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ARTICLE

Exploring the Staging Patterns of MNC Entry to New Markets: The Resource Leverage Approach

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ABSTRACT

This study aims at providing explanations for how MNCs (multinational companies) proceed with their manipulation of resources and competencies in the entry process to a foreign market. To an increasing extent, such processes perform as a staging process of resource leverage. This study identifies three stages, using the multiple case study incorporating grounded theory: the initial stage, the adaptive intensification stage, and the advantage persistence stage. In the initial stage, an MNC's entry decision tends to be based on the resource replication mode of resource leverage; the resource exploitation mode of resource leverage is used mainly in the adaptive intensification stage, and the resource exploration mode is used in the advantage persistence stage. This study suggests that these resource leverage modes incorporating their microfoundations can be viewed as a set of potential measurements for examining MNCs' dynamic capabilities in the entry process to a new host market.

1. Introduction

It is commonly believed that international diversification can enable a firm to capitalize on business opportunities and diversify risks in the global market. In such a process, the dynamic capabilities view (DCV) suggests that an international firm's diversification is built by extending its existing resources, which would be primarily meritorious^[1]. Teece suggests that one critical strategic function of executives in a firm is the generation of innovations to match market signals through allocating (and reallocating) and combining (and recombining) the firm's resources and assets^[2]. Such a suggestion regarding the field of entry decision (or entry process) of international firms; however, the assumption on how their resource or-

chestration leads to business success is quite general. As DCV research is significantly silent in this field, contributing to a better understanding on how an international firm manipulates its resource base in the global entry process is thus considered necessary.

In this study, we argue that resource leverage is an essential approach to a multinational company's (MNC) resource orchestration in the process of global entry. Combs et al. define resource leverage as a series of actions that aim at creating a firm's value based on its existing resources^[3], in which firms untangle knowledge, alter knowledge, and integrate knowledge with other kinds of knowledge to achieve innovation^[4]. From a view of diversification, McEvily et al. stress that resource leverage as the primary approach to firms' exploitation of existing

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competencies and resources entails the transfer of organizational knowledge or capabilities to different organizational units, new products and wider geographic markets^[5].

In addition, resource leverage enables a firm with capabilities to adapt to new markets. For MNCs, market adaptation is an essential challenge as they have to operate in contexts that differ to their home market in terms of culture, technological applications, laws, policies, etc^[6]. Market adaptation requires firms to modify and reconfigure their resources to respond to the changes in different markets^[7,8]. Considering an international firm has higher capabilities in resource leverage, it would more easily fit in a foreign market, and hence have the ability to outperform its rivals.

This study aims to elaborate on how MNCs proceed with their manipulation of resources and competences in the entry process to a new geographical market. We examine the changes in how MNCs conduct resource leverage during the potentially dynamic entry process in order to adapt to a specific global market. In essence, our explanations underline organizational ambidexterity with contributions to understanding the processual patterns for the interplay of resource development and market adaptation of MNCs.

We organize the paper as follows: First, we review market entry strategies of MNCs and the DCV with a focus on resource leverage to form the theoretical base for this study. Second, regarding the research method used in this paper, we note how we collect and proceed with the data analysis. We then present the empirical results and analysis. Finally, this paper discusses the findings and implications of the study.

2. Theoretical Backgrounds

2.1 Entry Strategies of MNCs

Internationalization is perceived as an ongoing strategic process of international firms^[9]. In this process, selecting the best market entry mode is crucial because it significantly impacts a firm's internationalization performance^[10] and determines its success^[11,12]. Therefore, research on market entry strategy has attracted attention in seeking to reveal the determining factors of MNCs' entry decisions. These factors may range from tacit knowledge to home country-related factors^[13,14,15].

In line with this stream of research, some authors suggest that a firm's internationalization performance is simultaneously influenced by a set of internal and external changing factors, which requires considering multiple factors rather than any specific individual factor for en-

try mode decisions. Therefore, there may be some cases where a firm adopts an entry mode that is not an optimal selection for a specific business unit, but instead aims to maximize value for the whole corporation^[16]. Additionally, recent empirical studies have been conducted to examine the antecedents to entry mode choice in a new type of firms, known as born global firms or international new ventures, which are featured by their internationalization operation from the inception^[17,18].

Several extant popular theories on entry mode choice include transaction cost theory, eclectic theory, organizational capability perspective, and network perspective^[18,19]. Each theory suggests different determining factors behind entry mode decisions, based on respective underlying assumptions. To be more specific, transaction cost theory focuses on cost minimization in resource transactions, eclectic theory focuses on a comprehensive consideration of multiple factors, organization capabilities on the value of a firm's resource, and network perspective deals involving interactions between firms and their global connection.

Nevertheless, these theories of market entry are criticized as quite static views when they focus only on the initial stage of entry^[9,20]. As stated by Kim and Hwang, when a firm expands internationally, it may have strategic motivations that are not limited to the selection of the most efficient entry mode^[21]. New market opportunities are no doubt an important motivation for a firm's internationalization strategy. In this theme, as the new market differs from the firm's domestic market, changing to adapt to the host country is inevitable for the firm to succeed. Furthermore, as the business environment is changing, market adaptation requires firms to constantly reconfigure their resource base to match and create change in the business's environment^[22,23]. This implies that successful market entry of MNCs in a new foreign market should be associated with stages of resource reconfiguration. Therefore, the issue of MNCs' market entry needs to be examined under a more dynamic perspective.

In fact, a dynamic approach to MNCs' market entry has also been suggested in some research. For example, the establishment chain perspective describes entry mode decision as a time dependent process^[24], in which a particular stage is the outcome of some prior stages^[25]. Song indicates that an MNC's operation in its host country contains a series of activities of competence development in which a prior stage serves as a platform for later stages^[26,27]. Further, Chang and Rosenzweig^[28], Guillen^[29], and Decker and Zhao^[30] posit that foreign direct investment (FDI) entries might be best understood as a series of sequential decisions associated with resource transfers

among countries. In line with this, Madhok indicates that a frequent balance between exploitation and development of organizational capabilities is necessary for successful market entry of MNCs^[31]. Also, some scholars view foreign market entry as an integrated process of both exploiting home-based knowledge and exploring host-country specific new knowledge^[32,33,34,35,36].

Recently, Efrat et al. emphasize the role of export dynamic capabilities (i.e., adaptability, innovativeness, unpredictability, and task-flexibility) in the allocation and reconfiguration of a firm's existing resources and competences to align with changes and opportunities in its external environment^[17]. Grøgaard et al. posit that resource combination capability will help MNCs to deal not only with the requirements of local responsiveness, but also the pressure of global integration in seeking to achieve cost efficiency^[37]. Additionally, Panibratov and Klishevich posits that adaptability capability helps a company overcome unpredicted situations in a changing environment, innovation capability and absorptive capability help a firm to understand and become more responsive to local markets, and alliancing capability facilitates the development of technology in a firm's initial stage of entering a new foreign market^[38].

Although the issue of market entry strategy of MNCs has been approached under a dynamic aspect in some research, when stating that market entry strategy is a multi-stage process by which firms use their internal competences to deal with external business environment, it has not been clarified how MNCs manipulate their internal resources in accordance with the external environment. Based on the DCV, we consider that obtaining sustained performance in a foreign market requires MNCs' ability to constantly leverage and transform its resources for new resource configurations that fit the local market. Therefore, in this study, we investigate the patterns of resource leverage that MNCs conduct to adapt to a new foreign market.

2.2 Dynamic Capabilities View

Dynamic capability is "the capacity of an organization to purposely create, extend, or modify its resource base"^[39,4]. The word "capacity" refers to the ability to perform a task in at least a minimally acceptable manner. Thus, if an organization has a specific dynamic capability, it can technically perform a certain activity with a high, moderate or minimally satisfactory level. The phrase "purposefully create, extend, or modify" in this definition implies that dynamic capabilities relate specifically to activities that can initiate changes to a firm's resource base in order to respond to a given context, and not apply to operational

capabilities that relate to the performance of daily activities in the organization. Similarly, Teece et al. define dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environment"^[1: 516]. Eisenhardt and Martin state that dynamic capabilities are a firm's processes that alter the other processes in the firm to match and even create market change^[40].

Dynamic capabilities are increasingly considered as a source of a firm's competitive advantage and even sustained competitive advantage in a changing environment. However, dynamic capabilities per se are not necessarily considered an immediate determinant to a firm's performance^[40,41]. According to Helfat et al., the performance of a dynamic capability is measured by two yardsticks: technical fitness and evolutionary fitness^[39]. Technical fitness indicates how effectively dynamic capability performs its function. Evolutionary fitness refers to how well dynamic capability matches market demand. Therefore, if a firm can exercise its dynamic capability in a highly technical way when there is no demand for this capability in the market, the firm will still not succeed. For this reason, market fitness can be considered as the link between dynamic capabilities and a firm's performance^[42,43]. Still, as Barreto's discussion^[44], for the DCV, how dynamic capabilities are operationalized, especially for developing the measurement of dynamic capabilities microfoundations, will be a necessary agenda for future research.

In a famous framework of dynamic capabilities designed by Teece^[2], he explained the mechanism by which firm performance is created from dynamic capabilities. Accordingly, dynamic capabilities are divided into three main groups: sense, seize and transformation (or reconfiguration). Sense capability refers to a firm's ability to scan and create (shape) new business opportunities. Seize capability relates to a firm's ability to transform a new business opportunity that a firm has identified into a new innovation and offer it to the market. Transformation (or reconfiguration) is a firm's ability to reconfigure its current resource base to maintain its existing advantage, as well as to generate new resource configurations in response to change, and even create change in the market. Firms need to implement sense, seize and transformation concurrently and constantly in order to ensure sustained performance.

To sum up, dynamic capabilities refer to a firm's ability to constantly modify its resource base in order to respond to market change. The performance of a dynamic capability is measured by technical fitness and evolutionary fitness. Firms that exercise their dynamic capabilities at a higher level can offer innovations with better market fitness than their competitors, in turn, leading to competitive

advantage.

2.3 Resource Leverage

Resource leverage refers to a firm's effort to get the most out of its resources^[45,46,47]. Many scholars posit that while firms' technological competences are fungible, they are often not fully utilized, and consequently not all value is extracted from them^[48,49]. Therefore, by leveraging a firm's existing competences, the firm will create more innovations, thereby obtaining incremental profits and avenues for growth and renewal. In addition, in the current changing environment, leveraging resources is considered the fastest and least expensive way for firms to adapt to the market.

A firm's resources can be leveraged in many ways. A few researchers state that the actions taken to leverage strategic resources can affect the extent to which the resources affect firm performance^[50]. According to Hamel and Prahalad's typology^[45], a firm can leverage its resources by concentrating, accumulating, complementing and conserving them. From the resource-based approach, leveraging by resource recombination has received much interest from researchers. Resource recombination refers to a firm's ability to combine knowledge in different fields and transform them into a new configuration. The term resource recombination runs parallel to the term complementing resource as used by Hamel and Prahalad^[45]. Kogut and Zander use the term combinative capability to signify the "intersection of the capability of the firm to exploit its knowledge and the unexplored potential of the technology"^[51]. In line with this, Kodama introduced the concept of technology fusion^[52] and Grant uses the term knowledge integration in regard to the generation of innovation by combining a firm's different existing technology or knowledge^[53].

Leveraging a resource includes a series of sub-processes. Galunic and Rodan postulate that leveraging resources entail a sequential process of untangling, altering, and integrating knowledge with other knowledge and then transforming them into a new innovation^[54]. Sirmon et al. state that a firm can extend its existing resources or knowledge to additional applications in other market settings by leveraging the same capabilities across different products and industries to serve other customers with similar needs; using the knowledge gained by serving customer needs to sell other goods or services to that customer to serve different needs; and learning how to apply the firm's market segment-oriented expertise developed by leveraging its capabilities to meet the expectations of additional customers^[55].

The ability to leverage resources is largely considered

a practical kind of dynamic capabilities. According to Galunic and Eisenhardt^[56], a firm's effort in leveraging its competences by using its capability of resource recombination is of growing importance in the quest to achieve dynamic capabilities. Resource leverage, as mentioned above, includes a series of activities in terms of changing a firm's resources in order to respond to external market opportunities. Chatzkel^[57] and Winter^[58] state that leveraging processes play a critical role in matching a firm's internal capabilities with its external environment, whereby market fitness and even competitive advantage are achieved through the creation of new idiosyncratic configurations that the market needs. Liao, in his recent research on the relationship between resource investment and firm performance conducted on small and medium enterprises in Taiwan, states that R&D leverage is an important dynamic capability that moderates such a relationship^[59].

In total, resource leverage examined in this study refers to a firm's ability to exploit more value from its current advantage, based on the combination of different resources, competencies, and knowledge. Resource leverage is comprised of a series of sub-processes. Resource leverage is a firm's dynamic capability to the extent that resource leverage helps create change in a firm's internal resource base in accordance with its external environment.

3. Methods

In the research, we used a qualitative multiple case study approach with constructivist grounded theory in data analysis to guide theory development (refer to Figure 1: Research Methodology Flowchart). Grounded theory is a method of research that enables researchers to construct a theory by gathering and analyzing data. Punch defines grounded theory as "a research strategy whose purpose is to generate theory from data"^[60]. This method of research develops a theoretical framework in an inductive manner rather than deductive approach^[61]. Grounded theory has been popular among researchers in the field of management due to its ability to build theory that is directly relevant to the interest of practitioners, to discover the social relationships and behavior of groups that have been subject to little exploration^[62], and to reveal even the most complicated processes in their actual settings^[63]. With this research approach, theory is developed from a real context, so it is more likely to offer insights into the nature of the research objective and hence enable researchers to infer a better explanation of the research phenomena, as well as provide a sound guide for businesses in practice^[64].

In this study, a survey of eight MNCs was conducted to explore the process by which these MNCs manipulate their resource base in a new foreign market. These com-

panies come from different fields of business, including Arcadyan (the communications industry, surveyed in Taiwan), Gemtek Technology (communications, Taiwan), Neweb (online payment services, Taiwan), Vinamilk (dairy products, Vietnam), FrieslandCampina (dairy products, Vietnam), Wacoal (lingerie, Vietnam), YCH Protrade (logistics and supply chain management services, Vietnam), AstraZeneca (biopharmaceuticals, Vietnam). The diverse sample of companies is selected to provide many possibilities for comparison, thereby enabling a richer development of theory. The information on the companies can be found in the appendix of this paper.

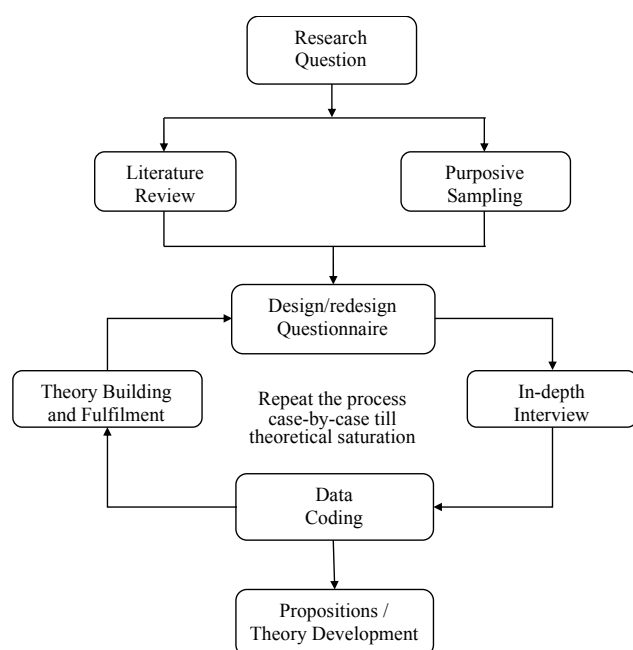


Figure 1. The Research Methodology Flowchart

In the survey, we conducted in-depth interviews with the participant companies' senior managers who had a comprehensive understanding of what their companies did to expand into new foreign markets from the beginning. In the interviews, semi-structured questions were applied so that we could further explore the interviewees' response, as well as discuss and raise issues that we might not have considered before. The interviews took place in Taiwan and Vietnam. While all these managers can speak English fluently, the interviews were conducted in the interviewees' mother tongue so that they felt more comfortable to share their companies' stories, and the interviewers could also obtain greater in-depth information.

We had Taiwanese and Vietnamese interviewers who were in charge of the interviews with Taiwanese and Vietnamese respondents, respectively. The interviews commonly lasted from 60 to 90 minutes, tape-recorded and then transcribed for analysis. The information of the

internationalization process of these companies was compared and arranged according to their themes. In addition, we also accessed the companies' websites to glean more information of these companies. Combined with the information from the interviews, we could better understand the strategies which these companies used to obtain performance-related information in local markets.

4. Findings

From our interviews, the market entry process of these MNCs was identified to have three main stages: an initial stage when MNCs first entered a new market, followed by a stage of intensified adaptation when they became familiar with business practice in the host country, and finally the stage when the firms' efforts were directed to maintain their performance in the local market. At each stage of entry, these MNCs had a specific way to leverage their resource base.

4.1 Resource Replication

In the initial entry stage, due to insufficient knowledge and experience in a new foreign market, the MNCs tended to begin their business with the current advantageous products and services from the home country. Therefore, the primary strategy implemented by these MNCs in the local market was a replication of their home country advantages. For example, exporting original products or services to the local markets, like Vinamilk and AstraZeneca, who exported their products to Cambodia and Vietnam, respectively. In addition, replication was also conducted by transferring the firms' existing knowledge from the home country to the local subsidiaries, so that they were able to offer the original products and services in the host market by themselves. One example of knowledge transfer was summarized by a Wacoal manager as follows:

In the beginning, we had around twenty employees. We were sent to Japan for training. At first, we were introduced to the basic regulations in a garment factory in the head office; then we were brought to the factory to become involved in the actual work. We studied by groups; the production management group learned about production management, the mechanical group learned mechanics from tutors, etc. We practiced as if we were real workers; they involved us in these jobs as they wanted us to know that these were the jobs that needed to be done every day, and every worker had to go through such work. As a garment company, everyone must learn how to sew, even if you were a production manager and never touched sewing ... Then, the experts of the parent company and we came back to the subsidiary in Vietnam to train other local em-

ployees.

Similarly, in the case of AstraZeneca, to deliver their drugs to the Vietnamese market, local employees were trained by experienced managers from AstraZeneca. As one local manager of AstraZeneca stated,

The training was focused on two main contents: information about the drugs and marketing skills. Information about the drugs was the same for every country, but for marketing skills, based on the global knowledge, we had to make necessary adjustments to match the local market. For example, when we organized conferences to introduce our drugs, we would consider who should be invited to participate in the conference, which activities should be held at the conference, where the conference should be held (in a hospital, or at a certain conference center), what evidence should be presented to convince the conference regarding the effectiveness of the drug, and which key messages should be focused to convince customers of the efficacy of the drugs.

The FrieslandCampina manager recounted the initial knowledge transfer in their company, “At that time, the local staff in the technical department was sent to the parent company for training. They were trained in production, laboratory, and technical issues. Afterwards, these employees would train the other local staff in the company”. He added, “regarding the formula of the product, in the beginning, we used the formula from the parent company.”

From the sample of our investigation, it can be seen that the type of knowledge transferred from the home country to the local market differs among different firms. For example, Wacoal focused on technological knowledge as they wanted to build factories in the host country when entering the initial stage. Thus, they trained people with technical skills to operate the machinery and equipment. For AstraZeneca, on another, due to the special nature of the pharmaceutical industry, the Company did not build production factories in the local market; instead, they focused on training local employees with marketing skills so that the local subsidiary could quickly introduce its products to the domestic market. Furthermore, in this stage of entry, besides relying on the core competences of the parent company, MNCs also needed local people to help them adapt quickly to the local market. As one manager from FrieslandCampina stated,

We did marketing and sales by ourselves, as the parent company had experience in dealing with modern distribution channels such as supermarkets, whereas in Vietnam, traditional distribution channels like traditional markets, small grocery stores were very popular.

Despite the effort to replicate the original advantage

to access the host market, these MNCs were not so concerned about revenue and profit in this stage of entry. Instead, they prioritized understanding domestic consumers, accumulating experience in doing business in the local market, and quickly introducing their products and brands to the local market. This was manifested by their effort to build relationships with strategic partners in the local market such as local distributors and influential customers, or to hire local experienced employees. For example, in the case of Neweb, they made an alliance with Yahoo, a big local company in providing online payment service in the Chinese market. Through the provision of services relating to technology for Yahoo, Neweb gradually gained insights into the local business practices and increased their awareness of local customers regarding their brand, which served as a stepping stone for their later growth in China. As one Neweb manager said,

By this chance, the process by which we engaged in the Chinese market was smooth and successful. Step by step, we gradually learned and obtained knowledge of the Chinese ecommerce market, such as the issues of online shopping services, customer behaviors towards online shopping, and the commodity supply chain. From the co-operation with Yahoo, we indeed filled our knowledge gap for the Chinese market, and we had a strong partnership and obtained high reputation in both Taiwan and China.

Vinamilk also made an alliance with a local distributor when they initially entered the Cambodia market. In this relationship, Vinamilk sold their products only to this local distributor, and then the local distributor distributed Vinamilk's products to the local market by himself. According to one manager of Vinamilk,

...for us, initially, finding a qualified distributor to distribute our products in the Cambodian market was our goal. At that time, we had not set a goal that we would work directly with local supermarkets or other low-level distributors even though we knew that if we worked directly with them, we would earn higher profit because we could save commissions that we had to pay these intermediaries, and would be able to compete with other local suppliers.

In the alliance with the local partner, Vinamilk accepted sacrificing their profit:

Normally, the company's expected profit for traditional export was 20%; now we accepted a profit of 5% or even 0% in the first three years, and used the remaining 15% profit to invest in the local distributor. If we wanted them to position our product at the price we wanted, we had to reduce the price and our profits must be lower, so the distributor would be willing to cooperate with us.

Through the alliance with the local partner, Vinamilk

could understand the local customers. One Vinamilk manager stated,

The relationship between the local distributor and us was exporter and importer or seller and buyer, but our responsibility did not terminate when we delivered the products to the local distributor. Instead, we built a close relationship with this distributor by an intensive aftersales service. For example, we instructed him to transport and store the product, assisted him in dealing with the complaints from customers about the product, and we received feedback about the product taste from the local customers through this local distributor.

Learning and accumulating knowledge of the local market in this stage is a rather long-term period and challenging to MNCs. In this process, they may encounter mistakes and failures. This unfavorable experience, however, is useful for their success in the later stage. In the case of Wacoal, for example, after the factory was ready to go into operation, this company produced and sold their products to the local consumers. However, they were not successful as their product price was relatively higher than the majority of the local customer's affordability at that time. As a result, Wacoal decided to postpone their sales in the local market, focus on manufacturing and exporting their products to the other foreign branches, like Thailand, Japan, Singapore. In 2006, Wacoal came back to their original plan when they realized promising economic signals in the Vietnamese market. They conducted intensive market research, surveys, and product tests to prepare for the sale of their products in the local market again.

4.2 Resource Exploitation: Combination with Local and Home

After the initial entry, MNCs show their aggressiveness and commitment toward seizing market opportunities in the local market.

Broadening or offering a more applicable set of portfolios of resource recombination was conducted by the firms. FrieslandCampina broadened its product portfolios by adding a nutritious milk product line to their product portfolio, including powdered milk for children from one to three years and formula milk for infants and children under twelve months. These new products had already been traded in FrieslandCampina's home country and in other foreign branches for a long time. In Vietnam, however, it took the company around five years to prepare for the production and sales of the new product line in the local market due to the strict requirements for product quality from the local government. As stated by one FrieslandCampina manager,

If we want to produce and sell this kind of product, we

have to have a factory that satisfies the standard requirements from the local government, and employees with a habit of complying regulations on manufacturing, hygiene and food safety; we need to have the ISO and HCCP certificate. If we pass these requirements, we are allowed to produce this type of product.

Learning from the experience of working with customers was the way YCH successfully implemented the expansion of its market share. One manager from YCH stated,

The market was divided into many segments, including customers who did not know anything about logistics; they often came to us for advice. The second type was customers who also had employees with knowledge about logistics processes but their knowledge was at a basic level, not so excellent, and we called them the average customer. The third type of customers was companies such as Nike, Adidas, and Unilever; these customers set the requirements higher than the average standard in the market. When serving these customers, we would learn from them and apply the knowledge we learned to the average customers or customers without knowledge of this field. Big customers have very strict requirements. And from the experience of serving them, we showed the results to our new customers, and they were very impressed with our service.

In this way, YCH has been able to expand its products portfolios from handling simple goods to goods that YCH had never handled before, like alcohol and even more complicated goods like pharmaceuticals and chemicals. They can also handle shipments exported to countries with complex import customs regulations like the United States. As one YCH manager stated,

For the experience in handling wine, it was the customers who taught us; we took every step to adapt to their requirements. For example, wine storage must not be too hot or too cold, there must be a cool area, and customs stamps must be affixed to wine bottles before the wine is sold to the market. Compared to pharmaceuticals and chemicals, alcohol is not too difficult to handle, except it is fragile.

The YCH manager added,

When we served Target, an American company, they strictly required us to comply with the anti-terrorism standards of American customs. Therefore, all of our steps in handling their goods must comply with these standards. Consequently, we gained experience in handling goods that were exported to America, which is the strength of our service when competing with the other competitors in the market, and we could use this knowledge to serve other customers who also want to export goods to America.

Although customers are different, they have one thing in common: they want to export goods to America.

Customization of products to the local context was another way for MNCs to enhance their performance in the local market. This strategy is emphasized by the firms in the food and garment industry. As one Vinamilk manager stated:

In the dairy industry, the formula for milk products, which is R&D, is crucial. Therefore, it is necessary to have dairy products to suit the tastes of the local consumers. The parent company's R&D team can only share milk formulas, but to adapt these formulas to the local market, local R&D teams are needed.

In addition, when naming its joint venture company, Vinamilk chose the name Angkormilk, which appears on all the products of the company sold in the Cambodian market. For Cambodians, Angkor is a national symbol. Therefore, Vinamilk's efforts to localize the products to make them more familiar to the local consumers.

FrieslandCampina also shared their experience on customization of the product to the local context,

After four to five years, we had our own laboratory and R&D team. The R&D department developed a formula specifically for the Vietnamese market. Based on the formula from the parent company, we adjusted the formula according to the Vietnamese nutrition regulations, so there was a slight change in the taste of milk in the Vietnamese market compared to the home market.

Similarly, Wacoal also customized their products to the local context; as one Wacoal manager stated,

At that time, Vietnamese customers' spending power was more limited than in other markets. We had to think about products that were affordable for the Vietnamese consumers. We had to calculate how to lower the cost of products while maintaining the quality standards of the corporation. If the price of the product was too low, it would affect the reputation of the Company, but if using too ordinary materials to produce the product, it would make the product become normal, while the customers that we targeted were the ones from the high medium to the high-end segment market.

Customization of the product required MNCs to spend much time, money and effort. One Wacoal manager stated,

When we conducted surveys to understand the local consumers' tastes about the product, we understood them to a certain degree; then we chose the products we already sold in other markets, for example, in Singapore, Japan ...; we had surveyed these markets, and then re-surveyed... to produce the products that matched the Vietnamese market. After two years, we understood the tastes of the Vietnam-

ese consumers.

Similarly, to Vinamilk,

...to develop a final milk formula for the Cambodia market, we had to conduct many trial tests with consumers, collected feedback from customers;...as we are manufacturers not scientists, we had to collaborate with nutrition centers in Europe, like in Denmark.

In addition, Vinamilk factory's initial ambition was to expand to international markets, so the scale and capacity was large, which enabled them to obtain economies of scale; however, when the firm customized its product to the local taste of the Cambodian market, the Company had to produce a small number of products as it took a long time for the local customers to widely accept them. Therefore, the company could not optimize the capacity of the facilities and had to accept the situation of under-capacity, which was "a kind of cost of investment" (Vinamilk).

In order to serve the purpose of increasing sales and market share in the local market, the MNCs paid great attention to building and maintaining a close relationship with local partners. One manager of FrieslandCampina told about the process in which they cooperated with their suppliers of raw milk.

We built a close relationship with them directly, without intermediaries. We guided them to practice according to standards for the agricultural sector. We signed sales contracts with them, usually for 3 to 4 years, in which we committed to buy their output in the whole period. We not only paid for the milk, but we also cared about if this was a satisfactory payment which they could afford to live on and also have money to save.

One Vinamilk manager shared their story about handling the relationship with local distributors:

When our products were widely accepted in the Cambodian market, many other experienced local distributors asked to cooperate with us. To make the final decision that Vinamilk would continue to cooperate with the existing local distributor, we had to discuss together many times; we had to consider many issues, including revenue, profits, opportunities, and ethics. We went even further, while we maintained an exclusive distribution relationship with the original local distributor, we could still access the new channels of distribution of the other parties which had advantages that our existing exclusive distributor's channels did not have. We did that by persuading these parties to buy our products from our existing local distributor because buying directly from us or from him, the price was the same. As such, we had to lower the selling price for the existing local distributor. We accepted this because we believed that the market share would increase. So, in this case we created a win - win result for all the parties.

Reconfiguration of the organizational structure to get closer to the market was an important strategy of firms in this stage. As a Vinamilk manager stated,

When our products were widely known and accepted by the local customers, we found that the current business model had disadvantages; for example, there were many costs incurred, such as logistics cost, the cost of transporting the product to the distributor's premise, and then from the distributor's place to all other places in Cambodia, in addition to the very long time when the product is produced in Vietnam till it was available on shelves in Cambodia. Consequently, Vinamilk changed from the export model to production and trading in the local country. We built a production factory in the local country, invested in modern equipment and machinery for the factory, and established a joint venture with our original local partner in which the capital contribution ratio of Vinamilk is 51% and the local partner is 49%.

4.3 Resource Exploration for In-depth Local Adaptation

After a period of rapid growth based on the firms' efforts to adapt their existing core competence to the local market, the MNCs tended to focus on sustainable development in the local market by quickly predicting and sensing changes in the market and properly adjusting their resource base to respond to these changes.

The companies have shifted their investments into areas they have never experienced before. In the case of Gemtek who expanded to the Chinese market, when the wireless technology industry matured in China, ...

We (Gemtek) changed from providing wireless service to total internet solutions for their customers by reorganizing their R&D team, recruiting more local technicians and cooperating with the other local internet providers. All these activities were aimed to help us learn the new technology quickly to catch the new opportunities in the local market.

Likewise, Arcadyan shared their experience in reacting to changes in the Chinese market when the demand for the application of fiber-optic telecommunications, including fiber to the home (FTTH) and fiber to the buildings (FTTB), increased in China, especially in the cities and coastal areas due to a booming economy and rapid growth in the population. In response to this trend, Arcadyan collaborated with one of the major providers of networking and telecommunications equipment in China to learn fiber-optic technology.

I knew that it was the best opportunity by which Arcadyan could approach fiber-optical telecommunications technology and develop FTTH and FTTB applications; we

had to learn fiber-optical technology and transform it into our knowledge base so that we could open the gate of the Chinese market through local distributors.

AstraZeneca has invested heavily in research to prepare for the future obtainment of business opportunities in the local market.

The Vietnamese market has undergone favorable changes in terms of policies, and the local government has committed to help patients through the national health insurance program. Based on an optimistic prediction about the growth of the economy, and the increasing spending on health of the local people, we had a lot of expectations concerning this market of nearly one hundred million people. From 2013 to 2019, AstraZeneca invested approximately US\$ 37 million to support the implementation of clinical trial studies in Vietnam through a network of more than 130 clinical trial research units throughout the country. The data collected from these research programs will support the development of drugs that better meet the needs of the patients in the country.

YCH flexibly satisfied their customers' demand by providing new service, which helped them maintain a close and stable relation with their customers.

In the field of goods delivery, previously, our customers wanted B2B but now they require us to expand to B2C service. The revenue from this segment was not good, but we still did it to keep our customers. For example, in the case of Amor, one of our big customers in the cosmetics field, Amor's customers previously bought its products in large shopping malls like Vincom, but now they could buy online. As such, Amor wanted us to provide it via B2C service. If YCH could not do it, other companies would. If a competitor successfully offered a small segment, they might take the other segments, such as warehouse service. Therefore, as the distribution channel in the market is changing, we have to follow our customers to adapt to their needs.

Response to unexpected events was another important issue in the companies' interest. FrieslandCampina shared their experience when a campaign calling for Vietnamese people to use Vietnamese goods in the local market.

The campaign caused disadvantages for us as well as other MNCs in the local market. In response to this situation, we tried to make the Vietnamese customers understand that FrieslandCampina was an essential part in their life, no matter what our country of origin.

In another situation, FrieslandCampina manager stated, *When the Vietnamese customers were worried that the milk might be contaminated with melamine, they doubted the ingredients that were added to the raw milk powder because they thought that they could not know exactly*

what was added, and when they knew, it was too late as their children had drunk it or died. So, they strongly demanded one hundred percent fresh milk, which was pure milk, with no substance added. Pure milk was a commodity, so the price would be very cheap, but we wanted premium price which required a respective value, so we had to add value. And we did this in a cautious way. Besides, we regularly run the message "from grass to glass" in our advertising programs to emphasize the quality of our milk.

To sustain the performance and to further grow, changing the business model was an important issue. One Vinamilk manager stated,

Previously, our partners completely decided the marketing and distribution of the products and gradually there was conflict of interest, for example, which channel the product should be sold to, and what the discount rate should be. It is impossible for a joint venture to exist successfully for a long term because conflicts of interest will always exist. Therefore, we gradually acquired the remaining shares in the company and took over the whole company.

Similarly, in the case of AstraZeneca, after twenty-five years in Vietnam, from a representative office, AstraZeneca was granted a certificate of eligibility for the pharmaceutical business, and licensed to export and import drugs in Vietnam.

5. Towards the Processual Staging Perspective of MNC Entry

Our findings revealed that the market entry process of our participant MNCs has three main stages, with respect to resource leverage. In the *initial stage*, due to a lack of business experience in the entry target market, the strategic tendency of these international companies is to enter the host country by replicating their home-based advantages. When their knowledge of the host market is enhanced, they will intensively leverage their existing resource base for a better fit in the host market. In this stage, which is termed as the *adaptive intensification stage*, the resource leverage is performed in an exploratory manner and includes a resource and knowledge recombination, reconfiguration, redeployment, or any combination of these resource leverages. In the following stage, which is called the *advantage persistence stage*, MNCs have the intention to sustain their economic fruit that is derived from the adaptive intensification stage. They are oriented towards creating blue-ocean opportunities, or even leading the market by resource leverage, which is primarily conducted by using an exploratory approach.

With this essential staging pattern of the MNCs' entry

process, this study proposes the following:

Proposition 1: The MNCs' entry process to a foreign market is shaped in a staging cycle, according to its resource leverage, which includes, in sequence, the initial stage, the adaptive intensification stage, and the advantage persistence stage. Each stage corresponds to a primary resource leverage mode, by which MNCs make decisions for their entry strategies in the entry process. These include the following: (a) the initial stage, with resource replication; (b) the adaptive intensification stage, with resource exploitation; and (c) the advantage persistence stage, with resource exploration.

5.1 Initial Entry Stage: Resource Replication

In the initial stage of the MNC entry process, resource replication is the main strategy. In the investigations of this study, resource replication was generally done by MNCs, through exporting the existing products or services to the host market, or through transferring their existing knowledge and competencies to the local subsidiaries in the host market, such as technological knowledge, operational know-how, and marketing skills that are specialized for their home-based goods or services.

In addition, our observation of the initial entry process of MNCs revealed that learning plays a fundamental role in helping them to adapt to a new host market. They learn from their strategic partners, who may be the local distributors, local partners, local supply chains, or even local employees. While MNCs are willing to accept mistakes and financial losses, the learning process represents a series of hit-and-miss actions that are teeming with unfavorable experiences. In the present findings, we have identified the intention of MNCs to increase their learning effectiveness and efficiency in the initial adaptation process to a local market. As Neweb and Vinamilk did, they built close cooperation ties with their local partners or distributors. In this case, an alliance was a general form of such a relationship.

According to the present findings on the resource leverage of MNCs' in the initial stage of the entry process, we propose the following:

Proposition 2: Resource replication is typically performed as an extending instance of the parent-based advantages of MNCs in the initial entry stage. It is not merely exporting the existing goods and services, but it is about resource replication that is implemented as a learning mechanism, in order to adapt well to the host country's market in the initial stage of the entry process. In this mechanism, MNCs transfer the necessary knowledge and competencies to the subsidiaries for the replication of the existing advantages; they also absorb market knowledge

from outside the firm, especially from their strategic partners.

5.2 Adaptive Intensification Stage: Resource Exploitation

Relative to the initial entry, the present findings showed that the participating MNCs of this study demonstrated a much stronger aggressiveness and commitment toward resource leverage in the host country's market in the adaptive intensification stage. Because they were becoming familiar with the host market, they were strongly motivated to speed up their adaptation process to the local environment. They deliberately engaged in the local distribution system, built or reformed the supplier network, and, if possible, made necessary changes in doing business in the local market. Through these activities, they could effectively and efficiently accumulate useful information and knowledge, which could be used to serve as the foundation for reconfiguring and transforming their resources and competencies, and for recalibrating the strategic vision and goals of their local operations.

As discussed in Proposition 1, in this stage, MNCs' resource leverage is conducted at an intensive level and tends to be the pattern of resource exploitation. Through integrating the parent-based advantages and the knowledge gained from the local market, MNCs broaden and diversify their product (or service) portfolios, which in turn enable MNCs to access much broader market segments in the host country. On the other hand, MNCs have great intentions of enhancing their capacity to access the market, by gaining market knowledge from their customers (i.e., learning from the market and paying efforts on customization), by building a much closer and hypervisible relationship with their strategic partners, especially on the market side (i.e., joint ventures), and by proceeding with the organizational change that benefits the market operations.

With these findings in the adaptive intensification stage of the MNC entry process, we propose the following:

Proposition 3: Resource exploitation is generally conducted as the creation of multiple instances by the integration of the existing advantages of MNCs and the new knowledge and competencies that they gain from the local market. The resource exploitation mechanism can help MNCs to expand by offering portfolios and by diversifying their market segments. Therefore, MNCs have a high likelihood of possessing a better capability of accessing the market and enhancing their reconfiguration and transformation capability for their resource base. In addition to their adaptive capabilities, such the result potentially enables MNCs to specifically recalibrate their strategic vision and goals in the local market.

5.3 Advantage Persistence Stage: Resource Exploration

The present findings show that in the advantage persistence stage, MNCs tend to conduct resource leverage in an exploratory manner, for the strategic purpose of sustaining their advantage. This is primarily because MNCs have accumulated a great deal of experience in, and knowledge about, the operation in the host country's market. Instead of relying on the parent-based advantages, they have great intentions of taking action or undertaking new research initiatives (i.e., those for R&D, production, or marketing), for better local engagement, or even creating changes that potentially enable them to take the lead in the host market. Therefore, the resource leverage manner of MNCs tends to be much more diverse and intensified, according to the market signals that are scanned and identified for potential opportunities.

During this stage, in addition to scanning the host market signals for potential market opportunities, MNCs make an effort to seize these opportunities by not only exploiting the existing advantages, but also by exploring the local resources (knowledge and competencies) that are specific to the host conditions. As can be seen in the participating MNCs of this study, such the efforts or actions proceed from new investments, especially in unfamiliar areas, such as new market segments, technologies, and key component access. Furthermore, the participating MNCs also demonstrated their capacity to advance by inflexibly and quickly responding to unexpected events in the host environment. The change of the business model is a critical issue in such a development.

Proposition 4: Resource exploration is conducted to create multiple instances by extending the advantages of MNCs, which are developed specifically for the host country's market and by using local resources. With the strategic purpose of sustaining the advantage, the resource exploration mechanism can help MNCs build the capacity to timeously and flexibly engage in potential future opportunities in the local market. Thus, MNCs have a high likelihood of possessing a better capability of seizing local opportunities, and hence sustaining a competitive advantage in the host country's market.

6. Discussions and Conclusions

The findings of this study contribute to research by suggesting that the processes the market entry of MNCs are dynamic and staged with resource leverage. Such a staging pattern of market entry is aligned with some previous studies, such as Chang and Rosenzweig^[28], Guillen^[29] and Decker and Zhao^[30] on FDI research, and Kogut

and Zander^[51] and Madhok^[31] on the market penetration of MNCs, with the focus on a combination of knowledge between the home-based and local markets. When their experience and knowledge of the local market increases, the business strategy of MNCs will also be developed, and it will more likely to adapt to the host market.

The analyzed cases in this study revealed that there were three main activities that are used by international firms to leverage their resource base in a local market, namely, resource replication, resource exploitation, and resource exploration. Resource replication is mostly used in the initial stage of entry, when the firms wanted to deploy their home-based advantage to serve the local market. Resource exploitation is intensively used when the firms desire to significantly increase their market share and profits in the given context. Resource exploration is deployed when MNCs wanted to carry out innovations that seek to deal with potential changes in the local market. By performing such resource leverage, MNCs expand their existing advantages to additional applications, in different contexts.

The findings of this study contribute to the DCV. This study suggests that resource replication, exploitation, and exploration are considered to be the yardsticks by which to examine the dynamic capabilities of MNC's in the entry process. This study thus responds to Barreto's call for developing the measurement of dynamic capabilities^[44]. In addition, these findings explain the potential pattern for the interplay of resource development and the market adaptation of MNCs. Thus, this study provides significant evidence to reinforce the concept of organizational ambidexterity^[65,66,67]. Through the exploration into the behaviors of MNCs in resource leverage, our research also makes a substantial contribution, not only by integrating the DCV with international business management, but also by enhancing a dynamic view of international business management.

In addition, the analyzed cases in this study revealed that the success of MNCs stemmed from the provision of product offerings for market acceptance. To realize this expected outcome, all the participating firms tried hard to reconfigure their existing resources and competencies in the given contexts, despite their parent advantages being superior to those of the host market. As Danneels posits^[48], it is not sufficient for a technology to have many applications; instead, these applications need to serve markets. Teece argues that a firm's innovation is easily constrained by its existing knowledge^[1]. Even though they possess a high technical capability, firms may fail when there is no market demand for that capability^[39]. Liao and Rice conclude that innovations are vital to a firm's competitive

advantage; only insofar can these innovations lead to such expected outcome when they are associated with market acceptance^[42].

The emphasis on the issue of market acceptance in this study also contributes to addressing the criticism of the DCV that it lacks a clear explanation of the relationship between a firm's dynamic capability and its performance^[68]. Our investigation into the participating companies revealed that if a firm can exercise its resource leverage in accordance with the market trends, it can outperform its competitors. That is, firms with a higher level of dynamic capabilities can timeously provide superior or proper offerings to match the changing market context and, hence, achieve an improved performance. Several studies underline that different firms may have different levels of dynamic capabilities^[39, 44], and that the performance effects depend on whether firms use their dynamic capabilities "sooner" or "more astutely" than their competitors^[40].

In the entry process of MNCs, strengthening market penetration requires an MNC to conduct various types of resource leverage concurrently. It depends on which entry stage the MNC is in, as well as what its market orientation and ambitions are for market opportunities. The allocation of generic assets (i.e., money and employees) and the reconfiguration of other resources (i.e., specific technologies, knowledge or market channel arrangements) need to be done timeously and appropriately to ensure harmony, according to the firm's process, in terms of resource leverage. Afterwards, the transformation of resources will be conducted to develop specific, or even distinct, resources and competencies. These may include specific products, technologies, or skills in distribution. Learning (including organizational and individual learning) plays a crucial role in this process. From the present findings, therefore, this study reveals and suggests the essential role of resource allocation, reconfiguration, transformation, and learning in an international firm's resource leverage in the entry process. As Barreto admits, any typological dimension of dynamic capabilities might have its own constructs, which may overlap other dimensions; and such complexities make the operationalization of dynamic capabilities difficult^[44]. Our approach of resource leverage potentially provides a step forward for such issues, and it simultaneously provides an insight into how MNCs orchestrate their resources, in order to adapt to a new market.

Despite the contributions of this study, there is still a limitation in terms of the data collection. Using the cross-sectional approach may prevent us from realizing more detailed and relevant information of the entry strategy of companies. In this study, we posit that the entry of MNCs into a new market goes through various stages.

Therefore, a longitudinal investigation would be more appropriate. In this method, the interviewees would not have to recall the events that happened a long time ago, instead of recalling more recent events. As a result, the information provided might be more comprehensive.

In conclusion, the entry of MNCs into a foreign market is, to an increasing extent, a staging process of resource leverage. Three stages are identified in this study, including the initial stage, the adaptive intensification stage, and the advantage persistence stage. Each stage corresponds to a primary resource leverage strategy. In the initial stage, an MNC's entry decision tends to be based on the resource replication mode of resource leverage; the resource exploitation mode of resource leverage is used mostly in the adaptive intensification stage, and the resource exploration mode is used in the advantage persistence stage. As this study suggests, these resource leverage modes incorporating their microfoundations can be viewed as a set of potential measurements for examining the dynamic capabilities of MNCs in the entry process to a new host market.

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Appendix – Introduction to the Participant MNCs

Arcadyan Company

Arcadyan Technology Corporation is a Taiwan-based company established in 2003, and headquartered in the Hsinchu Science Park. The Company is principally engaged in the research, development, manufacture and sales of wireless local area network (LAN) products and broadband wireless gateways. Arcadyan products are sold worldwide. Arcadyan has R&D centers and technical support centers in regions such as Taiwan, China and the US. They also have sales offices in Europe and the Americas. Arcadyan expanded to the Chinese market in 2008.

Gemtek Technology Corporation

Established in 1988, Gemtek Technology Co., Ltd. is one of Taiwan's leading companies in the Wireless Communications Technologies Industry. Gemtek's headquarters is in Hsinchu, Taiwan. Over the years, Gemtek has transformed itself into a top-notch Original Design Manufacturer (ODM) for total solution providers. Gemtek is one of the few manufacturers in Taiwan that offer key technologies for Wireless Area Network and Broadband Network products. Gemtek has further expanded its global production and marketing offices in greater China (Kunshan, Changshu), Vietnam, the U.S., Japan, and many European countries. Gemtek expanded into the Chinese market in 2002.

Neweb Company

Neweb Technologies Co., Ltd. was founded in 2001; it is a major provider of online payment service in Taiwan.

Neweb provides payment services to almost all major EC sites, including music distribution sites and recruiting sites. With over 4,000 stores and experienced management, Neweb, in addition to the provision of payment services, develops payment solution provisions for banks in Taiwan, assists with cross-border transaction for Chinese consumers, etc. Neweb has more than 2,000 business partners at home and abroad, including Citibank Taiwan Co. Ltd., Chunghwa Telecom Co. Ltd. and Yahoo Inc., which helps bring about the cross-strait cooperative venture. Neweb is the very first Taiwanese company to provide third-party payment platforms in Asian countries. Gemtek expanded into the Chinese market in 2004.

Vinamilk Company

Vietnam Dairy Products Joint Stock Company, also known as Vinamilk, is a company producing and trading milk and milk products as well as related machinery and equipment in Vietnam. Vinamilk is currently the leading enterprise in the dairy processing industry in Vietnam, occupying around 50% market share of all kinds of milk in Vietnam. In addition to strong domestic distribution with a network of more than 220,000 sales points covering 63 provinces and cities, Vinamilk products are also exported to 43 countries around the world, such as the US, France, Canada, Poland, Germany and Japan. In the Middle East, Southeast Asia, etc. After more than 40 years of satisfying consumers, till now Vinamilk has built 14 production plants, 2 logistics factories, 3 branches of sales office, a factory in Cambodia (Angkormilk) and a representative office in Thailand. Vinamilk expanded into the Cambodia market in 2007.

FrieslandCampina Vietnam

FrieslandCampina Vietnam is a joint venture company established in 1995 in Vietnam between Import and Export Company of Binh Duong Province (Protrade), Vietnam and Royal FrieslandCampina, the leading dairy group in the Netherlands with 140 years of experience in global markets, in which the Dutch partner holds 70% of the shares. The Company specializes in manufacturing and supplying milk and dairy products. FrieslandCampina Vietnam is one of the leading brands in the dairy industry in Vietnam. The company has a network of more than 2,400 farmers who have signed purchasing contracts, providing

about 170 tons of quality milk per day for the Company. The Company has been present in Vietnam since 1995.

Wacoal Company

Wacoal Corporation was established in Nakagyo District (Kyoto, Japan) more than 50 years ago. With a mission to help women show off their beauty, Wacoal Group has quickly grown and become the leading company in manufacturing lingerie in Japan. For more than fifty years, Wacoal Group has expanded to global markets by establishing branches and subsidiaries everywhere, including Asia (Taiwan, Hong Kong, China, etc.), Southeast Asia (Vietnam, Singapore, Malaysia, etc.), Europe (France, Germany, Italy, etc. and North America (USA, Canada). Since April 1998, Wacoal Vietnam Co., Ltd. with 100% capital from Wacoal Japan has been established at 110 Amata, Amata Industrial Zone, Bien Hoa, Dong Nai, Vietnam. Wacoal's factory in Vietnam is considered to be the largest Wacoal factory worldwide.

YCH Protrade Company

YCH is one of the largest companies in Singapore that provides logistics and supply chain management services, and also the leading regional supply chain management partner to many of the world's leading brands across Asia Pacific. This Company has expanded to eleven countries in the Asia Pacific area. In Vietnam, the YCH Group established a joint-venture with Protrade Corporation (Vietnam) in 2009. Investment in Vietnam is part of YCH's overall plan to establish a strategic network of logistics centers across the Asia Pacific region; its main objective is to maintain the development of cooperative relationships with YCH customers.

AstraZeneca Company

AstraZeneca is a multinational company, specializing in providing biopharmaceuticals for cancer, cardiovascular, kidney-metabolism and respiratory treatments. The Company operates in more than one hundred countries with headquarters in England and Sweden. AstraZeneca set up its representative office in Vietnam in 1994. In 2019, AstraZeneca Vietnam was granted a certificate of eligibility for pharmacy business by the Ministry of Health of Vietnam, and was allowed to conduct drug export and import activities in Vietnam.

ARTICLE

A Study on Income as a Determinant of Buying Decision-making Styles

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ABSTRACT

The following paper attempts to understand if income determines the buying decision-making styles of consumers in Bhubaneswar, the capital city of Odisha, a state located on eastern India. A total of 103 respondents of Bhubaneswar were chosen by using the Mall intercept method. The samples were classified into three groups based on their average annual family income such as High Income, Middle Income and Low Income groups. Exploratory Factor Analysis was carried to identify the decision-making styles. ANOVA was employed to compare the shopping styles of these three income sub-groups. Results indicate that differences in consumer shopping styles exist among the income sub-groups. Findings of the study can be used by marketers for segmentation, targeting and positioning of retail shoppers which may facilitate them to compete efficiently. It is recommended that different income sub-groups should be viewed as distinct consumer segments and strategies should be formulated to cater each segment effectively.

1. Introduction

Income is one of the bases for demographic segmentation of the consumer market. Income forms the basis for social situations like class, status and the like. Social class, status, regional differences, rural, or urban residence, religious affiliation and ethnic background collate together to form different sub-cultures^[1]. Studies also support that region, religion, age, gender, social class and occupation based subcultures have their co-existence^[2]. Consumers are influenced by social status, lifestyle, personality, attitudes, demographics, culture, and the like which influence their purchase decision towards products and services^[3]. Demographic factors such as gender, age, and income have a bearing impact on the adoption of

particular consumer decision-making styles^[4,5]. Income being one of the important demographic factors is related to commitment towards a particular product class, brand, or consumption activity and therefore has marketing implications related to segmentation, targeting, and positioning.

2. Previous Studies on the Influence of Income on Buying Decision-making

In Botswana, consumers belonging to high-level income groups and low-level income groups revealed high-quality consciousness, novelty-fashion consciousness and time energy-conserving^[6]. But a research suggests that low income group consumers are highly price-

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conscious due to financial constraints^[7] and less quality conscious even in matters of consumption of food^[8]. But, high income earners have sound financial muscles and thus splurge in impulsive buying^[9], seek leisure, spend greater time in shopping, plan their shopping spree significantly^[10] and are more inclined to buy products online^[11]. From the aforesaid studies, it can be interpreted that high income consumers elicit proclivity towards the traits of high-quality consciousness, novelty-fashion consciousness, recreational-hedonism, impulsiveness but tend to be less price conscious and confused due to over choice.

3. Decision-making of Consumers and Consumer Style Inventory (CSI)

The decision-making process is a totality of need identification, information collection, evaluation of alternatives and purchase-decision by consumer^[12]. Consumer shopping behavior is well understood by his/her decision-making styles an analysis of which, enables marketers for crafting successful marketing strategies^[13]. Decision-making styles are pretty enduring in nature and represent mostly static consumer personality, attitude, approach or mental orientation playing a vital role in buying goods, selecting stores or other purchase situations^[14]. Sproles and Kendall, in 1986 developed a Consumer Style Inventory (CSI) entailing eight dimensions of decision-making. Closed-ended questionnaires with 40 items/questions were administered by Sproles and Kendall to assess the decision-making styles of high school students in the USA towards personal products namely clothing, cosmetics and hairdryers. The responses which were the by-products of cognitive-emotional aspects of the respondents formed the bases for validation and finalization of the 40 items by Sproles and Kendall. The eight dimensions namely, Perfectionism/high quality Consciousness, Brand Consciousness, Novelty-fashion Consciousness, Recreational-hedonistic Consciousness, Price and 'value for money' Consciousness, Impulsiveness, Confused by over-choice and Habitual, Brand loyal orientation collated to form CSI.

3.1 Description of Eight Consumer Decision-Making Styles

- **High-quality consciousness or Perfectionism:** Focuses on not compromising with quality
- **Brand consciousness:** Focuses on buying well-known and expensive brands and equating
- **high price with high quality**
- **Novelty- fashion consciousness:** Focuses on adopting

to latest and new fashion, trends, fads

- **Recreational-hedonistic consciousness:** Focuses on the enjoyment related to shopping or looking for products.
- **Price and "value for money" consciousness:** Focuses on getting best value for money or sales price consciousness.
- **Impulsiveness:** Focuses on unplanned shopping or purchase.
- **Confused by over choice:** Focuses on difficulty to handle information overload.
- **Habitual, brand loyal orientation:** Focuses on buying the same brands or buying at the same stores.

Consumer Style Inventory has been parsimoniously applied by several studies in different cross-cultural contexts to analyze its applicability and validity^[5,15-21].

4. Research Gap

There has been limited research on the influence of income on consumer buying decision-making in Odisha. Also, there have been sparse literature and scant studies on understanding the influence of income on consumer decision-making by using Sproles and Kendall scale^[4-6]. Thus, this study, simultaneously is an attempt for validating the applicability of Consumer Style Inventory scale as proposed by (Sproles and Kendall, 1986).

5. Objectives

The proposed study aims to unfurl the buying decision-making styles of different income sub- groups in Bhubaneswar and investigate if income influences the buying decision-making styles of consumers.

6. Research Framework

The present study investigates the influences of income on consumer decision-making styles. The relationship between predictor and criteria variables are shown in Figure 1.

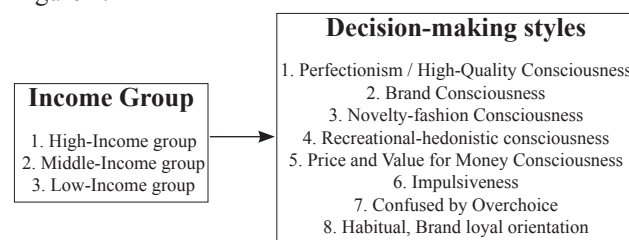


Figure 1. Proposed framework

6.1 Research Hypothesis

H1: Income has no significant influence on buying decision-making styles of consumers in Bhubaneswar city of Odisha.

The aforesaid hypothesis is general and the study intends to initially identify the major consumer decision-making styles prevalent among Bhubaneswar based consumers considering the income aspect. Since the Consumer Style Inventory provides a total picture of the decision-making styles of consumers, it would be interesting to unearth the consumer decision-making styles of income sub-groups and understand if income influences the identified decision-making styles.

7. Methodology

7.1 Research Instrument

This research was quantitative in nature involving a purposive sampling technique. The sample size was 103. Data were primary in nature and collected through Mall intercept method. A close-ended structured questionnaire was administered to collect the primary data regarding buying decision-making styles of consumers. Respondents were asked to mention about their average annual family income (in INR). The CSI developed by Sproles and Kendall was employed in this study with some minor dropping of four statements owing to validity-reliability issues. All the statements were measured on a 5-point Likert Scale ranging from Strong Disagree (1) to Strongly Agree (5). According to Sproles and Kendall, the reliabilities of CSI Scale ranged from 0.48 to 0.76.

7.2 Data Sources

The self-administered survey was undertaken and purposive sampling technique was used. Data was collected from 103 respondents from Bhubaneswar, the capital city of Odisha. Odisha is an eastern state of India. The sample consisted of 12 high-income groups (10 Lakhs INR and above), 48 middle-income group (5-10 Lakhs INR) and 43 low-income group (Upto 5 Lakhs INR). Mall intercept method was used for data collection. The data after being collected was analyzed using SPSS (version 20) and then Exploratory Factor analysis was carried. ANOVA was applied to find out the variations across regions as decision-making style is concerned.

8. Data Analysis

8.1 Reliability Test

Cronbach Alpha was used to assess the internal reliability of the 36 scale item of the questionnaire. (Out of the 40 original items of CSI, 4 items having factor loadings less than 0.4 were dropped). Cronbach Alpha coefficient was found to be .714 and since it is greater than .7

Cronbach Alpha ideal therefore the scale items possess a satisfactory internal consistency and hence reckoned statistically reliable.

8.2 Exploratory Factor Analysis

EFA is a technique that involves data reduction and allows simplification of the correlational relationship between continuous variables. Exploratory factor analysis is being used to examine relationships among key interval scaled questions and assesses the data suitability.

The Bartlett's test is significant ($p < .05$) and KMO value is .735 which is greater than .6, hence the factor analysis is appropriate and meets the two criteria of assumption.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.735
Bartlett's Test of Sphericity	Approx. Chi-Square	2406.608
	Df	820
	Sig.	.000

Bartlett's Test of sphericity and KMO Test for sampling adequacy were found appropriate, thereby supporting the appropriateness of data/scale items for factor analytic modelling. The Principal component analysis was employed for factor extraction and orthogonal form of Varimax rotation was applied on principal component solutions. The variables whose factor loadings were greater than .50 were retained. Factors with Eigen values greater than one were extracted. The eight factors explain 58% of variance.

8.3 Component Matrix

The varimax rotation was done to extract the decisional style factors of the consumers belonging to the three income sub-groups. The eight factors were extracted by observing the rotated component matrix.

8.4 Interpretation of Factor Matrix Table

As evident from Table 2, it is found that 8 factors extracted together account for 58.28 % of the total variance (information contained in the 36 original variables). Hence, we have reduced the number of variables from 36 to 8 underlying factors.

The Table 3 depicts the rotated component matrix which aids in interpreting the factor matrix easily. The items 7,8,9,10,11 and 12 are clubbed together and form the first factor which explains 24.589% of variance. Hence, the first factor is termed as "Brand Consciousness". The second factor explains 7.818 % of variance and the items 1, 2,3,4,5 and 6 are collated to form the second factor called

Table 2. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.286	24.589	24.589	7.286	24.589	24.589	3.540	16.493	16.493
2	3.205	7.818	32.407	3.205	7.818	32.407	3.242	7.907	24.400
3	2.644	6.448	38.855	2.644	6.448	38.855	2.817	6.871	31.271
4	2.363	5.764	44.619	2.363	5.764	44.619	2.784	6.789	38.060
5	1.868	4.556	49.175	1.868	4.556	49.175	2.572	6.273	44.333
6	1.341	3.270	52.445	1.341	3.270	52.445	2.020	4.926	49.259
7	1.233	3.008	55.453	1.233	3.008	55.453	2.007	4.758	54.017
8	1.159	2.828	58.281	1.159	2.828	58.281	2.004	4.264	58.281
9	1.154	2.814	61.095						
10	1.076	2.624	63.719						
11	.990	2.416	66.135						
12	.949	2.315	68.450						
13	.900	2.196	70.646						
14	.868	2.116	72.762						
15	.837	2.041	74.803						
16	.784	1.913	76.716						
17	.744	1.815	78.531						
18	.737	1.798	80.329						
19	.711	1.733	82.062						
20	.675	1.647	83.709						
21	.661	1.613	85.322						
22	.631	1.539	86.861						
23	.602	1.496	88.357						
24	.554	1.269	89.626						
25	.534	1.243	90.869						
26	.507	1.045	91.914						
27	.495	.998	92.912						
28	.440	.947	93.859						
29	.409	.919	94.778						
30	.388	.908	95.686						
31	.361	.881	96.567						
32	.334	.814	97.381						
33	.312	.761	98.142						
34	.271	.662	98.804						
35	.258	.629	99.433						
36	.233	.567	100.000						

“Perfectionism/High Quality Consciousness”. The third factor explains 6.448 % of variance and it encapsulates the items 21, 22 and 23. These accumulated items form the third factor which is “Price/Value for Money Consciousness”. The fourth factor explains 5.764 % of variance and the items amalgamated under this factor are 13, 14, 15, 16 and 17. This factor is “Novelty-Fashion Consciousness”. The fifth factor explains 4.556 % of variance and it is termed as “Recreational-Hedonistic shopping Consciousness”. The items 18, 19 and 20 are assembled together under this factor. The sixth factor entailing items 33, 34, 35 explains a variance of 3.270 %. This factor is called as “Habitual-Brand Loyal orientation”. The seventh factor explaining a variance of only 3.008 % comprises of items 29, 30, 31 and 32 and termed as “Confused by Over-choice”. Items 24,25,26,27 and 28 are aggregated together to form the eighth and last factor “Impulsiveness” explaining a small variance of

only 2.828%.

Thus, for objective one, the purchase decision-making styles emerging from exploratory factor analysis are Brand Consciousness, Perfectionism/High Quality Consciousness, Price/Value for Money Consciousness, Novelty-Fashion Consciousness, Recreational-Hedonistic shopping Consciousness, Habitual-Brand Loyal orientation, Confused by Over choice and Impulsiveness.

8.5 Hypothesis Testing on the Basis of Differences in Consumer Decision-making Styles across Income Groups

To address the second objective, ANOVA was conducted to demonstrate the difference between the shopping styles of consumers across different income groups in Bhubaneswar city of Odisha.

Table 3. Rotated component matrix (Orthogonal rotation)

ITEMS	1	2	3	4	5	6	7	8
I feel it highly important to purchase the best quality products		.737						
I want to choose the products perfectly while shopping		.740						
I try to buy the very best quality products		.734						
To buy the very best quality, my efforts are also special		.678						
I have high expectations from the products that I purchase		.688						
If I find a brand or product that seems good enough, I shop quickly		.729						
Usually I buy the well-known brands	.713							
I like buying brands that are costly ones	.818							
Highly priced products are of higher quality	.813							
I get the best products from nice departmental stores and specialty stores	.695							
Best-selling brands are my preference	.643							
Brands that are most advertised are usually very good choices	.621							
It is very important for me to resort to fashionable and attractive styling				.726				
My wardrobe is kept up to date by me with the changing fashions				.566				
Very newest style of one or more outfits are possessed by me				.633				
To purchase something new and exciting is a matter of fun				.684				
For seeking variety, I shop different stores and select different brands				.670				
To go to shopping is one of the enjoyable activities of my life					.706			
I enjoy shopping just for the fun of it					.553			
I make my shopping trips fast					.618			
I purchase as much as possible at sales prices			.643					
The products of lower prices are usually my choice			.738					
I am very careful to find the best value for the money			.760					
I should make more careful planning for my shopping than I do								.779
I show impulsiveness while purchasing								.640
Often I do careless purchases which I later wish I had not								.694
For best buys, I take time to shop carefully								.638
I am careful in watching how much I spend								.699
I often feel confused to choose among so many brands							.628	
Store choosing is sometimes a harder task							.720	
More learning about products makes the choice of best products harder							.672	
I am confused by all set of information given on different products							.599	
I buy over and again my favourite brands						.612		
I usually stick to brands after finding them best						.687		
I visit the same stores each time I shop						.602		
I change the regularly buying brands						.679		

Table 4. ANOVA table for difference in decision-making styles across income groups

Consumer Decision-making style	Income group	Mean	F	Sig. (2-tailed)
Brand consciousness	HIG	3.96	34.78	0.031
	MIG	3.47		
	LIG	2.85		
Perfectionism / High quality consciousness	HIG	3.32	2.51	0.49
	MIG	3.41		
	LIG	3.09		
Price Consciousness	HIG	3.87	32.45	0.032
	MIG	3.61		
	LIG	4.13		
Novelty-fashion consciousness	HIG	4.26	27.63	0.034
	MIG	4.09		
	LIG	3.97		
Recreational-Hedonistic shopping consciousness	HIG	3.97	21.68	0.038
	MIG	4.02		
	LIG	3.74		
Habitual-Brand Loyal orientation	HIG	3.82	24.78	0.036
	MIG	4.09		
	LIG	4.47		
Confused by Overchoice	HIG	2.21	27.39	0.034
	MIG	3.89		
	LIG	2.53		
Impulsiveness	HIG	2.89	36.03	0.027
	MIG	2.97		
	LIG	2.34		

Income Groups	Average Annual Family income (INR)
High-income group (HIG)	10 Lakhs INR and above
Middle-income group (MIG)	5-10 Lakhs INR
Low- income group (LIG)	Upto 5 Lakhs INR

9. Interpretation

From the ANOVA table, it is evident that $p < 0.05$ for the seven factors namely Brand consciousness, Price consciousness, Novelty-fashion consciousness, Recreational-hedonism, Habitual-Brand Loyal orientation, Impulsiveness and Confused by Over choice. It indicates that statistically significant differences exist among the decision-making styles of different income sub-groups. High-income group consumers were found to be more brand-conscious and novelty-fashion conscious than other income groups. Middle income groups exhibited preponderance towards recreational-hedonism, confused by overchoice and impulsiveness. Low-income groups revealed highest price-consciousness supporting the results of the study^[7]. Low income groups also scored higher in habitual brand loyalty. High-quality consciousness trait was equal for all the income sub-groups as $p > 0.05$. This finding corroborates the findings made by the research^[6]. Thus, owing to the above findings, the null hypothesis, H1: Income has no significant influence on buying decision-making styles of consumers in Bhubaneswar city of Odisha is rejected. Therefore, it can be inferred that income has a pre-dominant influence on the buying decision-making styles of the consumers in Bhubaneswar city of Odisha. In a nutshell, the high, middle and low income group consumers in the city of Bhubaneswar, located in eastern India vary in their buying decision-making styles.

10. Conclusions

This study aimed to divulge the influence of income on buying decision-making styles of consumers of different income groups such as high, middle and low income groups. Exploratory factor analysis was undertaken to determine the decision-making styles and ANOVA results indicated that striking similarities and dissimilarities existed among the decision-making styles of income sub-groups. Marketers and retailers should be very careful while designing the marketing-mix for different income groups. They should not ignore any group of consumers rather address each group effectively. In general, marketers and retailers should give focus on improving quality, fashion-novelty and brand awareness building among consumers. This can be done by offering the consumers tailored and up-to-date products. Brand

familiarity can lead to brand loyalty and keep confusion at bay. Further, it can make the shopping experience a pleasant one. The store personnel should be able to help information-seeking consumers. Marketers can adopt various loyalty programmes to augment the proclivity of brand loyal income groups. For price-conscious income-groups, marketers should provide products at affordable price-ranges, easily available in the stores in malls. Focused merchandising, visual displays and appeals, and store atmospherics may also stimulate impulsiveness among shoppers. Mall owners should offer pleasant ambience and services to the shoppers who can flock in malls with their family and friends for leisure pursuits or socialization.

A clear understanding of decision-making styles of different income groups may be warranted for marketers to predict the consumer needs and formulate effective strategies.

Income should be focused as an essential demographic element for segmenting the consumers and all income groups should be considered as distinct, identifiable and heterogeneous markets.

The study has certain limitations. Firstly, it gives suggestive evidences rather than conclusive demonstration that such a kind of variation in decision-making styles exists among different income sub-groups. Secondly, the sample size chosen was also small which may result into biasness. Thirdly, the study was restricted within a particular city of Odisha.

The study connotes that further researches can be made to investigate and verify the explanatory role of income towards the decision-making of different income groups.

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ARTICLE

Does the Accounting Information Systems (AIS) Influence the Economy?

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ABSTRACT

The purpose of this study is to look at the impact of accounting information systems on the economy. The study has been directed based on the analytical and theoretical. It observed a total of 500 respondents. To run the research and to get informative results, this paper used primary data. It uses the Chi square test, ANOVA tests, and Multinomial Logistic tests for analyzing the results. It calculates the data with the help of IBM statistical packages for social science (SPSS). This paper assumes that AIS is beneficial for Bangladeshi organizations, which contributes to the economic development of Bangladesh. However, it finally shows that this system has a gap between what accounting information systems are & what should be. This paper suggests that an organization may get potential benefits through the implementation of AIS in Bangladesh. It also will be benefited stakeholders from implying it. The paper conducts based on the listed financial organizations of Bangladesh. This is the main limitation of this study. It is the first work in Bangladesh based on my knowledge. It provides accurate information to all stakeholders that help them to the right decision. It will also help to improve the economic development of Bangladesh.

1. Introduction

AIS is a system for collecting, recording, storing, & processing data to generate information for decision-making purposes. Good financial statement by the AIS process by the applicable reporting standards^[1]. Accounting information helps outside companies to make the right investments performance appraisal, monitor activity, and control^[16]. An AIS is a system that processes data to provide users with information to plan, manage, & manage their business^[19]. The drive of the AIS delivers information to external parties^[19]. The AIS collects the raw data, then processes it, and then presents the data to

the users in the form of useful accounting information^[28]. In past, accounting information system emphasizes on the recording, summarizing, and validating of financial transactions data. These functions are associated with managerial accounting, financial accounting, & tax compliance issues^[12]. An AIS is a set of subsystems that effort together to process the financial information needed by management in interrelated and financial decision-making processes^[38]. Committed is a contract that is free, visible, and expected by all parties. The people work effectively to attain organizational objectives so that the organization is responsible for the government leaders of the organization in terms of its resources, resources,

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leadership, and control. Management must work through others to achieve goals, where leaders cannot implement the whole strategy of the organization by working alone. Commitment is such a situation where an individual party wants to maintain the organization and the objectives within the organization^[19]. Management commitment is the confidence and strong support of management to work together to formulate, implement, and implement a policy so that it can achieve the goal^[19].

Management information can provide to assist in making decisions regarding the effectiveness of the AIS^[12]. AIS can assess as an added value to the benefit^[9]. AIS has effectiveness as a measure of success in achieving established goals^[2]. Choe states that successful implementation of AIS is not easy to achieve and often creates problems because it is affected by many factors, among others: (I) join users; (II) leadership support; (III) user training and education; (IV) the working groups of the group within the organization, & (V) other organizational factors such as responsibilities, size of the organization, characteristic, & others^[8].

Bangladesh is an emerging economic country. The progress of the economy increases day by day. Bangladesh is an overpopulated country where labor remuneration cost is lower from the developing and developed countries. Many developing and developed countries invested in Bangladesh for cheap labor costs that reduce production costs. For investing, investors want to know well transparency for financial statements of companies and organizations. To make the right financial statements, it needs an accurate accounting system.

We identify a research gap that helps to make correct financial statements. This study helps all stakeholders through the right information. This study design research questions that are following:

- (1) Does accounting information systems increase organizational accounting and financial performance?
- (2) Does the quality of AIS influence management commitment?
- (3) Does the quality of AIS influence user competence?
- (4) Does accounting information software improves accounting standards?

To get responses to these questions, this study designs a questionnaire. After collecting respondents' responses, this study analyzed this response through 3 popular methods Chi-square tests, ANOVA tests, and Multinomial logistic tests. The purpose of this study is to look at the impact of accounting information systems on the economy.

This study shows that AIS is beneficial for Bangladeshi organizations. Which contributes to the economic

development of Bangladesh. However, it finally shows that this system has a gap between what accounting information systems are & what should be.

This paper suggests that an organization may get potential benefits through the implementation of AIS in Bangladesh. It also will be benefited stakeholders from implying it. The paper conducts based on listed financial organizations of Bangladesh. This is the main limitation of this study.

This study consists of ten following segments such as 2. Information Systems; 3. Accounting Information System; 4. Literature review & hypotheses development, 5. The benefit of Accounting Information Systems, 6. Quality of Accounting Information Systems, 7. Company Financial Performance, 8. Research Methodology, 9. Analysis and Result Discussion & Robustness Check, & finally, 10. Conclusion and policy implication.

2. Information Systems (IS)

An information system is a system that collects information, storing, accessing, processing, managing, controlling & reporting information so that an organization can achieve its goals^[33]. Technically an information system is a set of correlative components that take out, process, stock, and allot information for the purpose of decision making and control function of an organization. Besides helping in decision making, control and coordination activities, the information system provides its helping hand to find out complex issues and making new facilities for employees. An information system gathers information related to vital issues like people, places and other things of an organization^[24]. The following elements include information systems.

2.1 Inputs

Data are the collection of raw facts of events of an organization that are not organized before they are taken into processing stage. Only by the help of data we cannot make any type of decision whatever they are in controlling and productive^[24]. Data must be gone into the IS to be readied. Information is the realities that are gathered and handled by the data framework. Data are meaningless & useless, which by the process transformed into a meaningful, organized, & useful form which is called information. There are various types of input devices. They are mouse, keyboard, joystick, light pen scanner, microphones, Magnetic Ink Character Reader Recognition (MICR), Optical Character Reader (OCR), optical mark reader (OMR), bar code reader, badge reader, digitizer, and touch screen^[35].

2.2 Processor

The data must process through a processor to create useful and meaningful information. Processor performing arithmetic functions (multiply, divide, add, subtract etc.) or logical operations (comparisons like less than, equal to, greater than, etc.) on data to convert them into useful information. CPU is thought as the cerebrum or brain of the computer. It performs all types of data processing tasks. It stocks data, interim results, and instructions (program). It checks the operation of all parts of the computer. ALU (Arithmetic Logic Unit), Memory Unit, Control Unit are the parts of the central processing unit (CPU)¹.

2.3 Output

Output disposes the refined or processed data to the people or organization who will use it. Because raw data cannot be used for decision making and controlling functions^[24]. It is meaningful data that we get after processing the raw data. Output devices include all the hardware that transmit fact, knowledge, or information from the computer's CPU to the computer user. There are various output devices such as printer, plotters, speaker, monitor etc. The device that alters information into visual information is called a monitor. Information and graphics made with the help of computer are printed out as hardcopy with the help of printer^[35].

2.4 Data Storage

Must have internal stored data and external data for data processing. The place where data is stored after processing is called data storage. The unit occupies the data and instructions needed for processing, interim results of processing etc. The storage devices are divided into two parts such as primary storage and secondary storage. The primary storage is used for holding continuous program instructions, holding data, results. These storage devices are very rapid in operation, being small capacity, expensive and unrestful. The secondary storage devices are used for holding amassed program instructions, data and information of stored jobs. They are very slow in speed but have greater capacity than primary storage devices. They are very cheaper than the primary storage^[35].

2.5 Procedures & Instruments

An information system generates data through a computerized information system. The software contains

methods and instructions that instruct computers to process data^[35].

2.6 Users

Users are people who use the information generated by the system and who interact with the system. The current world users are very much dependent on quality information. So, the quality of information should be good enough to make an effective decision and control activities. There are various characteristics of useful information such as unailing, relevant, full-fledged, timely, understandable, verifiable, accessible etc.^[4].

2.7 Control Measure

For the IS to produce accurate and error-free information, the information system must take the necessary steps to protect and control. There are various viruses and non-virus related threat in the path of quality information system. Viruses are the self-duplicating program that intervene a computer hardware and operating system. Among the virus some are disturbing, and some are destructive in nature. If the virus is active in the operation, then it affects the overall program of the computer. So, management information system should be alert regarding the virus. In many cases the information is being theft by the third party. In these cases, the company uses the encrypt and decrypt system^[35].

3. Accounting Information System (AIS)

An AIS is an information system that collecting data, processing data that create the information necessary for its users. Accounting information systems accumulate data accounting as a set of components for future use, & process it for end-users^[6,16]. An accounting information system consists of hardware, software, databases, brain ware systems, & network communication technology^[39,40]. Accounting is called the language of business. And information system provides the vehicle of that language intelligently. There are six components of accounting information systems. They include the (a) the system user; (b) process and formula for collecting, processing and storing data; (c) data of institution and activities; (d) usable software; (e) technology infrastructure like computer, peripheral devices and network for communication; (f) and controlling and security measures^[4].

3.1 Software

Software is a kit of indications, data or programs needed to set into action a computer and execute specific ought. Hardware describes the physical issues of computer

1 (www.tutorials point.com).

so software is the inverse of it ^[35]. Software is a generic term used to refer to applications, scripts and programs that run on a device. It can be thought of as the variable part of a computer, while hardware is the invariable part. Hardware and software are two main categories of information technology (IT). Software is a set of hardware that performs instructions for specific tasks ^[3]. The software contains all the data collection process instructions ^[40]. Computer software acts like a stuff that will help you do the work. Computer without the software is like a home entertainment system with no tape, CD, or movies. Software is being developed continuously for meeting the time demand of organization. The bigger the version develops, the bigger the version changes. Usually, a big change will result in an entire number upgrade; a tiny change may result in a tenth of a decimal place ^[35]. Mainly there are two types of software such as system software and application software.

3.2 Hardware

Computer hardware is a combined term used to describe any physical element of an analog or digital computer. The term hardware separates clear parts of a computing device from software, which contains written instructions that tell the physical elements what to do². Hardware is an assortment of software programs that used to run a computer. The program is a series of computer commands. The operating system works to create and control relationships between components installed on a computer system ^[38].

3.3 Brain-ware

Brain-ware is an essential component of an AIS. Brain-ware is a resource that deals with the creation, accounting, and processing of accounting information systems, distribution, and use of information ^[39].

3.4 Procedure

The process is a repetitive operation based on specific rules for running an information system. The process becomes a guiding agency for deciding what activities can be performed ^[39]. The processes do not usually change and are running in the same order to ensure standardized and consistent results. Guides, training pieces and tutorials are common means to explain the processes to employees so that they can practice them to accomplish the objectives of the organization³.

3.5 Database

A database is a set of interrelated file collections. It is not just a selection of files. The records in each file must be allowed to relate to the other files. A database management system is a data set controlled by software ^[5].

3.6 Communication Technology

A telecommunications system is a combination of hardware and software that is compatible with any other place for information communication. The telecommunication system permits data transmission on public or private networks and creates a network communication system by joining two or more devices and sets a standard way to communicate ^[3].

Qualitative features of information systems are reliability, integration, flexibility, accessibility, & timeliness. Accounting information system can evaluate by the efficiency of the transaction processing system, transaction processing cycle criteria, data system integration, adaptability of the data system, and accessibility of the data system ^[41].

4. Literature Review

Soudani (2012) shows effective performance between AIS and organization performance. Unfortunately, they found no connection between AIS and performance management ^[36]. Sari, SE, & Purwanegara (2016) showed that quality of accounting systems is influenced by some factors, these factors are management commitment, information technology, organizational structure, e-commerce, & leadership style ^[34]. Hellström (2006) points out that accounting information has more value relevance than a transitional economy from a developed market economy. They further feel that the relevance of the information increases due to progress in transition ^[17].

Salehi & Abdipour (2013) point out that the implementation of AIS is being hampered by a number of factors. These factors are moderate managers, human resources, environmental factors, organizational structure, financial problems & organizational culture. They further mention that if employees are rewarded in the new system, this system will lead to more benefits ^[32].

The quality and effectiveness of real-time financial reporting depend on the efficiency of providing real-time, uninterrupted financial monitoring ^[22]. Real-time financial reporting, accounting, real-time auditing, information systems create the essential for a new breed of professionals who work efficiently in accounting and information technology. Real-time financial reporting delivers benefits to investors & financial analysts. It has raised several concerns in previous discussions about

2 <https://searchnetworking.techtarget.com/definition/hardware>

3 <https://www.myaccountingcourse.com/accounting-dictionary/procedure>

the use of technology that will bring the technology community closer to real-time financial reporting. Corporate management may object to the database tactic because it presents financial independence in a way that best serves their interests. Real-time financial reporting can lead to greater transparency in financial reporting. It enables more efficient monitoring of the choices of management accounting methods. World Wide Web pages show investors that they can access financial information on a real-time basis. It could argue that the cost of publishing in real-time and the fear of sending proprietary information to competitors may discourage companies from disclosing their financial information in a real-time manner. However, these difficulties can be offset by the effect of timely disclosure of capital expenditure^[10]. Botosan (1997) states that companies that provide timely financial disclosure that are less costly for suppliers. Botosan searches offer some insight into the probable benefits of real-time financial reporting^[7].

Dandago & Rufai (2014) show that accounting information technology reduces operational costs & can improve the efficiency of banks by facilitating transactions between customers within the same or different networks^[11]. Hla & Teru (2015) found that the accounting information system is very important in both business and organization where it helps to simplify management decision making, internal control & quality of financial reporting. They also point out that AIS facilitates transactions & also plays an important role in the economic system^[18]. Kwarteng & Aveh (2018) refer that accounting information system influences corporate performance. They further refer that there has a significant relationship between organizational culture on accounting information system & corporate performance^[23]. Accounting information always plays a vital role in managers' decision making regarding financial & economic issues^[29]. Khaghaany, Kbelah, & Almagtome (2019) show that there has a significant relationship between share price & sustainability reporting^[21].

4.1 Hypothesis Development

The use of IT (information technology) conducts more available & swiftly regained information, including internal information, external information, previously encountered, and thus rises the accessibility of information. Widely funded companies can be competitive advantage by deploying IT to support their business. The ability to align IT strategies and business strategies involves an appropriate level of IT practice. Thus, high level IT expected to be used in developed countries and

lower-level IT in underdeveloped countries. The following assumptions formulate to give the right answers to the researchers according to the application and benefits of the AIS and research problems.

Hypothesis 1: Does Accounting information systems cause to increase accounting & financial performance?

Hypothesis 2: Does Accounting information systems cause more accuracy of financial reporting?

Hypothesis 3: Does AIS cover all financial information needs of the organization?

Hypothesis 4: Does AIS cover all management levels information of Bangladesh?

Hypothesis 5: Does the quality of AIS influence by management commitment?

Hypothesis 6: Does the quality of AIS influence by user competence?

Hypothesis 7: Does accounting information software improves accounting standards in Bangladesh?

5. The benefit of Accounting Information Systems (AIS)

AIS has some advantages in any organizations which as follows:

5.1 Good Cooperation

Anything that is always associated with a particular environment develops third party logistics initiatives to bridge the existing chain linking. Although third-party logistics businesses exist in the market as separate entities, they & other firms still need to maintain a close relationship. It means that customers must maintain and control the flow and timeliness of the material to ensure the general operation of their products, which allows third-party logistic enterprises to cooperate with AIS in up downstream companies & control the entire supply chain. Conducts integrative activities and truly achieves supply chain competition.

5.2 To Meet the Needs of Multi-users

As the environment changes, the use of accounting information expands to include all levels of enterprise management, all outside investment firms, government agencies, intermediaries, & accountants and non-accountants. The traditional based AIS can only create affordable financial statements with financially and low accounting information, narrowing the scope of use. Accounting information systems record all resource & economical business activities, allowing users to access their desired information through event-driven buttons in an interactive interface.

5.3 To Control Simultaneously

The account contains the work of supervising and regulating the economic activities of the enterprise. "Accounting" can only inspect after the manual and computerized accounting system, but mistakes cannot avoid. The new accounting information system integrates real-time processing, spends standards. It allows control of the approval process, manages budgets, and much more so that employees change from passive to active to manage their activities based on standard and identify problems promptly, correct deviations & correctly after, control in advance and simultaneously.

6. Quality of Accounting Information Systems (AIS)

Accounting information system is an interconnected system that integrates manual and computer parts, recording, summarizing, analyzing, and using data management to provide the user with information about the output. An AIS usages a mechanism to transfer inputs to attain the whole objectives of the process^[19].

The AIS is a set of software systems that work to record transaction data, process data. It offerings information connected to accounting to internal & external parties. An AIS is a structure that adapts inputs to convert financial data. That used to manage the actions of an entity and to deliver accounting information to those worried^[19].

The AIS is a field of information technology & structures. That design is to assist financial institutions in managing and controlling related matters. AIS is a system that identifies data, records, stores, & processes data for decision-makers. However, accounting information systems that will efficiently progress the quality of organizational financial reporting.

The functions of AIS are: 1. to support management operations. Stewardship mentions to the responsibility of managing the resources of an organization properly. 2. Helping managerial decision. 3. Support the day-to-day actions of the company. Information systems offer information to efficient employees to perform their daily responsibilities effectively & efficiently^[19]. It can provide to assist in management decisions regarding the effectiveness of AIS.

7. Company Financial Performance

Performance is a record of the results produced over some time. Performance record in the results generated in a period^[25]. A set of performance results that typically denotes to the success of the execution of an executed

task^[37]. The financial performance of a company is the level of success or financial success achieved by an organization over some time. The stage of achievement or financial success is usually related to the level of profit obtained by the corporation. The success of the AIS implication has highlighted the issues that affect the effective implementation of the AIS^[15]. They have eight-element achievements in the field of AIS, namely: (i) user quality improved applications, (ii) user self-sufficiency, (iii) organizational commitment, (iv) quality of staff, (v) various types of services, (vi) Quality of service, (vii) benefits of end-user computing, & (viii) the definition of the role of AIS^[13].

Raymond refers the successful accounting information system divided into two parts, namely: (i) the context of the organization such as- size, time frame, maturity resources (ii) in the context of accounting information systems, such as AIS practice^[30]. The determinants of the successful implementation of accounting information systems divided into four aspects, namely: (i) technology, (ii) work, (iii) structure, (iv) the people^[20]. Agung divided the five aspects of determining the success of the accounting information system, namely: (1) AIS facility, (2) AIS competency, (3) AIS integration, (4) user support, & (5) AIS structure^[1]. They share six critical success elements of the information system, namely: (i) top management support, (ii) favorable conditions, (iii) user experience, (iv) user training, (v) the attitude of the user, & (vi) user participation^[31]. The amount of profit can be measured using different ratios. The performance measure indicators return on assets (ROA), return on equity (ROE), and profit margin^[26,14,2,27].

8. Research Methodology

This study has been conducted based on analysis and a theoretical approach. For collecting data, it covers listed organizations of Bangladesh. It observed a total of 500 respondents. To run the research and to get informative results study used only primary data. Chi-Square has been used to analyze basic results. Finally, to test the robustness check, this study uses ANOVA tests and Multinomial logistic tests. It calculates the data with the help of IBM statistical packages for social science (SPSS).

9. Analysis and Result Discussion

Table 1 represents the descriptive statistics of all variables. The average values of all indicators are positive. That indicates that the sample indicators have a significant effect on all hypotheses.

Table 2 examines correlation matrix, among the

Table 1. Descriptive Statistics

	AIS	QAIS	AISW	H1	H2	H3	H4	H5	H6	H7
Mean	1.6040	1.5260	1.5040	1.8780	1.798	1.828	2.376	2.628	2.306	2.128
Median	1.0000	1.0000	1.0000	2.0000	2.0000	2.0000	3.0000	3.0000	3.0000	2.0000
Std. Deviation	.75917	.74191	.73693	.86754	.833	.841	.758	.618	.798	.886

Table 2. Correlations Matrix

	AIS	QAIS	AISW	H1	H2	H3	H4	H5	H6	H7
AIS	1									
QAIS	.225**	1								
AISW	.597**	.156**	1							
H1	.033	-.018	-.063	1						
H2	-.095*	-.055	-.082	.423**	1					
H3	.050	.055	.105*	.111*	.153**	1				
H4	.071	.043	.033	-.046	-.197**	-.109*	1			
H5	.031	.078	-.036	-.122**	-.426**	-.119**	.230**	1		
H6	.022	.029	.075	-.650**	-.509**	-.118**	.074	.146**	1	
H7	-.070	-.054	-.041	.503**	.233**	.180**	-.110*	-.015	-.554**	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Note: AIS indicates Accounting Information Systems. QAIS denotes Quality of Accounting Information Systems. AISW represents Accounting information software. H indicates Hypothesis.

independent variable the correlation values show below 0.70. It indicates that models are free from major multicollinearity problem. Hypothesis 1: Accounting information systems cause to increase accounting & financial performance. Table 3 indicates that the mean value is 1.878 and the S.D value is 0.867. The chi-square value is 20.244 and the p-value is 0.000. The value of hypothesis one indicates that we can't accept the null hypothesis. So we accepted the first hypothesis. It means AIS can increase the accounting & financial performance of any organization. It refers that the use of AIS that will enhance the company's accounting and financial performance. This further indicates that accounting information systems will be adopted by Bangladeshi firms to improve accounting and financial performance.

Hypothesis 2: Accounting information systems cause more accuracy of financial reporting. Table 4 displays that the mean value is 1.798 and the S.D value is 0.833. The chi-square value is 17.706 and the p-value is 0.001. The value of hypothesis two indicates that we can't accept the null hypothesis. So we accepted the second hypothesis. It means AIS can collect and provide more accurate information to prepare financial reports. It refers that the

use of AIS that will enhance the company's accuracy of financial reporting. Any company that adopts accounting information systems will create more accurate financial statements & provide reliable information to prepare financial reports. This further indicates that accounting information systems will be adopted by Bangladeshi firms to improve the accuracy of financial reporting.

Hypothesis 3: AIS covers all financial information needs of the organization. Table 5 indicates that the mean value is 1.828 and the S.D value is 0.841. The chi-square value is 8.190 and the p-value is 0.085. The value of hypothesis three indicates that we can't accept the null hypothesis. So we accepted the third hypothesis. It means AIS cover all financial information needs of the organization. It refers that the use of AIS that will cover the company's all types of financial information. This further indicates that AIS will be adopted by Bangladeshi firms to cover all types of financial information.

Hypothesis 4: AIS covers all management levels information of Bangladesh. Table 6 indicates that the mean value is 2.376 and the S.D value is 0.758. The chi-square value is 15.923 and the p-value is 0.003. The value of hypothesis fourth indicates that we can't accept the null

Table 3. Relationship between AIS and accounting & financial performance.

Agree Neutral			H1			Total	
			Disagree				
AIS	Agree	Count	117	72	93	282	
		% of Total	23.4%	14.4%	18.6%	56.4%	
	Neutral	Count	76	30	28	134	
		% of Total	15.2%	6.0%	5.6%	26.8%	
	Disagree	Count	29	15	40	84	
		% of Total	5.8%	3.0%	8.0%	16.8%	
Total % of Total		Count	222	117	161	500	
		44.4%	23.4%	32.2%	100.0%		
Hypotheses		Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
1 st Hypothesis		1.878	0.867	4	20.244	0.000	Accepted

Table 4. Relationship between AIS and accuracy of financial reporting.

Agree Neutral				H2			Total
				Disagree			
AIS	Agree	Count	115	80	87	282	
		% of Total	23.0%	16.0%	17.4%	56.4%	
	Neutral	Count	82	25	27	134	
		% of Total	16.4%	5.0%	5.4%	26.8%	
	Disagree	Count	37	28	19	84	
		% of Total	7.4%	5.6%	3.8%	16.8%	
Total % of Total		Count	234	133	133	500	
		46.8%	26.6%	26.6%	100.0%		
Hypotheses		Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
2 nd Hypothesis		1.798	0.833	4	17.706	0.001	Accepted

Table 5. Relationship between AIS and financial information needs of the organization.

Agree Neutral			H3			Total	
			Disagree				
AIS	Agree	Count	129	72	81	282	
		% of Total	25.8%	14.4%	16.2%	56.4%	
	Neutral	Count	70	34	30	134	
		% of Total	14.0%	6.8%	6.0%	26.8%	
	Disagree	Count	28	26	30	84	
		% of Total	5.6%	5.2%	6.0%	16.8%	
Total % of Total		Count	227	132	141	500	
		45.4%	26.4%	28.2%	100.0%		
Hypotheses		Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
3 rd Hypothesis		1.828	0.841	4	8.190	0.085	Accepted

Table 6. Relationship between AIS and management levels information.

Agree Neutral				H4			Total
				Disagree			
AIS	Agree	Count	43	93	146	282	
		% of Total	8.6%	18.6%	29.2%	56.4%	
	Neutral	Count	33	32	69	134	
		% of Total	6.6%	6.4%	13.8%	26.8%	
	Disagree	Count	9	17	58	84	
		% of Total	1.8%	3.4%	11.6%	16.8%	
Total % of Total		Count	85	142	273	500	
		17.0%	28.4%	54.6%	100.0%		
Hypotheses		Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
4 th Hypothesis		2.376	0.758	4	15.923	0.003	Accepted

hypothesis. So we accepted the four hypotheses. So, we rejected the null hypothesis. It means AIS can cover and provide all management levels information. It is a strength of Bangladeshi organizations that available AIS can provide management information needs.

Hypothesis 5: The quality of AIS is influenced by management commitment. Table 7 displays that the mean value is 2.628 and the S.D value is 0.618. The chi-square value is 6.231 and the p-value is 0.183. The value of hypothesis fifth indicates that we can't reject the null hypothesis. So we rejected the fifth hypothesis. So, accepted the null hypothesis. It means the quality of the AIS doesn't influence by management commitment. It is a weakness of Bangladeshi organization which quality of the AIS doesn't influence by management commitment.

Hypothesis 6: The quality of AIS is influenced by user competence. Table 8 displays that the mean value is

2.306 and the S.D value is 0.798. The chi-square value is 16.442 and the p-value is 0.132. The value of hypothesis sixth indicates that we can't reject the null hypothesis. We rejected the sixth hypothesis. So, we accepted the null hypothesis. It means the quality of the AIS doesn't influence by user competence. It is another weakness of Bangladeshi organizations in which the quality of the AIS doesn't influence by user competence.

Hypothesis 7: Accounting information software improves accounting standards in Bangladesh. Table 9 displays that the mean value is 2.128 and the S.D value is 0.886. The chi-square value is 12.195 and the p-value is 0.116. The value of hypothesis seventh indicates that we can't reject the null hypothesis. So we rejected the seventh hypothesis. So, we accepted the null hypothesis. It means accounting information software doesn't improve accounting standards in Bangladesh. It is another

Table 7. Relationship between quality of AIS and management commitment.

Agree Neutral			H5			Total
			Disagree			
QAIS	Agree	Count	27	76	209	312
		% of Total	5.4%	15.2%	41.8%	62.4%
	Neutral	Count	7	18	88	113
		% of Total	1.4%	3.6%	17.6%	22.6%
	Disagree	Count	3	18	54	75
		% of Total	.6%	3.6%	10.8%	15.0%
Total % of Total		Count	37	112	351	500
		7.4%	22.4%	70.2%	100.0%	
Hypotheses	Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
5 th Hypothesis	2.628	0.618	4	6.231	0.183	Rejected

Table 8. Relationship between quality of AIS and user competence.

Agree Neutral			H6			Total	
			Disagree				
QAIS	Agree	Count	69	95	148	312	
		% of Total	13.8%	19.0%	29.6%	62.4%	
	Neutral	Count	18	18	77	113	
		% of Total	3.6%	3.6%	15.4%	22.6%	
	Disagree	Count	19	22	34	75	
		% of Total	3.8%	4.4%	6.8%	15.0%	
Total % of Total		Count	106	135	259	500	
		21.2%	27.0%	51.8%	100.0%		
Hypotheses		Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
6 th Hypothesis		2.306	0.798	4	16.442	0.132	Rejected

weakness of Bangladeshi organizations that accounting information software doesn't improve accounting standards in Bangladesh. So, accounting information software doesn't harmonize with Bangladeshi accounting standards.

9.1 Robustness Check

To examine the robustness results, this study uses the likelihood ratio tests and ANOVA tests. Table 10 shows the likelihood ratio tests which performed by multinomial logistic test. The likelihood ratio tests support the basic results of this study.

Table 10 shows that the significant values of H1, H2, H3, H4 are 0.003, 0.018, 0.034 & 0.002 respectively which represent hypothesis (H1) to hypothesis (H4) is accepted. On the other hand, remaining significant value is 0.589, 0.141, and 0.118 respectively which represent don't accept the hypothesis (H5) to hypothesis (H7). The likelihood ratio test supports the main basic results of this study.

On the other hand, Table 11 shows the result of ANOVA tests. ANOVA tests result accept all hypotheses (H1-0.093 (0.024), H2-0.093 (0.024), H3-0.040 (0.024), and H4-

0.013 (0.024)) except hypothesis H5-0.196 (0.204), H6-0.193 (0.204) and H7-0.364 (0.364). Where our basic results and likelihood ratio tests also provide the same results. ANOVA tests reject the hypothesis H5, and H6 which indicate that the quality of AIS doesn't influence by management commitment and user competence. Rejected H7 indicates that accounting information software doesn't harmonize with Bangladeshi accounting standards.

10. Conclusions and Policy Implication

Accounting information systems focused on recording data, summarizing, and validating about business financial transactions. These events performed for a variety of groups concerned with decisions related to financial accounting, managerial accounting, & tax compliance in this account. This paper conducted based on analysis and a theoretical approach. We evaluate the potential application and benefit of accounting and information systems in Bangladesh. Our result showed that if the application of accounting and information systems ensures apply in each organization in Bangladesh. Accounting information systems improve financial statement & reporting of Bangladesh. It also ensures that it covers

Table 9. Relationship between Accounting information software and accounting standards

Agree Neutral				H7			Total
				Disagree			
AISW	Agree	Count	95	72	154	321	
		% of Total	19.0%	14.4%	30.8%	64.2%	
	Neutral	Count	50	15	41	106	
		% of Total	10.0%	3.0%	8.2%	21.2%	
	Disagree	Count	23	13	37	73	
		% of Total	4.6%	2.6%	7.4%	14.6%	
Total % of Total		Count	168	100	232	500	
		33.6%	20.0%	46.4%	100.0%		

Hypotheses	Mean	S.D	D.F	Chi-Square	Asymp. Sign	Decision
7 th Hypothesis	2.128	0.886	4	12.195	0.116	Rejected

Table 10. Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests			Goodness-of-Fit	
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.	Pearson Sig.	
Intercept	264.342 ^a	0.000	0			
H1	280.315	15.973	4	0.003	0.105	Accepted
H2	276.236	11.894	4	0.018	0.105	Accepted
H3	274.759	10.417	4	0.034	0.105	Accepted
H4	281.383	17.041	4	0.002	0.105	Accepted
H5	60.198	2.818	4	0.589	0.729	Rejected
H6	70.464	13.085	4	0.141	0.729	Rejected
H7	65.326	11.859	4	0.118	0.183	Rejected

Table 11. ANOVA Tests

B		Unstandardized Coefficients		Beta	t	Sig. Sig.	Reg.	Decision
		Std. Error						
Equation	(Constant)	1.434	.168		8.548	.000		
	H1	.072	.043	.083	1.684	0.093	0.024	Accepted
	H2	-.118	.046	-.129	-2.569	0.011	0.024	Accepted
	H3	.060	.041	.067	1.478	0.040	0.024	Accepted
	H4	.057	.046	.057	1.248	0.013	0.024	Accepted
	H5	.090	.054	.075	1.666	0.196	0.204	Rejected
	H6	.017	.042	.018	.395	0.193	0.204	Rejected
	H7	-.034	.037	-.041	-.909	0.364	0.364	Rejected

all financial information need of the organizations. The major weakness is management levels information which accounting information systems don't cover and provide all management levels information. The quality of AIS doesn't influence by management commitment and user competence. Accounting information software doesn't improve accounting standards in Bangladesh. So, accounting information software doesn't harmonize with Bangladeshi accounting standards. However, the result showed that has a huge gap between what accounting information systems & what should be. However, to handle this situation, a manager should take more aware of AIS benefits and more academic action for reducing such gaps in Bangladeshi corporate sectors. This paper suggests that an organization may get potential benefits through the implementation of AIS in Bangladesh. It also will be benefited stakeholders from implying it. It provides accurate information to all stakeholders that help them to the right decision. It will also help to improve economic development. This paper conduct based on Bangladeshi limited respondents that is the main limitation of this study.

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ARTICLE

Economic Policy Uncertainty, Heterogeneity of Executives and Enterprise Innovation

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ABSTRACT

This study analyzes how economic policy uncertainty affects corporate innovation, and the moderating effects of executive heterogeneity. A three-phase dynamic investment and financing model is first built to analyze the mechanism. Empirical analysis confirms that the increase in the degree of economic policy uncertainty promotes enterprise innovation. Further results show that this promotion effect is more significant in enterprises with male executives, low educational level, no financial experience and political background. Moreover, the positive impact is only found in enterprises with moderate executive ability, and the overconfidence of senior executives plays a positive regulating role in it.

1. Introduction

As an important means to promote industrial upgrading, technological innovation plays an important role in improving economic vitality. Innovation is the original power of sustainable economic development and the core of national international competitiveness. How to promote enterprise innovation to drive high-quality economic development has become an important economic issue to be explored. Therefore, exploring the factors that drive enterprise innovation plays a key role in promoting enterprise independent R&D and realizing long-term and sustainable economic development.

In recent years, China has issued a series of fiscal policy, monetary policy and industrial policy. In 2008, China launched the “4-Trillion-Yuan Stimulus Package”

to promote investment, consumption and stabilize the economy, which led to the year of China’s economic policy uncertainty index rose rapidly. Since 2012, China has introduced numerous measures to strengthen the regulation of local government financing platforms, promote the development of emerging financial format such as internet finance, and supply-side structural reform to achieve the goal of stable growth and structural adjustment, the degree of policy uncertainty increases.

The successive introduction of economic policies has played an important role in improving the consumption structure, promoting industrial upgrading and improving the real investment environment. However, the change and adjustment of economic policy inevitably lead to the increase of the uncertainty of economic policy and affect the micro-enterprises’ investment and financing behavior

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by influencing the industry and market environment.

Most research has focused on the effects of economic policy uncertainty on Corporate Investment, R&D innovation, asset allocation behavior, and executive turnover^[1-4]. The rise in economic policy uncertainty delays the decision to invest in R&D^[1,5], increase the number of patent applications filed by listed companies^[6], and strengthen their cash holdings^[7], and reduce the probability of executive change^[8].

As for the relationship between economic policy uncertainty and enterprise innovation, on the one hand, the external market risk and the bank's credit grudging due to the increase of economic policy uncertainty restrains the willingness of R&D and Innovation. On the other hand, the increase of economic policy uncertainty strengthens the motivation of enterprises to use policy change and industrial structure adjustment to accelerate the innovation of enterprises to increase market power. As the decision-makers and executors of the company's production and operation, the senior managers' gender, age characteristics, educational experience, employment experience, political background and personal ability, it is inevitable that the behavioral mechanisms will have an impact^[9-12]. In view of this, this paper attempts to explore the impact of economic policy uncertainty on enterprise innovation, as well as the regulatory mechanism of top management heterogeneity on the above relationship.

Using the data of non-financial listed companies in Shanghai and Shenzhen stock markets from 2007 to 2018, this paper empirically analyzes the impact of economic policy uncertainty on enterprise innovation, and the heterogeneity of the above effects in the east, the middle and the west, the allocation of credit resources, and the degree of patent protection; Secondly, we use the method of replacing the core variable and IV tool variable to test the robustness of baseline regression model. Then, the paper further analyzes the mechanism of the relationship between economic policy uncertainty and enterprise innovation, including the personal characteristics, executive competence and overconfidence.

Compared with the previous studies, the contributions of this paper are as follows: First, it breaks away from the traditional research perspectives of economic policy uncertainty and corporate investment, financial asset allocation and tax collection and management intensity, this paper analyzes the two opposite influence mechanisms of economic policy uncertainty on enterprise innovation, and makes a useful supplement for the research of macroeconomic policy on micro-enterprise behavior mechanism. Secondly, the paper explores the heterogeneity of economic policy uncertainty on

innovation in firms with different gender, education level, financial experience and political background. Thirdly, it further analyzes the regulation mechanism of the dynamic relationship between the uncertainty of economic policy and the innovation of enterprises by the personal ability and the overconfidence of senior managers, thus providing a theoretical basis for the field of policy uncertainty and the investment behavior mechanism of micro-enterprises, provides a new perspective.

The rest of this paper is arranged as follows: Section 2 reviews the relevant literature and develops the research hypothesis. Section 3 describes the research design and data. Section 4 is the empirical analysis. Section 5 further discusses the moderating effects of executive heterogeneity. Section 6 concludes.

2. Theoretical Analysis and Research Hypotheses

The research on the relationship between economic policy uncertainty and enterprise investment can be summarized in two points of view. The first view is that the increase of economic policy uncertainty restrains the investment scale of corporate entities^[8,13,14]. The rising uncertainty of economic policy discourages corporate investment by increasing the cost of capital and marginal return on capital channels^[15]. Another view is that the rise of economic policy uncertainty promotes enterprise R&D innovation, and the macroeconomic environment affects the relationship between policy uncertainty and business investment^[16]. The relationship between economic policy uncertainty and innovation activities is influenced by government subsidies, financial restraint, the nature of enterprise ownership, industry characteristics and other factors, as well as incentive and selection effects on enterprise innovation behavior^[6].

The changes of industry policy, market competition and credit availability caused by the uncertainty of economic policy also affects the R&D investment activities of enterprises. The rising uncertainty of economic policy increases the volatility of the macro-economy and aggravate the deterioration of the enterprise management style and the external market environment, increased competition in the industry reinforces the incentive for firms to respond to external risks through R&D and innovation^[17].

On the one hand, an increase in uncertainty about economic policy is likely to spur innovation. First, the increase of economic policy uncertainty means that the future industry and market uncertainty increased, increased investment risk. Once the enterprise can accurately predict

the future industry development trend, through R&D innovation to achieve the goal of industrial transformation and increase market share, it is bound to lead to the enterprise in the future production and management of first-mover advantage. Obviously, under the stimulation of industrial transformation and increasing market share, the increase of economic policy uncertainty will promote enterprise R&D innovation. Secondly, the increase of economic policy uncertainty increases the uncertainty of cash flow, executives prefer to hold more liquid financial assets, so they sell a lot of fixed assets to mitigate the adverse impact of the external environment in order to achieve the goal of reducing business risk^[2]. The increasing uncertainty of economic policy increases the operating risk of enterprises, which leads to diversification through R&D and innovation in order to reduce the liquidity risk caused by single business model. Third, in an environment of rising economic policy uncertainty, the opportunity cost and risk of managers and technicians changing jobs increases, and the mobility of labor decreases. Therefore, the increase of economic policy uncertainty reduces the mobility of core R&D personnel, which promotes the continuity of R&D innovation and increases the scale of effective output, thus enhancing R&D innovation Input, with the uncertainty of economic policy increasing, external investors are more sensitive to the release of negative news, and the "herd behavior" is obvious. R&D innovation can send a positive signal to outside investors, reduce the stock price crash risk, and improve the availability of financing and consumer confidence in enterprises. Therefore, in order to stabilize the expectations of external investors and enhance consumer confidence, managers tend to conduct R&D innovation when economic policy uncertainty is rising.

On the other hand, the uncertainty of economic policy may also inhibit enterprise innovation. The increase of economic policy uncertainty restrains firms' innovation input by increasing cash flow volatility, increasing the degree of financing constraint and increasing the value of waiting options. Specifically, first, the increased uncertainty in economic policy has increased the volatility of cash flows, and the corporate sector is more willing to allocate funds to more liquid assets in order to achieve the incentive of precautionary reserves. Secondly, the credit crunch caused by the uncertainty of economic policy also leads to the increase of external financing cost and the inhibition of enterprises' R&D willingness. The uncertainty of economic policy increases the systemic risk to a certain extent, which makes financial intermediaries strengthen risk control, tighten financing channels, and raise the threshold of business loans, which is not conducive to business technological innovation, the frequent change

of economic policy means that the uncertainty of future industry development increases, and most investors hold a wait-and-see attitude, waiting for the option value to rise. The decline in investor confidence and the unpredictability of stock price movements brought about by the rise in economic policy uncertainty may directly lead to a decline in senior executives willingness to invest in enterprise innovation^[8,9], an increase in uncertainty about economic policy also makes investors more sensitive to corporate decisions. Once negative expectations of corporate R&D projects are maintained, the likelihood of voting with feet is higher, resulting in a higher risk of corporate R&D, not conducive to enterprise R&D investment. It can be seen that the uncertainty of economic policy may have a positive or negative impact on enterprise innovation.

In order to describe the effect of economic policy uncertainty on R&D behavior, we build a three-phase investment and financing decision-making model, to analyze the possible mechanism of the rising uncertainty of economic policy on enterprise innovation. The model period is marked $t = (0, 1, 2, 3)$. Suppose a representative firm i in phase 0 decides whether to invest in R&D project j , the investment period of the project is 3 years, and once the firm decides to participate in the R&D project, it cannot withdraw halfway. The project requires an investment of $I_{j,1}$ and $I_{j,2}$ in the first and second phases, respectively, assuming that the probability of project failure σ_j is independent of changes in the external market environment and depends only on the technical barriers and market prospects of the project itself. If an enterprise i decides to invest in R&D, the probability of bankruptcy risk $\varphi_{i,j,t}$ is due to the tight liquidity caused by R&D investment in the t period. When the uncertainty of economic policy is high, the financial intermediary's loan-sparing behavior makes it more difficult and costly for the enterprises to obtain funds from the outside.

Suppose that in period t , the degree of uncertainty of economic policy is EPU_t . $\partial(\varphi_{i,j,t})/\partial(EPU_t) > 0$ can be obtained. Whether the research and development of the project can be successful or not, the enterprise cannot predict in advance, only can estimate the potential risk of the project, whether the research and development success of the project can be observed in period 3. If the project is successful in period 3, there are two benefits for the enterprise. Part of the revenue comes from the cash income $F_{i,j,3}$ generated by the transformation of the current results. The other part comes from the potential future income of industry transformation, decentralization and increasing market share, which is discounted to the present value $\vartheta_{i,j,3}$. Assuming a discount rate of $\gamma_{i,t}$, the higher the uncertainty of economic policy, the higher the present value

of future earnings from R&D, i. e. $\partial(\vartheta_{ij,3})/\partial((EPU)_t) > 0$.

Furthermore, it is assumed that the principal-agent and information asymmetry problems between the shareholders and the managers make the investment and financing decisions by the managers. Managers make investment and financing decisions based on their own profit maximization, in which the effectiveness of managers depends on the level of profits and risk aversion. That is, $\delta V(\pi_{i,t}) - \rho_i \delta_{i,t}^2$, in which, $\pi_{i,t}$ represents the level of profit of enterprise i in the t period, $V(w)$ corresponding to the current level of corporate earnings. ρ_i indicates that the degree of risk aversion of managers is determined by the characteristics of executives themselves. If the degree of risk aversion of executives is higher, then ρ_i is higher. $\delta_{i,t}$ represents the current external risk, and when the degree of economic policy uncertainty increases, it means that the external risk to the enterprise is higher, that is, $\partial(\delta_{i,t})/\partial((EPU)_t) > 0$. Therefore, if an enterprise decides not to invest in R&D Project j during the period 0, then the profit level of the company during the period t is $V(\pi_{i,t})$ respectively. According to the above analysis, the utility function of the top management is shown in formula (1) when the enterprise does not invest in Project j .

$$L(i, t) = \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \{ \delta V(\pi_{i,t}) - \rho_i \delta_{i,t}^2 \} \quad (1)$$

If the enterprise decides to conduct R&D, then the value of the firm in period $t = (1, 2)$ is $V(\pi_{i,t} - I_{i,t})(1 - \varphi_{ij,t})$. In period 3, the expected utility function of the manager is: $(1 - \sigma_j - \varphi_{ij,3}) * \{ \delta * V(\pi_{i,3} + F_{ij,3}) + \vartheta_{ij,3} \} - \rho_i \delta_{i,3}^2$. Therefore, the utility function of the entire project investment period expected by the top management in the first period is shown in formula (2).

$$U(i, t) = \sum_{t=1}^{t=2} \gamma_{i,t}^{-(t-1)} \{ \delta (1 - \varphi_{ij,t}) V(\pi_{i,t} - I_{i,t}) \} + \gamma_{i,t}^{-2} * [(1 - \sigma_j - \varphi_{ij,3}) * \{ \delta * V(\pi_{i,3} + F_{ij,3}) + \vartheta_{ij,3} \} - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \rho_i \delta_{i,t}^2] \quad (2)$$

Therefore, as the actual decision-maker and executor of the investment and financing decision-making, the manager chooses whether to invest in Project j according to the maximization of its effect function. The trigger condition of R&D investment can be found as shown in formula (3).

$$\gamma_{i,t}^{-2} \{ \delta (1 - \sigma_j - \varphi_{ij,t}) V(\pi_{i,3} + F_{ij,3}) - V(\pi_{i,3}) \} + \gamma_{i,t}^{-2} (1 - \sigma_j - \varphi_{ij,t}) * \vartheta_{ij,3} - \delta \{ [V(\pi_{i,1}) - V(\pi_{i,1} - I_{i,1})(1 - \varphi_{ij,1})] + \gamma_{i,t}^{-1} [V(\pi_{i,2}) - V(\pi_{i,2} - I_{i,2}) * (1 - \varphi_{ij,2})] \} > 0 \quad (3)$$

If at the end of the payback period ($t = 3$), the present value of the difference between the expected return on investment from the R&D investment in project j and the profitability of the project j not invested, R&D innovation

occurs when the present value of the future potential return from project investment j is greater than the present value of the previously uninvested project ($t = 1, 2$) minus the expected return on R&D investment. Otherwise, the enterprise will not invest Project j .

Next, we further discuss the impact of rising economic policy uncertainty on corporate R&D decisions. Based on the above analysis and hypothesis, the uncertainty of economic policy increases, which means that enterprises are more likely to have a liquidity crisis because of R&D investment in project j . That is, $\partial(\varphi_{ij,t})/\partial((EPU)_t) > 0$. The rising uncertainty of economic policy also increases the potential gains of enterprises in terms of increasing market share, diversification and industrial restructuring due to the success of research and development projects, i.e. $\partial(\vartheta_{ij,3})/\partial((EPU)_t) > 0$. It is also assumed that the increase in economic policy uncertainty increases the external risks to management decisions, that is, $\partial(\delta_{i,t})/\partial((EPU)_t) > 0$. If we take the first derivative of the manager's utility function for the degree of uncertainty in economic policy, we get:

$$\begin{aligned} \partial U(i, t) / \partial EPU_t &= \sum_{t=1}^{t=2} \gamma_{i,t}^{-(t-1)} \{ \delta (1 - \partial \varphi_{ij,t} / \partial EPU_t) V(\pi_{i,t} - I_{i,t}) \} + [\gamma_{i,t}^{-2} (1 - \sigma_j - \partial \varphi_{ij,t} / \partial EPU_t) * \{ \delta * V(\pi_{i,t} + F_{ij,t}) + \vartheta_{ij,3} \}]|_{t=3} + [\gamma_{i,t}^{-2} (1 - \sigma_j - \varphi_{ij,t}) * \{ \delta * V(\pi_{i,t} + F_{ij,t}) + \partial(\vartheta_{ij,3}) / \partial((EPU)_t) \}]|_{t=3} - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \{ 2\rho_i \delta_{i,t} \partial(\delta_{i,t}) / \partial((EPU)_t) \} \end{aligned} \quad (4)$$

Since $\partial L(i, t) / \partial EPU_t = - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \{ 2\rho_i \delta_{i,t} \partial(\delta_{i,t}) / \partial((EPU)_t) \}$, according to the formula (4), if the uncertainty of economic policy increases, the negative impact of the increase in the liquidity risk of R&D investment on operating performance is smaller than the positive impact of the transformation of the results of the current period and the potential return on the performance of the firm after the R&D success, an increase in uncertainty about economic policy would promote innovation. On the contrary, it inhibits enterprise innovation.

Therefore, based on the mechanism analysis and theoretical model, this paper proposes two opposite hypotheses about the impact of economic policy uncertainty on firm innovation:

H1a: Increased uncertainty in economic policy promotes entrepreneurial innovation.

H1b: Increased uncertainty about economic policy can inhibit entrepreneurial innovation.

Furthermore, consider that the manager is the executor of the enterprise's investment and financing decisions. In this part, we analyze the influence of managerial competence MA_i and managerial overconfidence MC_i on the innovation behavior of enterprises. The improvement of top

management ability can strengthen corporate governance and cash management level, thus reducing the probability of bankruptcy of enterprises due to long-term and large-scale R&D investment, that's $\frac{\partial \varphi_{ij,t}}{\partial MA_i} < 0$. Overconfidence in the executive means that he or she underestimates the risk of the investment itself, which is $\frac{\partial \varphi_{ij,t}}{\partial MA_i} < 0$.

Therefore, the utility function $U(i, t)$ of R&D investment is used to solve the first derivative for executive competence and overconfidence respectively, and the results are shown in formulas (5) and (6).

$$\frac{\partial U(i, t)}{\partial MA_t} = \sum_{t=1}^{t=2} \gamma_{i,t}^{-(t-1)} \left\{ \delta \left(1 - \frac{\partial \varphi_{ij,t}}{\partial MA_t} \right) V(\pi_{i,t} - I_{i,t}) \right\} + \gamma_{i,t}^{-2} \left[\left(1 - \sigma_j - \frac{\partial \varphi_{ij,t}}{\partial MA_t} \right) * \{ \delta * V(\pi_{i,t} + F_{i,j,t}) + \vartheta_{i,j,3} \} \right]_{t=3} - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \rho_i \delta_{i,t}^2 \quad (5)$$

$$V(\pi_{i,t} + F_{i,j,t}) + \vartheta_{i,j,3} \Big|_{t=3} - \sum_{t=1}^{t=3} \gamma_{i,t}^{-(t-1)} \rho_i \delta_{i,t}^2 \quad (6)$$

Because, according to formula (6), the improvement of senior management ability will increase the income of enterprise R&D investment, and then promote enterprise R&D innovation behavior under the situation of economic policy uncertainty. Similarly, , which means that during periods of high economic policy uncertainty, overconfidence of top management can also have a positive effect on firm R&D innovation behavior.

3. Research Design and Research Data

3.1 Sample Selection and Data Sources

This paper selects the data of non-financial listed companies in Shanghai and Shenzhen stock markets from 2007 to 2018 as the research sample, and excludes the ST sample. On the measurement of economic policy uncertainty, this paper uses Davis et AL's index of economic policy uncertainty in China, which is based on the key words in The People's Daily and Guangming Daily¹. The index calculates the number of articles with keywords such as "Finance", "Currency", "Securities Regulatory Commission", "Banking Regulatory Commission", "People's Bank" and "National Development Reform Committee", divide the number of articles that appear by the total number of articles for that month to get the exact value of policy uncertainty for that month, and use January 1995 as a benchmark to calculate China's economic uncertainty. Corporate financial data come from the CSMAR database. All continuous variables are winsorized at the 99th percentile.

3.2 Empirical Models and Variable Definitions

In order to study the impact of economic policy uncer-

tainty on enterprise innovation behavior, this paper constructs an empirical model as shown in Formula (7).

$$R\&D_{i,t} = \beta_0 + \beta EPU_t + \rho X_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (7)$$

Among them, the lower corner i represents the enterprise, the t represents the year, β_0 is the constant, μ_i is the enterprise fixed effect, δ_t represents the year fixed effect, $\varepsilon_{i,t}$ as the unobserved residual term, Standard error clustering of regression model to enterprise level.

The ratio of R&D investment to total assets is regarded as the agency variable of R&D innovation ($R\&D$). In the robustness test, the R&D investment to revenue ratio ($R\&D_2$), the natural logarithm of patent validity ($R\&D_3$) and the natural logarithm of patent validity ($R\&D_4$) are used as the proxy indexes of enterprise innovation.

The EPU is the core explanatory variable of this paper, that is, economic policy uncertainty, which is measured by all monthly averages for the year². If β 's estimated value is significantly greater than 0, then the increase of economic policy uncertainty promotes enterprise innovation, and H1a is established, whereas if the estimated value is significantly less than 0, then the increase of economic policy uncertainty inhibits enterprise innovation, H1b verified.

$X_{i,t}$ is the control variable. This paper further controls the company size ($Size$), financial leverage ratio (Lev), profitability (ROA), capital intensity (Int), enterprise market age (Age), main business growth rate ($Growth$), the dummy variable of actual controller (Soe) and the dummy variable of independent director ($Isindirecotre$). Definition and statistical description of variables are shown in Table 1.

4. Empirical Results Analysis

4.1 Benchmark Regression

Table 2 reports the results of a baseline regression on the impact of economic policy uncertainty on enterprise innovation. Individual fixed effect and year fixed effect are controlled in the regression model. The coefficient of economic policy uncertainty (EPU) is 0.0194 on the basis of controlling three basic control variables: Company Size(-Size), Financial Leverage ratio(Lev), Profitability(ROA), and it is significantly positive at 1% statistical level. The last three columns of the table add other control variables one by one. The results show that the coefficient of economic policy uncertainty (EPU) is significantly positive at 1% statistical level considering different information sets. Column (4) of Table 2 shows the regression results after adding all the control variables that affect the enterprise innovation. The result shows that the EPU co-

¹ Data from the http://www.policyuncertainty.com/china_monthly.html

² In the empirical analysis, The EPU index is reduced 100 times

Table 1. Main variable definitions and descriptive statistics

Variable definition	Variable	Variable measure	Sample size	Standard deviation	Median	Mean value
R&D investment as a percentage of total assets	<i>R&D</i>	Enterprise R&D input/total assets	22178	0.0172	0.0078	0.0137
Uncertainty about China's economic policy	<i>EPU</i>	China's economic policy uncertainty index, measurement methods are detailed in the body	22178	0.3372	1.2217	1.2542
Scale of enterprise	<i>Size</i>	natural logarithm of total assets	22178	1.2935	21.8651	22.0243
Leverage ratio	<i>Lev</i>	Total liabilities/total assets	22178	0.2164	0.4386	0.4436
Profitability	<i>ROA</i>	net profit/total assets	22178	0.0581	0.0356	0.0378
Capital intensity	<i>Int</i>	Total assets/operating income	22178	2.3742	1.9021	2.5850
Enterprise Market Age	<i>Age</i>	year of study-year of company listing	22178	5.4315	16.000	15.6649
Growth rate of main business income	<i>Growth</i>	current year main business income/previous year main business income-1	22178	0.5509	0.1197	0.2145
Nature of the actual controller	<i>Soe</i>	state-owned enterprises = 1, Non State-owned enterprises = 0	22178	0.4941	0.0000	0.4233
Nature of independent director	<i>Isindirecotre</i>	independent director = 1, non-independent director = 0	22178	0.0092	0.0000	0.0001

efficient is 0.1332, which is significantly positive at 1% statistical level, it shows that the increase of uncertainty level of economic policy will promote enterprise innovation, i.e. H1a assumption holds.

Table 2. Economic policy uncertainty and enterprise innovation

Variable	(1) <i>R&D</i>	(2) <i>R&D</i>	(3) <i>R&D</i>	(4) <i>R&D</i>
<i>EPU</i>	0.0194*** (0.001)	0.0255*** (0.009)	0.1144*** (0.036)	0.1332*** (0.041)
<i>Size</i>	-0.0016*** (0.000)	-0.0014*** (0.000)	-0.0009*** (0.000)	-0.0009*** (0.000)
<i>Lev</i>	0.0000 (0.001)	-0.0004 (0.001)	-0.0026*** (0.001)	-0.0026** (0.001)
<i>ROA</i>	0.0130*** (0.002)	0.0098*** (0.002)	0.0041** (0.002)	0.0055*** (0.002)
<i>Int</i>		-0.0006*** (0.000)	-0.0006*** (0.000)	-0.0006*** (0.000)
<i>Age</i>		-0.0004 (0.001)	-0.0012 (0.001)	-0.0015* (0.001)
<i>Growth</i>			-0.0003** (0.000)	-0.0004*** (0.000)
<i>Soe</i>				0.0005 (0.001)
<i>Isindirecotre</i>				-0.0122 (0.010)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
<i>N</i>	27,627	27,548	24,145	22,178
<i>adj-R²</i>	0.157	0.166	0.161	0.159

Note: ***, **, * are significant at 1%, 5%, and 10% statistical levels, respectively. In parentheses are robust standard errors clustered to enterprise level, the same as below.

4.2 Regional Heterogeneity

There are great differences in economic development level, institutional environment and industrial policy among different regions in China^[20]. The effect of economic policy uncertainty on the behavior mechanism of micro-enterprises may have regional heterogeneity. In general, in areas with a higher degree of economic development, the capital market is more complete, the system design is more reasonable, and the external economic environment is more favorable for enterprises to engage in R&D and innovation Activities. The effectiveness of capital market can provide timely liquidity support for enterprise R&D innovation, ease enterprise financing constraints, and promote enterprise innovation. Wang et al. (2014)^[2] found that firms in more market-oriented regions were more motivated to innovate when economic policy uncertainty was on the rise. In areas with a higher degree of economic development, the proportion of overseas investment and the degree of market opening are stronger. With the increase of economic policy uncertainty, enterprises can make R&D innovation to realize decentralized management and increase market share.

The regional heterogeneity of the impact of economic policy uncertainty on firm innovation is reported in Table 3. The first two columns and the last two columns in the table give the regression results of some control variables and all control variables, respectively. The results show that the coefficient of economic policy uncertainty (EPU) is 0.0308 in the eastern region, which is significant at the 1% statistical level. However, the EPU coefficient is not

significant in the midwest. When controlling variables were added to columns (3) and (4) of the table, the results still showed that the positive correlation between economic policy uncertainty and firm innovation was only significant in the eastern developed regions, the above influence does not exist in the less developed areas of the central and western regions.

Table 3. Economic policy uncertainty and enterprise innovation: Sample regression in east, Midwest regions

Variable	(1) <i>R&D</i> The East	(2) <i>R&D</i> The Midwest	(3) <i>R&D</i> The East	(4) <i>R&D</i> The Midwest
<i>EPU</i>	0.0308*** (0.009)	-0.0137 (0.010)	0.1462*** (0.042)	-0.0359 (0.052)
<i>Control variable</i>	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
<i>N</i>	19,229	8,258	15,360	6,817
<i>adj-R²</i>	0.153	0.201	0.147	0.193

As a long-term, high-risk investment activity, R&D innovation requires periodic and continuous cash inflows. Studies have found that the problem of credit constraints caused by the low degree of financial market development is the cause of the decline in investment rates and consumption levels in developing countries^[21], the increase in the efficiency of credit resource allocation is the effect of industrial agglomeration. An important channel for corporate financing costs^[22], at the same time, political connections will also have a negative impact on the efficiency of credit resource allocation^[23]. Rising uncertainties in economic policies increases financial market volatility and exacerbate financial intermediaries' credit-grass behavior, thereby increasing the difficulty and cost of external financing for enterprises. However, the increase in the allocation of credit resources will reduce the inhibitory effect of financing difficulties caused by policy uncertainty on corporate innovation. Therefore, the promotion effect of economic uncertainty on enterprise innovation only exists in regions with a high degree of marketization of credit resource allocation.

The enterprise innovation decision-making depends on the trade-off between the monopoly profit and the development cost. In areas with low patent protection, R&D results are more likely to be copied and stolen by other enterprises, thus reducing their willingness to engage in R&D innovation. In areas with high patent protection, government departments tend to support enterprises' R&D

activities and provide them with government subsidies, financial guarantee and personnel support. However, in regions with poor patent protection, the process of patent application and approval is more complicated, and the research results cannot be guaranteed effectively, which will restrain the enterprises' innovation motivation. Based on the above analysis, it can be concluded that the increasing uncertainty of economic policy has a positive impact on R&D innovation of enterprises only in areas with high patent protection.

Table 4, columns (1) and (2), respectively, report on the relationship between economic policy uncertainty and business innovation, and the impact on the allocation of credit resources in different regions. The results show that the coefficient of economic policy uncertainty (*EPU*) is 0.1535 in the regions with high credit resource allocation, which is significantly positive at 1% statistical level. On the contrary, the *EPU* coefficient is significantly negative at the level of 10% in the regions with low marketization of credit resource allocation. The effects of economic policy uncertainty on innovation in high-and low-patentability regions are reported in paragraphs (3) and (4) of Table 4. The results show that the *EPU* coefficient is 0.1518 in the regions with high patent protection, which is significantly positive at 1% statistical level. These effects do not exist in regions where patent protection is low.

Table 4. Economic policy uncertainty and enterprise innovation: Regional Heterogeneity

Variable	(1) <i>R&D</i> High degree of credit resource allocation	(2) <i>R&D</i> Low allocation of credit resources	(3) <i>R&D</i> High degree of patent protection	(4) <i>R&D</i> Low degree of patent protection
<i>EPU</i>	0.1535*** (0.050)	-0.0514* (0.030)	0.1518*** (0.045)	-0.0219 (0.025)
<i>Control variable</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	15,378	5,658	15,545	5,646
<i>adj-R²</i>	0.165	0.140	0.162	0.172

4.3 Robustness Test

In order to verify the reliability of the empirical results, this paper uses three methods for robustness testing.

(1) Replace the explained variable. In the robustness test, the proportion of enterprise R&D investment in operating income (*R&D_2*), the natural logarithm of the effec-

tive number of patents (R&D_3) and the natural logarithm of the effective number of invention patents (R&D_4) are selected as the explained variables for empirical testing. The results show that after changing the measurement method of the explained variables, the economic policy uncertainty (EPU) coefficients are 0.1091, 0.0153, and 0.0312, respectively, which are significant at the 1% statistical level, indicating that economic policy uncertainty promotes enterprise innovation.

Table 5. Robustness test: replacing the explained variable

Variable	(1) <i>R&D_2</i>	(2) <i>R&D_3</i>	(3) <i>R&D_4</i>
<i>EPU</i>	0.1091*** (0.032)	0.0153*** (0.005)	0.0312*** (0.005)
<i>Control variable</i>	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes
<i>N</i>	22,178	16,828	14,359
<i>adj-R²</i>	0.152	0.564	0.664

(2) Change the measurement method of core variables. In order to ensure the validity and applicability of the empirical results, this paper adopts another method to calculate the uncertainty of economic policy. Specifically, this paper selects the data of Baker et al. (2016)^[24] and uses the number of articles in the South China Morning Post that include keywords such as "China", "Economy", "Uncertainty" and "Policy" and the total number of articles issued in the month as a proxy indicator of economic policy uncertainty, and all monthly averages of the year are used as the measurement indicator¹ of the economic policy uncertainty index for that year. Table 6 reports the regression results of economic policy uncertainty and corporate innovation after changing the measurement methods of core variables. Gradually adding control variables, the coefficients of EPU are significantly positive at the 1% statistical level. It can be seen that changing the measurement method of economic policy uncertainty, the promotion of enterprise innovation by the increase of economic policy uncertainty has not changed.

(3) Endogenous problems. This paper uses the global economic policy uncertainty and the US economic policy uncertainty index as the instrumental variables of China's economic policy uncertainty, and uses the two-stage least squares method for regression to ensure the robustness of the empirical model. The principle of selecting instrumen-

tal variables is that global economic policy uncertainty or US economic policy uncertainty will affect China's economic policy uncertainty, but will not directly affect micro-enterprises' investment and financing behavior. Therefore, this paper selects the global and US economic policy uncertainty indices² as the IV instrumental variables respectively. The global economic policy uncertainty index includes current price GDP and post-purchasing power parity GDP data, and the US economic policy uncertainty index includes US ten key words index of domestic newspapers³, a list of interim federal tax laws compiled by the Congressional Budget Office (CBO) report⁴, and the Philadelphia Federal Reserve Bank's survey of professional forecasters⁵. Database synthesized data. This paper uses the 2sls two-stage least square method to re-estimate the relationship between economic policy uncertainty and enterprise innovation. Table 7 reports the results of IV instrumental variable regression. The results show that the EPU coefficient is still significant at the 1% statistical level. That is, after considering the endogenous problem, a consistent conclusion is reached.

Table 6. Robustness test: changing the measurement method of core variables

Variable	(1) <i>R&D</i>	(2) <i>R&D</i>	(3) <i>R&D</i>	(4) <i>R&D</i>
<i>EPU</i>	0.0017*** (0.000)	0.0023*** (0.001)	0.0033*** (0.001)	0.0039*** (0.001)
<i>Control variable</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	27,627	27,548	24,145	22,178
<i>adj-R²</i>	0.157	0.166	0.161	0.159

2 Global data comes from http://www.policyuncertainty.com/global_monthly.html; US data comes from http://www.policyuncertainty.com/us_monthly.html

3 Ten newspapers include: "USA Today", "Miami Herald", "Chicago Tribune", "Washington Post", "Los Angeles Times", "Boston Globe", "San Francisco Chronicle", "Dallas Morning News", "Houston Chronicle" and "Wall Street Journal". To construct the index, each paper is searched once a month for vocabulary related to economic and policy uncertainty. In particular, search for articles containing "uncertainty" or "uncertainty", "economy" or "economy", and one or more of the following terms: "Congress", "Legislation", "White House", "Regulation", "Federal Reserve" or "deficit".

4 Temporary tax measures are a source of uncertainty for businesses and households, because Congress often extends tax measures at the last minute, undermining the stability and certainty of tax laws.

5 The individual level dispersion of three predictor variables directly affected by government policies is measured: CP, state and local government procurement of goods and services, and federal government procurement of goods and services. For each series, look at the quarterly forecast for the next year. The reason for choosing these variables is because they are directly affected by monetary policy and fiscal policy actions.

¹ Data comes from www.policyuncertainty.com/china_monthly.html

Table 7. Robustness test: IV instrumental variable regression

Variable	(1) <i>IV_GEPU_1</i>	(2) <i>IV_GEPU_2</i>	(3) <i>IV_USEPU_1</i>	(4) <i>IV_USEPU_2</i>
<i>EPU</i>	0.0044*** (0.001)	0.0044*** (0.001)	0.0044*** (0.001)	0.0044*** (0.001)
<i>Control variable</i>	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	21,814	21,814	21,814	21,814
<i>adj-R²</i>	0.159	0.159	0.159	0.159
<i>Sargan statistic</i>	0.000	0.000	0.000	0.000

5. Further Discussion: Executive Heterogeneity

Senior management is a hidden soft factor within a company, and its background characteristics also have an impact on the quality of the company's internal control. The increase in economic policy uncertainty has an impact on the financial market and the external industry environment, which in turn affects corporate R&D investment behavior. However, senior management as the actual executor of business decision-making means that the heterogeneity of senior management inevitably affects the relationship between economic policy uncertainty and corporate innovation. At present, there are many studies on the influence of executive characteristics on corporate behavior, but there are few literature on the influence mechanism of executive heterogeneity on the relationship between economic policy uncertainty and corporate innovation. In view of this, based on the analysis of the relationship between economic policy uncertainty and corporate innovation, this paper further examines the impact of executive heterogeneity on the economy from the three dimensions of executive characteristics, executive capabilities, and executive overconfidence.

5.1 Executive Characteristics

5.1.1 Executive Gender

Studies have shown that female executives inhibit corporate R&D investment and excessive investment^[25,26], and the relationship between the proportion of female executives and earnings management is also reflected as an inverted U-shaped relationship^[27]. Studies have found that gender significantly affects the degree of risk appetite of microeconomic entities^[28]. Compared with men, women have a higher degree of risk aversion and are more sensitive to negative information. Therefore, female executives

are less innovative than male executives, have smaller debt financing scales, and are more cautious in investment decisions. The increase in economic policy uncertainty has increased the degree of uncertainty in the external market environment, and the risk of R&D investment is also higher. Compared with male executives, female managers have a lower degree of risk tolerance, which means that they are more cautious in their investment and financing decisions during periods of rising policy uncertainty. Therefore, the increase in economic policy uncertainty may promote corporate innovation more significantly in companies with male executives. In order to examine the impact of the heterogeneity of executives on corporate innovation in companies with gender differences in executives. In this paper, the full sample is divided into two sub-samples according to the gender of executives, and group regression is performed.

Table 8 reports the impact of executive gender heterogeneity on economic policy uncertainty and corporate innovation behavior. The results show that without controlling all variables, the coefficient of economic policy uncertainty (EPU) is 0.0269 in the group of male executives, which is significantly positive at the 1% statistical level; however, if executives gender is female, the coefficient of economic policy uncertainty (EPU) is 0.0318, which is not significant, indicating that the positive correlation between the degree of economic policy uncertainty and corporate innovation is only significant in companies with male executive gender. The last two columns in the table add all the information sets. The results show that if the executive is male, the EPU coefficient is significant at the statistical level of 1%; however, in companies with female executives, the EPU coefficient is only 5%. It can be seen that the role of economic policy uncertainty in promoting corporate innovation behavior is more pronounced in companies with male executives. In order to further investigate whether there is a significant difference in the EPU coefficient between male executives and female executives, this paper adopts the method of Chow test to test the difference of group coefficients. The results show that, regardless of whether all control variables are included, there is no significant difference in the EPU coefficient between male and female executives, that is, the degree of influence of economic policy uncertainty on corporate innovation does not exist among executives of different genders significant differences. However, from the perspective of statistical significance, the promotion of business innovation by economic policy uncertainty is more significant in companies with male executives.

Table 8. Economic policy uncertainty, executive gender and corporate innovation

variable	(1) <i>R&D</i> Male executives	(2) <i>R&D</i> Female executives	(3) <i>R&D</i> Male executives	(4) <i>R&D</i> Female executives
<i>EPU</i>	0.0269*** (0.010)	0.0318 (0.042)	0.1241*** (0.043)	0.3289** (0.161)
<i>Control variable</i>	No	No	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	23,859	1,684	20,703	1,475
<i>adj-R²</i>	0.167	0.110	0.162	0.126
<i>Year FE</i>	0.109		0.419	

5.1.2 Education Level of Executives

The level of education can reflect the cognitive ability and level of an individual. The improvement of education level can enhance the information processing ability of microeconomic entities. Therefore, the improvement of the education level of executives may have a positive impact on corporate performance by strengthening the tendency of executives to transcend boundaries^[29]. However, on the other hand, some scholars believe that if executives have too high or too low academic qualifications, there may be problems with poor resilience and insufficient cognitive abilities, respectively, which has a negative impact on capital market performance and corporate operating performance^[30]. In the context of rising economic policy uncertainty, future industry development trends will be less clear, and the uncertainty of the market operating environment will also increase. The high degree of executive education is accompanied by higher cognitive ability, but also has the characteristics of poor coping ability and more conservative investment tendency, which is not conducive to corporate R&D and innovation. In order to further examine the relationship between economic policy uncertainty and corporate innovation, the impact of heterogeneity among samples of different levels of executive education. This paper divide the whole sample into two sub-samples with an education level of master and above and below master's level according to the level of executive education for empirical analysis.

Table 9 reports the regression results of economic policy uncertainty and corporate innovation in a sub-sample of executives with high and low levels of education. Columns (1) and (3) in Table 9 are the regressions of companies with a master's degree or above in the education level of executives. Columns (2)

and (4) show the corresponding regression results for undergraduate and below. Columns (3) and (4) in the table give the regression results after controlling all the information sets. It can be seen that the EPU coefficient is 0.0875 in enterprises with higher executive education, which is significant at the 5% statistical level, which shows that the economic policy uncertainty index has risen by 1%, and the level of R&D and innovation of companies with high executive education will increase by 0.0875%. Correspondingly, in the sample with a bachelor's degree or less of executive education, the EPU coefficient is 0.1714, indicating that the uncertainty of economic policies has increased by 1%, and the scale of enterprise R&D innovation has increased by 0.1714%. From a statistical point of view, the EPU coefficient is significant at the 1% statistical level among the samples with lower education levels of executives, and the coefficient (0.1714) is higher than the EPU coefficient (0.0875) in enterprises with higher education levels. Therefore, compared with companies with higher levels of executive education, the positive impact of rising economic policy uncertainty on corporate innovation is stronger in companies with lower levels of executive education.

Table 9. Uncertainty of economic policy, education level of executives and corporate innovation

variable	(1) <i>R&D</i> Highly educated	(2) <i>R&D</i> Low educated	(3) <i>R&D</i> Highly educated	(4) <i>R&D</i> Low educated
<i>EPU</i>	0.0154** (0.007)	0.0460*** (0.016)	0.0875** (0.039)	0.1714*** (0.062)
<i>Control variable</i>	No	No	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	10,279	10,380	8,992	8,802
<i>adj-R²</i>	0.142	0.177	0.134	0.173

5.1.3 Financial Experience of Senior Executives

Individuals' special work experience often affects their values, handling styles, and behavioral decision-making methods, which in turn determine the "stigma" of economic agents' behavior choices^[31]. The senior management echelon theory proposes that the physiological characteristics and personal experiences of senior management lead them to make highly personalized choices for the production and operation of the enterprise. The work experience of executives also affects their work style, social network

relationships, and risk tolerance attitudes, which in turn affects the behavioral selection mechanism of micro-enterprises. Compared with executives without financial background, the relationship between senior executives with financial experience and senior bank management is closer, and there is a bank-enterprise relationship. The establishment of bank-enterprise relationships can reduce financing difficulties, increase credit lines, and reduce mortgage conditions, thereby helping to improve corporate investment efficiency. Therefore, the financial background of executives makes the investment behavior of their companies less negatively impacted by the phenomenon of bank lending caused by economic policy uncertainty, which in turn leads to the positive impact of economic policy uncertainty on corporate R&D and innovation. This paper classifies companies according to whether they have work experience in financial regulatory agencies, policy banks, or commercial banks. For executives, there are samples with and without financial experience, and a sub-sample regression is performed.

Table 10. Uncertainty of economic policy, financial experience of senior management and corporate innovation

	(1)	(2)	(3)	(4)
variable	R&D Financial experience	R&D No financial experience	R&D Financial experience	R&D No financial experience
<i>EPU</i>	0.0428** (0.020)	0.0307*** (0.010)	0.1685** (0.075)	0.1382*** (0.042)
<i>Control variable</i>	No	No	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	1,013	23,143	883	20,303
<i>adj-R²</i>	0.132	0.156	0.135	0.160
<i>Chow test p value</i>	0.534		0.638	

Table 10 reports the impact of the heterogeneity of executive financial background on economic policy uncertainty and corporate innovation. The first two columns in the table report the regression results of not controlling the entire information set. The results show that the coefficient of EPU is only significant at a statistical level of 5% in companies with executives with a financial background; while in companies with no financial background, the coefficient of EPU is significant at a statistical level of 1% positive. In the last two columns of the table, all control variables are added. The results show that the EPU coefficient is 0.1685 in the

sample of executives with financial industry experience, which is only significantly positive at the 5% statistical level. However, in companies where executives do not have financial experience, the EPU coefficient is 0.1382, which is significantly positive at the 1% statistical level. The results show that the positive impact of economic policy uncertainty on corporate innovation is more significant in companies whose executives do not have financial experience. Table 10 also shows the difference between the EPU grouping coefficients in samples with and without financial experience of senior executives. The Chow test results show that according to whether there is financial experience in group regression, the EPU coefficient is not significantly different in different samples.

5.1.4 Political Background of Executives

Our government departments play an important role in resource allocation and economic activities. Existing studies have found that politically connected companies can improve corporate performance by obtaining tax relief, financial subsidies, and financing facilities^[33-35]. However, the administrative appointment and dismissal characteristics of the promotion of official executives also causes some companies to assume some social functions that are not conducive to the increase of profit margins for the purpose of political promotion, which causes a negative impact on corporate value^[36]. On the whole, companies with political backgrounds in executives have implicit guarantees from the government, which has led to a stronger tendency for government departments to favor such companies in terms of financing, tax relief, and industry policies. Therefore, the increase in uncertainty in the future industry development and the increase in the uncertainty of the external financing environment caused by the increase in policy uncertainty leads to greater negative impacts on the production and investment decisions of companies where there is no political background. In order to further examine the relationship between economic policy uncertainty, the political background of executives and corporate innovation, this paper classifies the political background of executives according to whether they have work experience in government departments. The regression results are shown in Table 11.

Table 11 reports the heterogeneous impact of economic policy uncertainty and corporate innovation in a sub-sample of executives with and without political background. The results in the table show that after controlling all the information sets, the coefficient of economic policy uncertainty (EPU) is 0.1376, which

is significant at the 5% statistical level. The EPU coefficient corresponds to -0.4924 in enterprises without political background, which is significantly negative at the 1% statistical level. It can be seen that the effect of economic policy uncertainty in promoting corporate innovation is only significant in companies where the senior management has a political background; however, economic policy uncertainty has a negative impact on corporate innovation in companies with executives without political background.

Table 11. Uncertainty of economic policy, heterogeneity of executive political background and corporate innovation

	(1)	(2)	(3)	(4)
variable	<i>R&D</i>	<i>R&D</i>	<i>R&D</i>	<i>R&D</i>
	Political background	No political background	Political background	No political background
<i>EPU</i>	0.1381** (0.056)	-0.4944*** (0.114)	0.1376** (0.057)	-0.4924*** (0.112)
<i>Control variable</i>	No	No	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	4,060	880	4,060	880
<i>adj-R²</i>	0.118 0.103		0.118 0.104	

5.2 Senior Management Ability

The ability of executives also has an impact on the relationship between economic policy uncertainty and corporate innovation. Specifically, companies with strong senior management capabilities can accurately interpret the introduction and changes of economic policies, and make timely and effective judgments on industrial development trends and capital market fluctuations. In companies with strong senior management capabilities, corporate governance is better, the degree of internal diversification is higher, and the ability to resist risks is stronger. It can be seen that in companies with strong executive capabilities and economic policy uncertainty is rising. Managers are less willing to conduct R&D and innovation for increasing market share, stabilizing expectations of external investors, and motives of getting involved in emerging industries. In contrast, the poor ability of executives means that they cannot accurately make judgments about the future development of the industry and the market, and they are more likely to miss

good investment opportunities.

In order to further examine the impact of economic policy uncertainty on corporate innovation, the heterogeneous impact of companies with different executive capabilities. This paper uses corporate investment deviation, that is, investment efficiency to measure executive capabilities. If the company's inefficiency investment is less than 10% of the same industry quantile in the same year, it belongs to a company with strong executive ability; If the company's inefficiency investment level is higher than the annual-industry 90% quantile, it belongs to executive ability poor business. If the company's inefficiency investment level is between 10% and 90% quantile, it is a company with moderate executive capabilities. Table 12 reports the heterogeneous impact of economic policy uncertainty and corporate innovation among companies with strong, moderate and weak executive capabilities. The results show that after adding all the control variables, the EPU coefficients are 0.0122 and 0.0329 in companies with strong executive capabilities and weak executive capabilities, and the coefficients are not significant. In companies with moderate executive capabilities, the EPU coefficient is 0.1424, which is significantly positive at the 1% statistical level. It can be seen that the positive correlation between economic policy uncertainty and enterprises only exists in enterprises with moderate executive capabilities.

Table 12. Uncertainty in economic policies, executive capabilities and corporate innovation

	(1)	(2)	(3)	(4)	(5)	(6)
variable	<i>R&D</i> Strong executive ability	<i>R&D</i> Moderate executive ability	<i>R&D</i> Weak executives ability	<i>R&D</i> Strong executive ability	<i>R&D</i> Moderate executive ability	<i>R&D</i> Weak executives ability
<i>EPU</i>	0.0086 (0.013)	0.1210*** (0.038)	0.0780* (0.041)	0.0122 (0.046)	0.1424*** (0.045)	0.0329 (0.048)
<i>Control variable</i>	No	No	No	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	6,851	20,697	2,282	3,187	18,991	2,098
<i>adj-R²</i>	0.167	0.169	0.244	0.102	0.168	0.249

5.3 Overconfidence of Executives

Executive overconfidence is also an important factor affecting corporate behavior. Overconfidence behavior of executives expands the scale of corporate investment and increases investment-cash flow sensitivity^[37]. Managers' overconfidence can also lead to an increase in risk-tak-

ing levels ^[38], and promote corporate R&D investment and R&D output behavior ^[12]. Overconfident managers are more inclined to choose high-risk and high-return investment projects, and give up some opportunities with stable risks and low returns. The increase in economic policy uncertainty increases the risk of corporate R&D innovation, but it also means that once R&D is successful, it has a stronger positive role in expanding market share, increasing corporate value, and improving operating performance. Therefore, the overconfidence of executives plays a positive role in regulating the relationship between economic policy uncertainty and corporate innovation. In view of this, this paper selects the proportion of executives' total compensation to the total compensation of supervisors as a measure of executive overconfidence, and compares the proxy variable of executive overconfidence (Netpro) with economic policy uncertainty (EPU). Interactively, the regression results are shown in Table 13.

Table 13. Economic policy uncertainty, executive overconfidence and corporate innovation

variable	(1) <i>R&D</i>	(2) <i>R&D</i>	(3) <i>R&D</i>	(4) <i>R&D</i>
<i>EPU*Netpro</i>	0.0001*** (0.000)	0.0001** (0.000)	0.0001*** (0.000)	0.0001** (0.000)
<i>EPU</i>	-0.0042*** (0.000)	-0.0043*** (0.001)	0.0253*** (0.008)	0.1036*** (0.033)
<i>Netpro</i>	-0.0001 (0.000)	-0.0001 (0.000)	-0.0001 (0.000)	-0.0001 (0.000)
Control variable	No	Yes	No	Yes
<i>Year FE</i>	No	No	Yes	Yes
<i>Firm FE</i>	Yes	Yes	Yes	Yes
<i>N</i>	25,191	21,885	25,191	21,885
<i>adj-R²</i>	0.146	0.134	0.162	0.152

Table 13 reports the moderating effect of executive overconfidence on the relationship between economic policy uncertainty and corporate innovation. The first two columns in the table do not control year fixed effects, and the second two columns control year fixed effects. Column (1) of the table reports the empirical results of adding some control variables and not controlling the year effect. The results show that the coefficient of the interaction term (*EPU*Netpro*) between economic policy uncertainty and executive overconfidence is 1%. The statistical level is significantly positive, indicating that the increase in the degree of overconfidence of executives will positively regulate the relationship between economic policy uncertainty and corporate innovation. All the control variables are added to the column (2) of the table, and the year effect is not controlled. The results show that the *EPU*Netpro* interaction coefficient is significantly positive at the 5% statistical level. The last two columns in the table control

the entire information set. The results show that regardless of whether the year fixed effect is controlled, the overconfidence of executives still has a positive adjustment mechanism between economic policy uncertainty and corporate innovation, indicating that the conclusions of this paper are still valid.

6. Main Conclusions and Policy Recommendations

This paper analyzes how economic policy uncertainty affects corporate innovation, and the moderating effects of executive heterogeneity. The study found that: First, the increase in economic policy uncertainty promotes enterprise innovation, and this effect is more pronounced in the eastern region, where the degree of marketization of credit resources is higher and the degree of patent protection is higher. Second, the positive impact of economic policy uncertainty on corporate innovation is more pronounced in companies with male executives, low levels of education, no financial experience, and political backgrounds. Third, the promotion effect of economic policy uncertainty on corporate innovation only exists in companies with moderate executive capabilities. However, the above effects do not hold for companies with too strong executive capabilities and too weak executive capabilities. Fourth, the overconfidence of executives plays a positive role in regulating the relationship between economic policy uncertainty and corporate innovation. Our baseline results are further supported by several robustness tests.

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ARTICLE

Project Planning and Scheduling in the Face of the Fourth Industrial Revolution (4IR)

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ABSTRACT

This paper addresses the integrated processes of planning and scheduling of projects using technologies advanced tools as means for managing change in the era of the 4IR. The paper explores the traditional project management planning and scheduling tools in conjunction with what technology has to offer, to bridge the gap between the traditional project management planning and scheduling tools and what the modern-day business market demands. An analysis of literature covering a wide range of theoretic and empirical studies was performed. The theories underlying various planning and scheduling methods were analysed in relation to the design of projects. A descriptive quantitative secondary data was used as a tool to assess the impact of technology on project planning for scheduling. The analysis of the study's data was conducted using the principles of cross - tabulation. Inferences were drawn on the significant impact of the use of advanced technological tools on project planning for scheduling in current business time. Organisations can make use of the findings of this study to correctly apply the available advanced technological tools for more efficient schedule management planning to enhance the successful delivery of their projects. Further, this research can be used to provide learning opportunities for new and inexperienced planners and schedulers, and as a basis for further research in this field of knowledge.

1. Introduction and Background to the Study

Project management is the process of planning, coordinating, and controlling the implementation of the project objectives for the benefit of stakeholders in the most efficient way possible^[22]. A clear definition of project management tools insufficiencies and their pertinent impact on the project performance is needed to promote new management changes in project planning^[10]. In order to improve the performance of a project, a competent management team must be able to monitor and control both

the project's operations and its planning^[22]. Additionally, the ability of the project management team to formulate a project plan, monitor its progress, estimate schedule variances, and take corrective actions is an important skill towards successful planning^[22]. The Project Management Body of Knowledge (PMBOK) expound on the importance of the planning process by highlighting that project processes are iterated frequently^[13]. As a consequence, defining the activities prior to scheduling and costing them must occur often before completing the project planning process.

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It is imperative that competent personnel should be involved in the plan and schedule processes. This is especially the case in construction project management, as the manner in which the work will be carried out determines the overall success of the project ^[2]. Planning involves a variety of tasks including ^[18]:

- Developing the project scope and integrating it into the project management system,
- Establishing the project's inputs and outputs.
- Establishing detailing methodology on how the project schedule will be executed.

The Management's efforts to plan and control schedules are often obscured by inadequacies in coordination and resource allocation in planning ^[1]. In spite of its perception as a discrete process, scheduling is integrated into the planning process in its many inherent characteristics. It is concerned with the planning process, in which a balance of resource trade-offs and controls, including activity sequencing and durations estimates, has to be identified provisionally ^[1]. Therefore, it is imperative that schedulers, planners and generally project managers should consider scheduling methods and systems in practical terms during implementation of the aforementioned processes ^[2]. The use of visual models and scheduling control systems by project planners and schedulers has increased in recent years ^[24]. Despite the above statement, the dynamic nature of project environments can lead to additional challenges ^[24]. Identification and control of risks and uncertainties during project implementation are examples of these, as well as the effectiveness and efficiency in the management of time and resources. Significantly, among these challenges is the connection between the different project management methods and how they can be linked to technology to take advantage of the many benefits of technology while also managing change. In this connection, although many scheduling techniques have advanced considerably, project managers and other project practitioners still face a substantial amount of challenges in creating a schedule that matches their needs and fits within their resources and time constraints ^[24]. As such, the complexity of scheduling and the inability of project managers to keep all relevant information concerning the schedule to make an informed decision may account for this ^[24].

The appropriate process of implementing project plans and schedules is by ensuring a variety of effective methods and tools. While development has taken place and brought about positive change, there is still a need for modification and integration of the project management tools and techniques particularly with the newer scheduling approaches. These methods and tools differ in their effectiveness and efficiency according to the views of

different project practitioners. Several factors contribute to this condition. A lack of understanding of the most appropriate basis for the implementation of these tools and methods that may be one of the factors to be attributable to this problem. As such, the present study seeks to remedy this deficiency by conceptualising and as well as adopting a more technology driven approach to planning and scheduling methods.

2. Problem Statement

Even with the evidently effective project management tools for planning and scheduling and despite the progress made in modern business, plan-and-schedule processes remain challenging. It is relevant to the project management industry to identify and address these challenges. Therefore, existing project scheduling tools and techniques have to be properly considered and assessed in order to find ways in which they can be used congruent with technology to ensure effectiveness and sustainability while managing change. With this in mind, the goal of this research project was to determine the importance of technology and its maximum applicability and use as a means to maximise the efficacy of planning for scheduling with the already existing project management scheduling tools. In order for the study to be conducted, the researcher made use of analytical method based on quantitative data in which quantitative secondary data were used to address the current research questions in order to achieve the studies objectives. As a result of the study, there are useful recommendations for improving project management planning for scheduling with the use of advanced technology driven tools.

3. Aims of the Study

This study aims at examining the advantages of using smart technologies in the planning process for scheduling project activities as a means to manage change in the 4IR era. The research questions guiding this study are:

4. Literature Review

4.1 Complexities of the Project Management Planning Process: An Overview of Existing Perspectives

In order to ensure a successful project completion, planning and execution must be properly implemented. Planning precedes execution, therefore, it is critical that planning be done properly ^[17]. When the project is poorly planned, and the execution and control processes are ineffective, the project will not be executed and controlled efficiently and therefore successfully ^[17]. Keeping track of

Table 1. Questions and Objectives of the study

Questions	Objectives
Does effective planning impact on the successful execution of projects?	To determine the impact of effective planning on project success.
Do you think the traditional project management scheduling tools are commensurate for project success in the modern project management environment?	To examine the gap between the traditional project management scheduling tools and what the modern project management environment.
How much technology is used to assist in the planning and scheduling of project activities, if used at all?	To determine the state of technology in the planning and scheduling of project activities.
What are the most commonly used technological scheduling tools in the modern project environment?	To determine what technological scheduling tools are currently being used in the industry.
What are the factors affecting project management effectiveness? Time management	To determine factors contributing to project effectiveness.
Are the current management planning and scheduling processes effective in the era of 4IR?	To determine the state of change management in the domain of project management.

all planning processes is the responsibility of the project manager, who is fully accountable for the project's success^[16]. Project planning is a critical function in project management^[11]. The responsibilities of this function include identify and schedule processes and comparing the status of the project to its baseline, analysing deviations, detecting out-of-control situations, and taking corrective action as necessary^[11]. The structure of a project is typically decomposed at an aggregate level by a Work Breakdown Structure (WBS), which breaks it up into manageable activities, and on a detailed level by a precedence diagram, which represents the technological and execution dependencies between the project activities^[13]. To achieve this goal, the activities are linked in hierarchy by means of precedence relations. By definition, project success involves completing the project within budget, on time, and to specifications, while ensuring the satisfaction of the customer and all other relevant stakeholders^[2]. Efforts to achieve the above will be more successful with effective implementation of plan and schedule processes^[1]. The project planning process involves a lot more than the application of well-established methods. The outcome of any project is dependent on effectively planned and proactively directed goals, scope and its quality standards^[1].

In order for a successful delivery of projects to be achieved, implementing plans and executing them effectively are both essential^[3]. Monitoring is used as a means of ensuring that each one of the two stages has been carried out appropriately, with corrective actions taken where there have been inconsistencies between the plan and execution of the phases^[3]. The fundamental importance of effective project planning is an antidote to poor planning that inevitably result in poor execution, and ultimately failure of the project itself^[13]. A project manager's role includes overseeing the ten project management knowledge

areas, in which 39 different processes must be managed. Initiation, planning, execution, and closure are the four stages of a project life cycle under which all the 39 processes are grouped^[20,18]. The PMBOK identifies 22 of the 39 processes listed in relation to planning^[20]. Therefore, according to the above statement, to effectively plan a project, these 22 steps must be completed. It is therefore, necessary to evaluate the product of each single process in order to evaluate the quality of the planning process implementation.

4.2 Science of Scheduling and Its Usefulness in Project Management

Defining Scheduling in Project Management

Project scheduling is defined as "predetermining duration and precedent activities of a project"^[26]. Essentially, scheduling is an important sub process of project management as it specifies the time frames for completing the project, the costs associated with the resources and labour requirements, and the order in which the tasks should be completed^[26]. Schedule management is also argued to involve the assigning of resources to tasks in a project in an iterative and multifaceted manner^[13]. By implementing proper time management, project managers can reduce overhead costs by ensuring that the project is not over-staffed, thus reducing the cost of completing the entire project^[11]. Project management scheduling consists of listing important project management tasks, deliverables thereof, and milestones determined within a project^[11]. In addition to the above, Each schedule also indicates when an activity is set to begin and end, its duration, and the resources allocated to it^[4]. A successful time management strategy depends on efficient project scheduling. During the planning phase of a project, the schedule management

Table 2. Project Management Knowledge Areas and Planning Process products

Knowledge area	Planning processes	Major product
Integration management	Project plan development	Project plan
Scope management	Scope planning	Project deliverables
	Scope definition	Work breakdown structure
Schedule management	Activity definition	Project activities
	Activity sequencing	PERT or Gantt Chart
	Activity duration estimating	Activity duration estimates
	Schedule development	Activity Start and End Dates
Cost management	Resource planning	Activity required resources
	Cost estimating	Resource cost
	Cost budgeting	Time-phased Budget
Quality management	Quality planning	Quality management plan
Human resources management	Organisational planning	Role and responsibility assignments
	Staff acquisition	Project staff assignments
Communications management	Communications planning	Communications management plan
Risk management	Risk management planning	Risk management plan
	Risk identification	Risk list
	Qualitative risk analysis	Project overall risk ranking
	Quantitative risk analysis	Prioritised list of quantified risks
	Risk response planning	Risk response plan
Procurement management	Procurement planning	Procurement management plan
	Solicitation planning	Procurement documents
Stakeholder management	Develop stakeholder engagement plan	Stakeholder register

Source: Developed by author.

plan is developed as part of the project management plan^[4]. In addition to project managers being able to summarise the beginning and end times of all the individual tasks that form a project, a project schedule can be a visual representation of how long a project is likely to take^[22]. Developing a project schedule is a complicated task as during this process, tasks are identified, sequenced, milestones are decided, and then schedule management is executed for those activities only afterward^[22]. According to the aforementioned statement it is evident that developing a schedule management plan that is effective project managers must define the work breakdown structure, identify the interdependencies amongst activities, sequence their order, estimate task duration, identify risks, and ultimately develop the schedule management plan as a whole^[22]. Schedule management planning includes many of the tools associated with schedule management, such as the Gantt chart, which is a type of bar chart illustrating a project schedule. For extremely complex projects, separate Gantt charts can be created for each key stage^[3].

The project management industry recognises six processes of managing time^[18]:

- Developing of the project schedule

- Planning schedule management
- Defining project activities
- Sequencing activities
- Estimating resources and
- Estimating durations

The schedule of a project can be developed, monitored, and controlled by project managers through the use of a variety of tools and techniques^[10]. There are increasing numbers of applications that can be made digitally using software and programs such as Excel and Microsoft Project.

Project Management scheduling tools and techniques

GANTT Chart - is a type of bar chart that encourages stakeholders to structure projects at different levels of detail in consideration to dependencies between all the tasks in the project. As a result, the duration of the project can be estimated and the critical path can be identified. A Gantt chart can also be defined a bar chart used to illustrate a project schedule. That includes some milestones although it includes no information about the resources or materials that will be required to complete the project^[3].

Schedule Network Analysis - consists of a graphical representation of all logical interrelationships of the ele-

ments of the project as seen in chronological order from planning through closure. Regularly monitoring the network diagram throughout the project is important to ensure the project is progressing as planned ^[4].

Critical Path Method (CPM) - shows the required sequence of activities to complete the most time consuming tasks in a project, and any dependencies between them. By using the CPM, project practitioners can visualize a project and calculate the amount of time and resources required to accomplish each activity. It also determines critical activities requiring attention in order to ensure that the project is completed on time” ^[4].

Programme Evaluation and Review Technique (PERT) - In comparison with CPM charts, PERT charts calculate time for activities more accurately. A time estimate is determined for each activity using three variables: the shortest time (SP), the longest time (LT) and the most probable time (MT). Based on the weighted average of these three estimates, the estimate for the activity is calculated. The formula is: Expected time = $(SP + 4(MT) + LT) / 6$. PERT is the most visually accessible scheduling tool in the construction industry. This diagram serves essentially as a visual representation of the phases of project activities in the order they should be completed.” This process represents the use of time, resources, or both ^[11].

Resource Oriented Scheduling - This method of scheduling is based on the project’s resources, and it prioritizes its most efficient use. Due to the limited resources, delays are most likely to occur as the teams rely upon them. In the absence of an effective method for deciding who gets them and when. Resources are allocated in an orderly manner in the Resource Oriented Schedule according to those who will use them while the project is in progress. This includes any resources that are limited in supply but highly sought after by project teams, whether it is space, machinery or labor ^[23].

Line of Balance (LOB) - The Line of Balance (LOB) technique is based on repeated iterations of thoughtful project planning. This is a part of the management control process that involves the repetitive work activities that are found in a project, such as high-rise buildings, pipelines, tunnels, and railways. In the LOB, time, cost and completion of the project are measured, presented, and compared to a specific plan. The scheduling tool was developed to identify the specific points in time where deviations occur in projects, as well as the subsequent results, reflecting project goals as a single line on a graph, of activities completed/time, to which teams are expected to adhere to stay on track ^[23].

Q Scheduling - The Q scheduling method, also known as quantitative or queue scheduling, uses a bar graph to show the quantities of materials to be used in different lo-

cations and at different times during a project. Scheduling in this way allows companies to determine the amount and type of material they will need at various times and locations. In addition, it integrates a hierarchical component which enables managers and workers to access which materials they need at what time, to order those materials accordingly, to follow tasks in sequence and to avoid disrupting other people’s work, all while tracking expenses ^[23].

4.3 The Coming of the 4IR and What it Means for the Project Management Industry

The 4IR is defined as a fusion of technologies. This characteristic of the 4IR blurs the division between physical, digital, and biological spheres ^[21]. In comparison to previous industrial revolutions, this fourth one is evolving at a much faster pace than those of the previous three ^[21]. Moreover, 4IR significantly disrupted the global economy, the way businesses operate and the way people work and live, socially and as well as professionally. This has taken place in almost all industries in almost all countries ^[8]. Systems of production, management, and governance are being transformed in an unprecedented way. Thus, to be successful, business leaders and executives need to understand the evolving conditions in their environments, challenge the assumptions made by their operating teams, and remain relentlessly innovative. In contrast, although some organisations and people are ready to face the challenges of 4IR, equipped with the tools they need to take advantage of it, others are unaware that a storm is brewing ^[10]. Knowledge is very important in the Knowledge era to deal with the disruption of the 4IR, but not just any knowledge ^[14]: organisations and project practitioners need knowledge of technical domains. It is not the technology that contributes most to productivity improvement, but the knowledge of how to make the best use of technology in particular work contexts ^[16]. Businesses are being impacted to a substantial extent by the technologies underlying the 4IR ^[1]. The complexity of modern projects has increased over the years comparatively to traditional projects of about (40-50) years ago, because of the current complexities, project managers are required to use much more effective and efficient ways to manage current projects ^[15]. Project managers already have an overwhelming amount of work on their hands, so this fact puts an even greater strain on them. However, digital technology has the ability to assist ^[15].

4.4 Importance of Technology in Project Management

As customers become more demanding these days, project management companies are demanded to innovate,

find ways to reduce timeframes, and develop evermore cost-effective resolutions while improving the quality of the work. Presently, technology is what has the ability to meet all of these demands. Technology has been revolutionising the business landscape in the past decades. We're witnessing a shift in the way project management is performed today that we've never seen before. Digitisation has made it possible to collaborate in real-time from any location with Building Information Modelling (BIM). Project management has greatly improved due to the substantial accelerating processes in the Project Management Office (PMO) and on site. The challenge for organizations is to incorporate these new methods into their traditional strategies in order to remain competitive in the so ever increasingly saturated industry.

4.5 Effective Use of Technology to Plan and Schedule Projects in the Project Management Environment

Although some companies remain reluctant to use technology, fast-rising and well-established project management companies are benefiting from the advantages of streamlining workflows with the help of technology tools as organisations implement better project management strategies^[15]. The assisting tools are listed below:

Virtual Designing with BIM

The concept of virtual designing with BIM gives the project team a vision of how the project should look when they follow the design and plan instead of using drawings. This allows the project team to detect errors even before they occur. In this way, which saves significant amounts of money, energy and as well as time in the process of corrective actions. Enhancing the project manager's original plan and creating mitigations and contingencies that may have been overlooked^[15].

Enterprise resource planning (ERP) Software

The process of project planning is never simple. Reviewing processes that worked in the past is often required when working on complex projects. An ERP system allows project managers and their teams to do so as the system allows for large amounts of data to be stored from previous projects. The modern project management software makes use of the cloud to store project files in a safe manner even after the project has been completed. All devices connected to the internet are able to download and view these files with convenience. The software has also expanded to offer other vital functionality, such as project management, document management, communication,

collaboration, file sharing, and system reporting. Thus, making use of this single platform, data can be shared across a multiple aspects of a project while minimizing double entry^[15].

Document Imaging and Digitisation

The general contractor's and project manager's office used to be overcrowded, filled with file cabinets overcrowded with submittals, time cards, change orders, drawings and diagrams, plans, invoices, and reams of other printed documents. As a result, if the project manager needs to locate a particular file, browsing through all the other folders takes a lot of time. These are sometimes misplaced or trashed by mistake. However, today's project managers are using document imaging, when they scan files, save them as images of PDFs, and arrange them into folders on the computer. In some cases, other project practitioners use electronic receipts and invoices to save them automatically to folders. As a result, the project manager is able to find files easier and attach them to reports, communication channels, or emails^[15].

Automated Workflow Tools

The process of reporting and sending team schedules in project management are some of the tasks that can be automated through digital means. Alarms can be set to notify the person-in-charge before a task is due, allowing projects to move faster and reducing instances of stuffing. The result is an increase in work quality^[15].

Scheduling software/Intuitive Project Dashboard

It is not sufficient to have a project management software that has all the features and functions a project manager needs, as this software will be also used by the project members of the team, the dashboard therefore, should be intuitive and straightforward. As a result, they will be able to drill down into the data and will save time and resolve confusion when navigating the menu. The dashboard is where most software displays the most pertinent data so that the project manager can see them instantly. In addition to special software that allows the contractor and subcontractor to share a single workspace, the subcontractor can also access only data related to their project as part of his access^[15].

5. Research Methodology

Academic research is often started by identifying what is currently known and what remains to be discovered about a topic^[6]. Literature related to the topic and supporting material should be cited, but it is also important

to consider previous data for further analysis. There may already be data that can be used to address the research questions^[7]. For the current study, an in-depth literature review of the area of interest was conducted, examining the previous and current work of experts in the field. The literature on Project planning and scheduling and as well as what changes the 4IR demands from organisations has been critically reviewed. In the review of literature in the 'literature review' section of this report, other researchers on this topic were identified and as well as cited, the same was true of agencies and research centres that conducted similar studies. Usually, original survey research does not use all collected data, and this unused data has value in supplying answers or in providing other perspectives on questions or issues^[7]. For existing survey data to be useful, it needs to be well matched to the right research questions^[7]. In this study, the research questions were addressed using existing data from three primary investigations on related topics. The method of data collection from the primary investigations was appropriately suited for this current study. To answer the research questions that were posed in the original research, it was decided to use existing survey data.

5.1 Analysis of Research Findings and Discussion

The study focused on analysing the impact of technology on planning and scheduling projects in the face of 4IR. Having used a descriptive analysis, the findings of the study are discussed in the figures below.

The results of the study demonstrate that effective planning has substantial impact on the successful execution of projects. The figure below indicates 55.5 per cent of the respondents to be in agreement with the statement above while 29.5 per cent are in between and the remaining 15

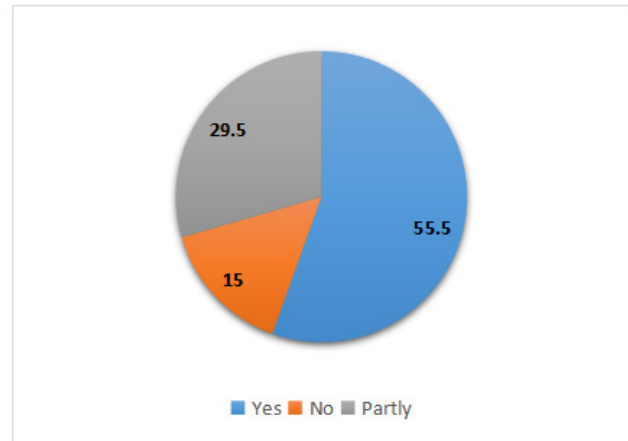


Figure 1. Does effective planning impact on the successful execution of projects?

per cent of the population disagreed with the fact that effective planning has an influence on successful execution of projects. The literature reviewed in this study reveals that without effective and efficient planning, organisations may lose a substantial amount of money in ineffectively planned projects resulting from mismanagement of resources and delayed projects. Therefore, any project management firm wishing to be successful in delivering projects in the 4RI era must take advantage of the benefits of technology with regards to tools available for planning for projects.

The graph above provides an indication of the amount of technology that is currently being used to assist in the planning and scheduling of project activities in project management. Wherein it is indicated that 55 per cent of the results show that it is moderately used, 50 per cent of the results convey that it is used only at minimum while 25 per cent indicates just enough, 35 per cent of the

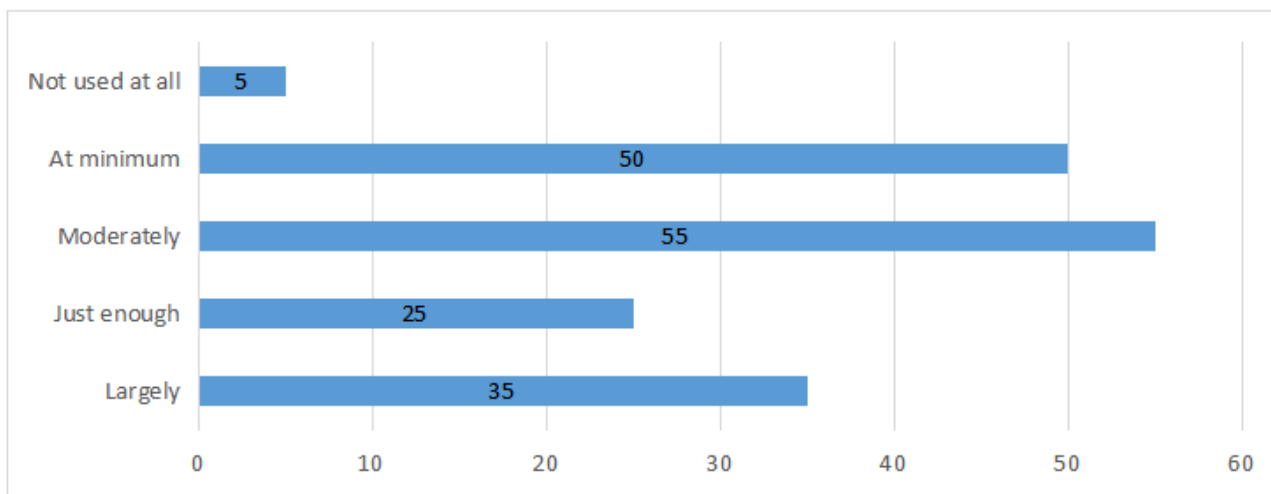


Figure 2. How much technology is used to assist in the planning and scheduling of project activities, if used at all?

results convey that it is used largely while only five per cent indicates that technology is not used at all to assist in the planning and scheduling of project activities. These findings fundamentally express the insufficient use of technology in the planning and scheduling of projects. This, therefore, is important information that pronounces what the objectives of this study aimed at exposing.

The provision of the findings depicted above indicate that 65.5 per cent of the collected data reports do not agree with the statement in question while only 35.5 per cent agrees to the statement. These findings summarise and simplifies the incommensurate effectiveness of the traditional project management scheduling for project success in the modern project management environment. With which we can conclude that there is a need for the integration of technology to bridge the gap between what the modern project management environment requires to

be (sustainable and thriving in the business market), and what the traditional project management scheduling tools are able to do or provide.

Figure 4 presents an interpretation of the commonly used technologies such as scheduling tools in the modern project environment where 65 per cent of the data indicates scheduling software to be the most commonly used tool, 35 per cent of the data, reports information gathering tools and as well as workflow automation to be the second most commonly used tools in the modern project environment. Both collaboration and tracking tools are reported to be the third commonly used tools by the 25 per cent of the data. The researcher sought to understand the current practised tools in order to draw recommendations of what else can be added to fill in the gap between what the industry demands and what is being offered. The summary of these findings, therefore, leaves us with the conclusion

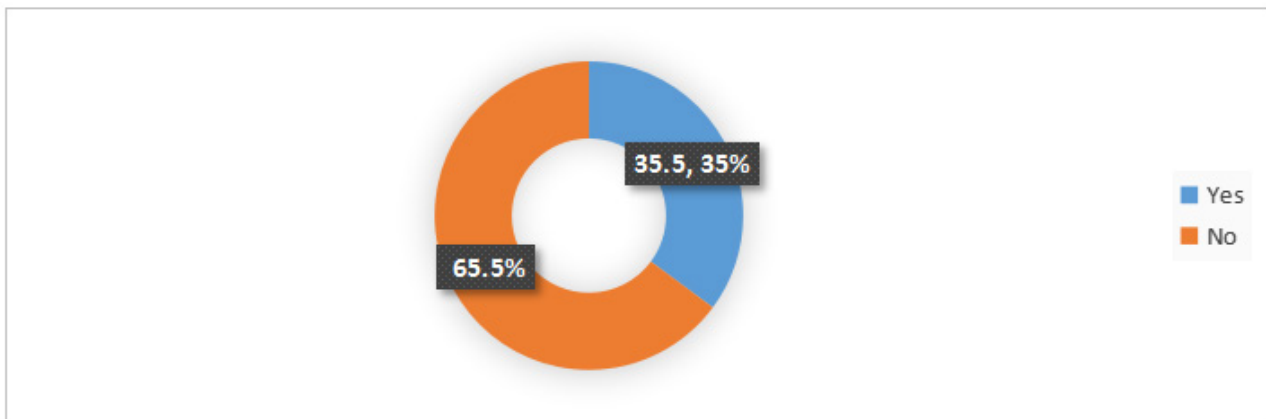


Figure 3. Do you think the traditional project management scheduling tools are commensurate for project success in the modern project management environment?

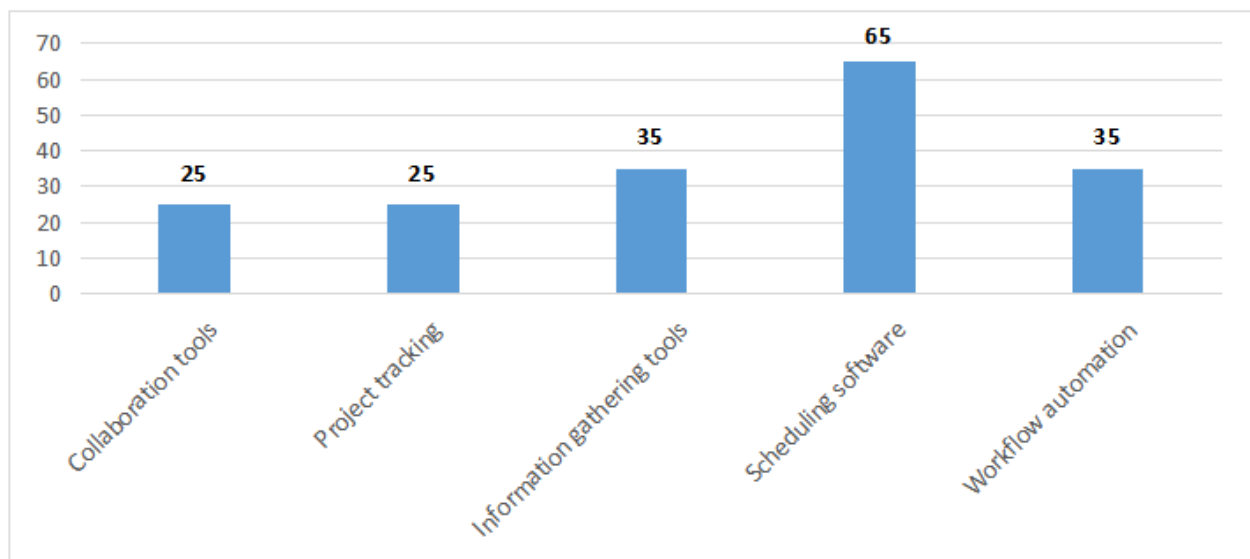


Figure 4. What are the most commonly used technological scheduling tools in the modern project environment?

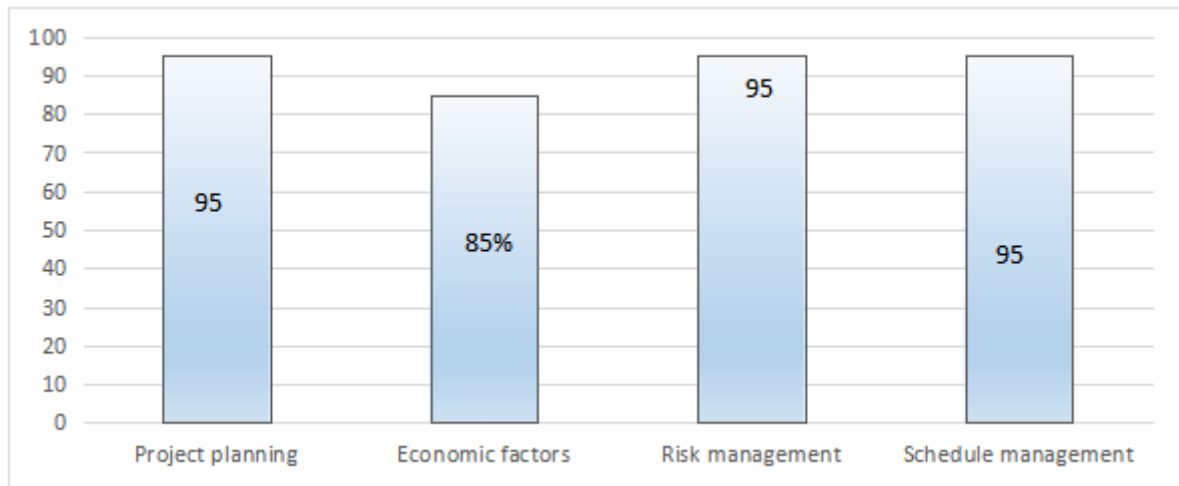


Figure 5. What are the major factors affecting project management effectiveness?

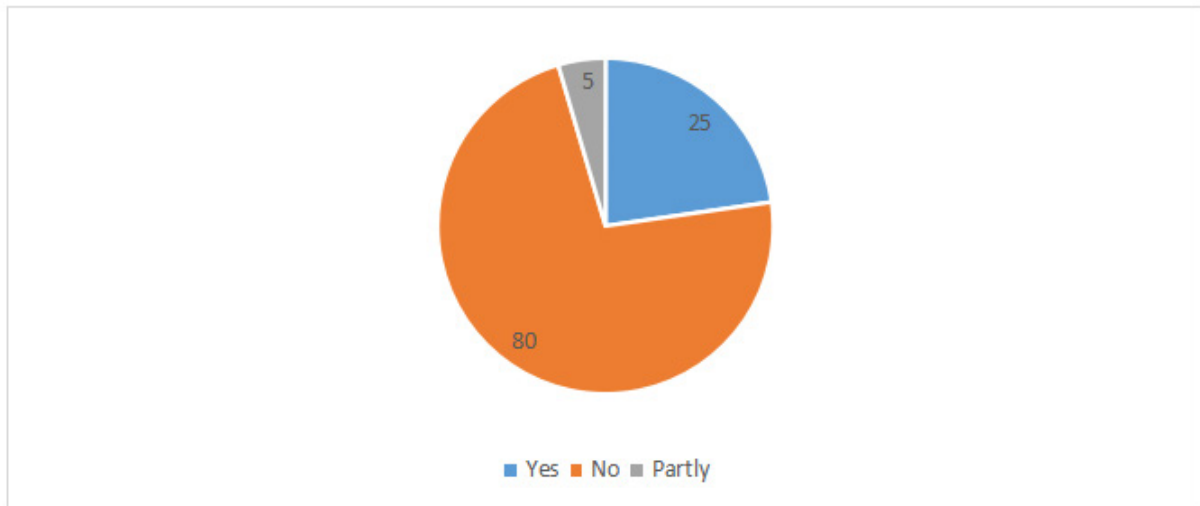


Figure 6. Are the traditional management tools and techniques used to plan and schedule sufficient to be effective in the era of 4IR?

that there is room for increased use of the technological scheduling tools in the modern project environment for a much more effective, efficient and well time managed project scheduling.

According to the data above, project planning, risk management and schedule management are amongst the major factors contributing to project management effectiveness, indicated at 95 per cent, while economic factors are reported at 85 per cent. The researcher here aimed to measure the level of the impact of project planning and schedule management on project management effectiveness in order to gauge their effect on project success.

The data above indicate that 80 per cent of the findings of this report indicate that the traditional management planning and scheduling tools and techniques are not sufficient to be effective in the era of 4IR. 25 per cent of the findings indicate positive to the statement in question

while a minority of 5 per cent indicates partiality. These findings, therefore, substantiates the information illustrated in Figure 4, that traditional management tools and techniques used to plan and schedule are not sufficient enough to be effective in the era of 4IR.

6. Conclusions

The findings of the study identify and examine a set of factors argued as contributors to the effectiveness of project management in the face of the 4IR. The literature reviewed in the study reveals that there are knowledge gaps within project management as far as technology can be effectively used to plan for scheduling in the management of projects. The research findings indicate a strong demand on the use of technology to be incorporated with the already existing project management tools in order to

ensure effective change management in the modern technology driven business market. Planning and scheduling are affected by the factors studied in this research which revealed a link between efficiency and sustainability of technology in today's businesses. Further, the study's results suggest that certain significant tools should be prioritized over others in the development of project plans and schedules. Additionally, project management policymakers should consider the possibility of ineffective planning and scheduling resulting from any mismatch between project management technology requirements. While the study only examines planning and scheduling aspects of project management, as far as technology is concerned, it has also provided some useful insights to the importance of effective project management in general. Since project management has traditionally been studied from a broad perspective, a number of tech-centric methodologies have emerged to improve its efficiency in operations, and one of those methodologies is schedule management planning. Scheduling management does not only help manage time, but also enables the tracking of different tasks with the use of advanced technologies so that the project can be managed more effectively. In addition to optimizing the use of resources and completing projects on time and effectively, this also helps employees understand their role and therefore, be more productive. Using the findings of this research, educators can better learn about the advantages and pitfalls of different planning techniques and tools, as well as strengthen their awareness of them. Consequently, this is hoped to motivate project practitioners to select and apply more appropriate methods, tools, and techniques in their work in order to improve quality planning processes. Based on the evidence collected and analysed, it is revealed that some successful projects utilise contemporary tools for project management, but they do not fully utilise them to their full potential. As a result, it can be concluded that scheduling is an important element of project success.

Contributions of the Study to Knowledge

The researcher of this article has the hope that this research study might add value to the pool of knowledge relating to planning for project scheduling with advanced project management tools in the face of emerging smart technologies, while it is not without limitations. This research study analysed the application of advanced project management tools for planning project scheduling in the face of 4IR. The study examined the traditional project management tools for project scheduling in conjunction with the use of smart technologies with the aim to provide a framework for change management. Moreover, it explored the common gaps between traditional project

management scheduling tools and those that are available as a result of smart technologies and suggested solutions to bridge these evidently promising and pervasive gaps between the two phenomena. Furthermore, this research study explored the positive characteristics of these concepts and offered recommendations on how they can be enhanced in value and usefulness. schedule planning and quality enhancement in project management.

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