducted the label and packaging in the internal, meaning that there are no many actors get involved in this stage. Last, mostly the product sold to the local food shop to other region for expanding the market, there were also sold to wholesaler (big market) in Serang city.

Turning into the hypothesis test, based on the data analysis, firm characteristics had no effect directly on both traceability costs and benefits. However, firm characteristics significantly effected on the traceability both costs and benefits through traceability level. Perceiving the traceability costs and traceability benefits were experienced by food processors represented by cracker and bread factory

being driven by traceability level implemented, although without imposition by the government. It was accounted for 73% of the respondents had annual revenue below \$22,300. At this level, food processors seemingly only recorded suppliers' detail, data and hour of product arrival, quantity, and quality grading, indeed, by paper-based. Further, in terms of traceability costs, around 40% of the respondents concerned on material category in implementation stage. The respondents likely considered that this kind of cost was tangible. Whereas, concerning specific benefit, food processors extremely paid attention into market share and customer response category which almost accounted for 47% observed, it was most highly rated. As such with limit knowledge and experience in traceability system, this particular size of industries are relatively overestimated on market share and customer response, as well as a tremendous costly at the material category. Furthermore, this study conclude that micro level companies could implement traceability system through only recording information at the level input, rather than upward or backward tracing, or even the smallest unit per batch/lot. Thereupon, food processor had ability to exhaustively comprehend the market and customer response. This indicates that in the case of small enterprises, an efficient paper-based traceability system could enable to effectively trace product.

### 6. ACKNOWLEDGEMENT

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