Keep Calm and Be Creative:
Exploration of Purchasing Added Value
in Technical Universities

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ABSTRACT

Top technical universities strive to be the pioneers of teaching qualifications and advanced science. Every year, a significant amount of government grant is invested in higher education and research institutes. Therefore, it is important to implement financial control and improve purchasing performance in technical universities. This paper aims to investigate how purchasing services create more added value to faculties, research institutes and other service departments. The literature has been reviewed to examine the types of purchasing added value, as well as the affecting factors and influential strategies. It is found that the purchasing maturity and early involvement positively affect the value added by purchasing. The empirical findings are based on mixed methods research conducted in 58 top technical universities in the world. It is found that purchasing in technical universities serves diverse customers and the commodities can be divided into two groups: facility procurement ("hygiene" nature) and scientific & laboratory procurement (value "motivator"). An attempt has been made to design a creative roadmap to achieve more purchasing added value in a Dutch university. Starting with the assessment of the status quo, a gap analysis has been followed to compare the current performance and desired future position. Subsequently, the step-based development scheme provides the improvement proposals: 1. Develop a more mature purchasing function to nourish value creation, including differentiating purchasing strategy based on portfolio management, creating a technology buying team for the Purchase-to-Pay system and designing a SMART purchasing performance measurement and evaluation system; 2. Promote added value in earlier involvement with internal customers; 3. Explore added value with partner departments and suppliers, as well as other universities through purchasing alliance. The main contribution of the research is a creative purchasing roadmap based on multidisciplinary concepts and best purchasing practices identified in the benchmarking study.

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1. INTRODUCTION: A CASE STUDY OF THE PURCHASING FUNCTION IN TECHNICAL UNIVERSITIES

The role of purchasing within the organization has evolved from being supportive to increasingly strategic importance within the organization (Easton et al., 2002; Paulraj et al., 2006). Externally, the purchasing function is moving away from the adversarial win-lose approach between buying and selling towards collaborative relationships (McIvor, et al. 1997). The main drivers of these changes include: increasing purchasing volume (Schiele, 2007), more stringent demand for product specifications and service requirements (Stanley and Wisner, 2001), and accelerating complexity of technology (Gadde et al., 2010). The traditional objectives of purchasing function are mainly cost savings and operation efficiency. In today's business environment, purchasing professionals emphasize increasing value creation (Lindgreen et al., 2009; Van Weele and Rozemeijer, 1996), and also integrated supply chain management (Paulraj et al., 2006).

In commercial businesses, the strategic role of the purchasing function is emphasized and contributes to competitive advantage (Ferguson et al. 1996; Brookshaw and Terziovski, 1997; Van Weele, 2010). The purchasing function in public sectors also attracts considerable attention because of the huge volume. There are over 250,000 public authorities in the EU which spend around 14% of annual GDP on the purchase of services, works and supplies (European Commission, 2017). Eurostat 2015 indicated that general government expenditure on education amounted to 4.9 % of GDP in the EU-28 and 5.4% in NL; public expenditure on tertiary education was equivalent to 1.3 % of GDP. Purchasing expenses on education are accounted approximately to 40% of the above amount, since purchasing is defined as "anything resulting in an invoice" (Telgen, 1994). Due to the enormous purchasing volume in tertiary education, especially in technical universities with research settings, it is very important to explore their purchasing added value.

The challenge of creating more purchasing added value can be observed in a real-life case. The University of Twente (UT) is a Dutch public university leading in socially-relevant technological developments. Its purchasing volume in 2016 is €78.5 million. The Procurement Department of UT (hereinafter referred to as "UTPD" or "PD") plans to redefine its position and create more value for the University. In this context, *position* means the role of the PD and to what extent it involves in and contributes to research and teaching activities. To determine its desired future position, the UTPD is seeking for the best practice in top technical universities. *Best practice* is a relative term and can be defined as a method or technique that achieves superior performance when comparing with others.

2. RESEARCH GOAL: TO FIND THE BEST PRACTICE FOR CREATING PURCHASING ADDED VALUE

The research aims to investigate factors and actions associated with purchasing value creation in technical universities, contributing uniquely to the academic niche of purchasing field. The research question is "*What is the best practice for the UTPD to promote more added value?*". The outcome will be presented as concrete advice for the given case study. Specifically, a gap analysis will actualize the department vision in a feasible manner. A roadmap will empower the department to perform its mission and pursue added value using a creative mindset. In order to be able to address the research question sufficiently, there is a need for a coherent understanding about purchasing added value and examining what drives the UTPD to its desired position. Thus, the study will provide a review of literatures in relation to purchasing added value and conduct a *benchmarking study* within top technical universities. Based on the expectation of the UTPD, the study includes the following objectives:

a) To review the literature about purchasing added value, especially value created for internal customers;

b) To deliver empirical results of purchasing added value in both UT and target technical universities;

c) To identify commodity characteristics typically found in technical university procurement;

d) To devise solutions for the UTPD to promote more purchasing added value.

The remainder of this paper is structured in a particular order:

Section 3 will explain the procedure of data collection;

Section 4 will be a literature review on the key topics;

Section 5 will be a benchmarking study in target universities;

Section 6 will be the presentation of the UTPD's status quo;

Section 7 will be the vision of the UTPD about its position;

Section 8 will be the roadmap recommended for improvements;

Section 9 reflects on the present research and suggests for further research.

3. RESEARCH DESIGN: MULTIPLE-METHOD TO SEARCH FOR BEST PRACTICES

The study was conducted between 24 April 2010 and 30 June 2017. It adopted a multiple-method design, an approach that integrates the collection and analysis of both. The literature review focused on purchasing added value, special value added to internal customers. The empirical research included three layers with successively smaller scopes: data collection via websites of top technical universities, remote interviews with target universities, and field research in the UTPD.

For the benchmarking study, a broad desk research at the website of purchasing department was conducted in 56 top technical universities. They were Top 100 universities listed by the Times Higher Education World University Rankings 2016-2017 under two different subjects: a. engineering & technology; b. computer science. The reason is that the UT has been also ranked very high with both subjects in recent years. Assumed that similar scientific and laboratory equipment are needed for the same research subject, this focus makes sensible comparison. In addition to the desk research on best purchasing practices, the interviews via the Internet were conducted with procurement directors/professionals. In the benchmarking study, the investigated universities were still global top technical universities. The selection mainly depended on the response to the email invitation but also the existing personal network from Professor Telgen. In order to gain expected outcomes, the interview questions were designed together with the manager of the UTPD, Geert Jan Westhof.

Before introducing the research design in the field, an overview of the UT's organization set-up will be presented. Currently, the University of Twente has over 6,000 students and more than 500 staff. As shown in Appendix A, the UT reports to the Ministry of Education and the Supervisory Board. The management team of the organization consists of the Executive Board, the deans of the

faculties, and the directors of the institutes. The Executive Board is supported and facilitated by 9 support departments. Facility Service Centre (the FB, "Facilitair Bedrijf" in Dutch) is one of these offering services to the residents. Many buildings in the campus have a service desk one can turn to with any service request, which are the front office of the FB. Its back office consists of the department of Procurement, Logistics, Security and Real Estate & Management. The FB also takes out and manages contracts for facility services, such as cleaning, catering, furniture and hot beverages. These tasks are under the charge of the Procurement Department.

In the field research, extensive involvement with the UTPD was required to assess its status quo and understands its vision. Thus, the researcher worked in the office for part time. Interviews with 8 employees and 5 internal stakeholders were conducted to understand the process and operations of the department. Appendix B shows the latest organizational structure of the PD. The interviewees within the department include: the manager, one procurement analyst, one contract manager, two tactical buyers, and three operational buyers. The interviewed internal stakeholders are the manager from MESA+ Nano Laboratory, the administrative manager and the accounting manager from the FB, two managers from the Logistics Department which also report to the FB. MESA+ Nano Laboratory is one of the five research institutes of the UT, of which all are internal clients of the PD. In addition to reporting to the FB, the PD also serve the FB as an important internal client. The Logistics Department is parallel with the PD and the two departments collaborate closely in daily operations. In order to ensure the accuracy of the assessment, the manager of the PD and one buyer did the final check and confirmation.

4. PURCHASING ADDED VALUE IN THE LITERATURE: FACTORS, TYPES AND STRATEGIES

As the marketplace becomes more competitive and the customer becomes more demanding, the concept of "value" attracts increased attention (Dumond, 1994). *Value* can be defined as "the customer's perception about whole bundle of benefits, being tangible or intangible, which satisfy the needs of the customer timely, effectively and efficiently" (Gabriel, 2006). Fawcett and Fawcett (1995) viewed an organization as a value-added system which integrate logistics, operations and purchasing activities. The system attempts to maximize the value of the supplied products and services and minimize the nonvalue-added activities. Purchasing can add value to products or services through improved interactions with internal customers and external suppliers, and thereby may increase the overall performance (Dumond, 1994). Furthermore, purchasing may contribute to an organization's long term growth, its strategic positioning and its overall competitive advantage (Van Weele et al., 1998). In Porter's Value Chain, procurement is also viewed as a support activity which contributes to the competitive advantage of an organization by adding value (Porter, 1985). This literature review gives the insight of factors affecting purchasing added value, types of value added by purchasing with emphasis to the internal customer, and strategies to increase purchasing added value.

4.1 Factors affecting purchasing added value

Dumond (1994) defined the concept of *value-based purchasing* (VBP), in which the decisions of purchasing professionals focus on the creation of value rather than on the traditional objectives of cost savings and efficiency. The VBP has been increasingly applied, for example in the American health care industry. The Hospital Value-Based Purchasing Program was initiated by Centers for Medicare & Medicaid Services (CMS) since 2010, and it has been formed an integral part of the transformation of the US healthcare system. Dumond (1994) indicates three groups of major organizational variables which empower the performance of value-based purchasing. The first one is *performance measurement system*, which establishes the means and motivation for effective value chain management. By linking the internal user to the external environment, *functional interaction* is needed to increase value by focusing on the internal users who require acquisition of the necessary information. Finally, *access to external information* about market and technology is needed to allow purchasing professionals to increase the value of products and services.

Although the value generated in purchasing activities becomes more diversified, cost savings are still considered to be purchasing's primary objective (Hartmann et al., 2012). Certain empirical studies demonstrated a positive impact of purchasing maturity on cost savings and financial performance (Foerstl et al., 2013; Schiele, 2007). Van Poucke and his associates (2015) explored the effects of *early purchasing involvement* on cost savings based on 644 sourcing projects from a database of a large, private financial services company. The results confirmed that early purchasing involvement enhances the cost savings outcome and empirically establishes the importance of purchasing professionals for realizing cost savings in sourcing projects.

Based on the findings from literature, Telgen and Pop Sitar (2001) designed a conceptual model to summarize the factors affecting the purchasing added values into four groups: company strategy, purchasing maturity, information management such as feedback and comparison, and organizational factors such as structure, policies and culture. As shown in Figure 1, the gray cells pinpoint that there is an association between a particular factor and a particular value added, while the white cells indicate the association between the factors and the added values. The obtained results show that *purchasing maturity* is the most important factor among others and affects positively all five considered values added by the purchasing services. Purchasing maturity (or purchasing development) can be defined as "the level of professionalism in the purchasing function" (Rozemeijer et al., 2003). The empirical data clarifies that the more developed the purchasing function is, the more purchasing added values are brought to the organization. The second important factor is *company strategy*, which affects costs, the quality and the time to market. The two important factors will be applied in this following stages in the present study. Namely, the maturity model will be used as the assessment tool to identify the current states of the UTPD; the earlier purchasing involvement will be the core of the proactive development roadmap.
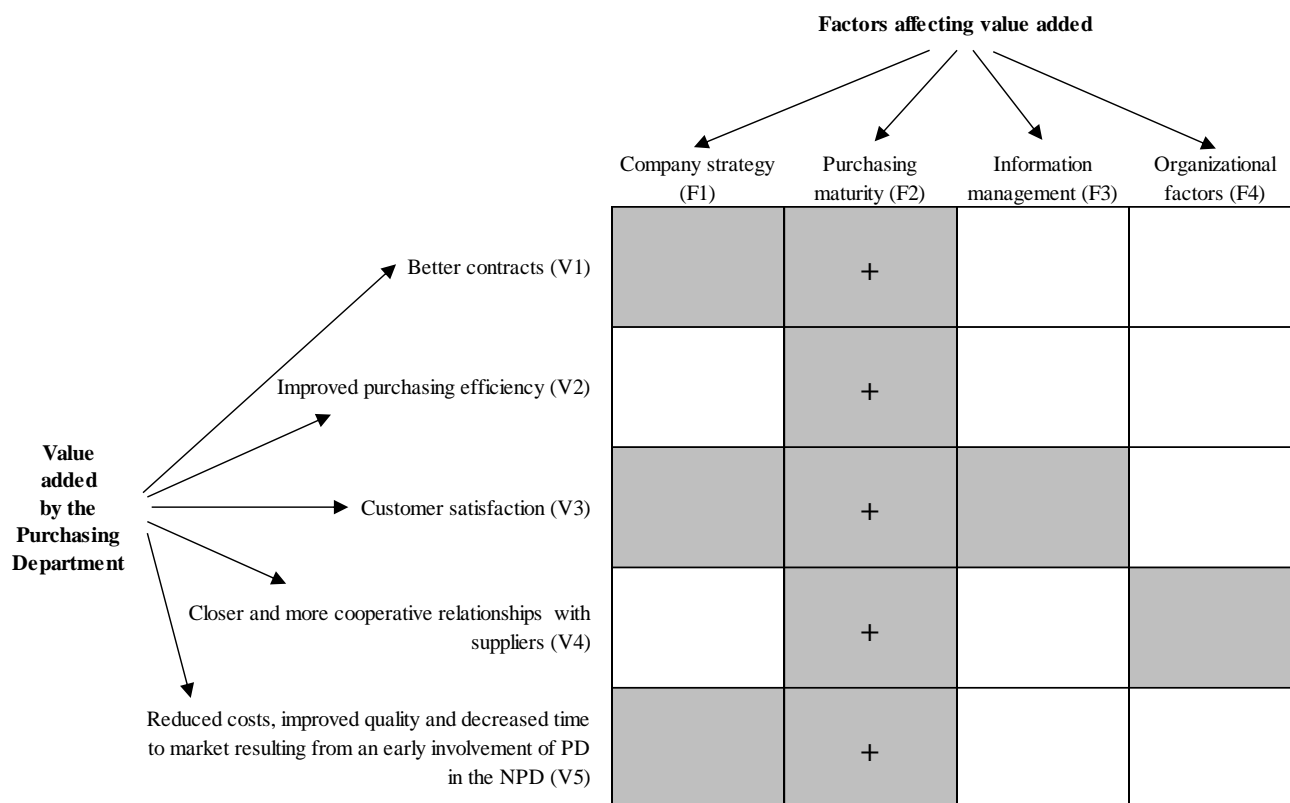
Value added by the Purchasing Department	Company strategy (F1)	Purchasing maturity (F2)	Information management (F3)	Organizational factors (F4)
Better contracts (V1)	(shaded)	+		
Improved purchasing efficiency (V2)		+		
Customer satisfaction (V3)	(shaded)	+	(shaded)	
Closer and more cooperative relationships with suppliers (V4)		+		(shaded)
Reduced costs, improved quality and decreased time to market resulting from an early involvement of PD in the NPD (V5)	(shaded)	+		

Figure 1. The relation between purchasing added value and affecting factors.

Source: Telgen and Pop Sitar, 2001

4.2 Types of purchasing added value

As shown in the above model, Telgen and Pop Sitar (2001) selected five categories of purchasing added value which they consider to be representative and important for every organization: better contracts, improved purchasing efficiency, customer satisfaction, closer and more cooperative relationships with suppliers, reduced costs, improved quality and reduced time-to-market resulting from an early involvement of the purchasing department in the new product development process. Different experts use different criteria to classify purchasing added value according to the need. "Savings realized" has been validated as a primary purchasing contribution by several researchers, and also considered as an important measurable area in the purchasing maturity process (e.g. Foerstl et al., 2013; González-Benito, 2007; Hartmann et al., 2012; Schiele, 2007). It can be the sum of cost reduction and avoidance realized in proportion to purchasing spend plus savings for one sourcing project (Van Poucke te al., 2014).

The emerging e-Commerce and other information technology enrich the kinds of values added by purchasing function (Telgen & Pop Sitar, 2001). The effects on the purchasing function include: concentration on strategic and value adding activities by transferring operational activities to users; streamline of the entire purchasing process to eliminate all non-value adding activities; a tighter control over the entire process; powerful supplier and end-user databases; information flow of all activities; and comprehensive and flexible management reporting system. Accompanying with the development of technology, the competence of purchasing professionals has been improved and also the maturity of the purchasing function has been accelerated. As stated earlier, purchasing maturity can facilitate purchasing added values. Van Weele (1998) identified the main values added by purchasing services in each of the evolution stages towards purchasing maturity, as demonstrated in Appendix C. In his model, six purchasing maturity stages were defined: transaction orientation, commercial orientation, purchasing orientation, process orientable, supplier chain orientation, and value chain orientation. The added values expand sequentially along with the first to fourth stage: from assuring the continuity of the supply, to importance in cost structure, to the benefits from internal cross functional co-ordination and uniform buying policies and systems, and finally to the extensive use of cross-functional teams and focusing on reducing total systems cost and satisfying the internal customer. In the stage of supply chain orientation, purchasing is characterized by improved information system, co-development with internal and external stakeholders, and early involvement in the new product development process. The ultimate stage of purchasing maturity aims to design the most effective and efficient value chain to maximize the end customer satisfaction, which is characterized by an extensive use of cross-functional supplier development teams and a close collaboration on advance technology with suppliers.

The purchasing added values mentioned above can be direct or indirect contribution, quantitative or qualitative benefit and also can be categorized in correspondence with its beneficiaries. Leenders and Schiele (1999) identified four ambits where the purchasing function create values and suggested classifying the purchasing added value into four corresponding categories. The first category is value added to the organization, which is reflected in the global results of the organization, for example controlled costs and right supplies. Value added to the

purchasing process impacts the smoothness of the purchasing process such as streamlined process, better supplier evaluation. Value added to the specifier is better understanding the needs of *internal customers* (user areas). The final group is value added to the supplier, which contributes to suppliers and influences their relationship with the organization, for example helping them to understand the needs. The focus of this work is the value added provided by the purchasing function to internal customers, which will be expatiated further in Subsection 4.4.

4.3 Strategies to increase purchasing added value

Through empirical data from 21 organizations in diverse industries, Dumond (1994) recommended a series of changes for managers to support and encourage value-based purchasing: "focus individual purchasers on customers' needs and identify value-adding processes; develop a performance measurement system that emphasizes quality, process improvement, and customer satisfaction; integrate purchasing into the organizations' communication system; educate not only individual purchasers but also their customers" (Telgen & Pop Sitar, 2001).

In order to increase resources which can empower the purchasing function to create more added value, O'Reilly (2000) identified five strategic initiatives:

1. Greater involvement with customers: It allows the purchasing department to identify priorities among purchasing tasks and set goals to align with other departments.

2. Expand the role of suppliers: Close relationships between buyer-supplier facilitate the supply chain flow and earlier involvement of suppliers can benefit the development of new products.

3. Be more participative in the planning process: This strategy is related with the first one, since it involves the participation of the purchasing department in the planning sessions of internal customers and vice versa. Reflection of customer feedback in the purchasing plan does not only give new insights to the purchasing professionals, but also transmit the customer a sense of ownership and empowerment.

4. Use technology more effectively: The popularization of the Internet and the implementation of e-Procurement tools has created enormous advantages benefits such as the standardization of procedures and optimization of time and space.

5. Be more results oriented: Indicators of performance must reflect the strategy of the organization and contributes to its goal. As part of its benchmarking efforts in both academia and industry, the Center for Advanced Purchasing Studies (CAPS) has proposed a series of strategic measurements which are applicable for any purchasing department and provide a way to compute and report results periodically and consistently.

Darin Matthews, the current Director of Procurement at UC Santa Cruz who has been interviewed by the researcher in the present study, summarized strategies to increase purchasing added value into two categories (i.e. short term and long term). As listed in Table 1, most of the strategies are practical and easy to understand, and some of them will be recommended to the UTPD later. Matthews (2006) also stressed that added value can and should be created in the different stages of the purchasing process: prior to solicitation (request for proposal process, specification development, etc.); solicitation phase (administration of process, deal with inquiries, etc.); award phase (negotiation, protecting company's interests, etc.); contract administration (to take care of disputes, ensure delivery, etc.). This means different strategies and approaches are required at each purchasing stage for value creation.

Table 1. Short and long term strategies to increase the purchasing added value.

Source: Matthews, 2006

Short term strategies	Long term strategies
• Effective communication:	• Professional development
- Improved communication skills	• Training program for users
- Improved listening skills	- Seminars
- User friendly documents	- User manual
- Regular meetings with users	• Training program for vendors
- Standardized specifications	• Cross-functional teams
• Cooperation	• Reputation of accessibility
• Active participation in the organization	• Customer-focused operation
• Timeliness	• Developing of a value-added mindset
• Streamlined purchasing process	-Search of opportunities
	- Resourcefulness
	- Innovation
	• Good use of technology

4.4 Value added purchasing for internal customers

The vision of an origination as a supply chain implies that each function cooperates closely with its internal suppliers and internal customers. Stanley and Wisner (2002) claimed that the organization's internal environment consists of structures, strategies, and communication patterns between internal suppliers and internal customers. Slack and Roden (2015) also described the internal customer-supplier relationship in their book:

The terms internal customer and internal supplier can be used to describe those micro operations which take outputs from, and give inputs to, any other micro operations. Each micro operation is therefore at the same time both an internal supplier of goods and services and an internal customer for the other micro operation's goods and services. The internal customer–supplier concept is regarded by some as one of the most powerful aspects to emerge from total quality management. It is recognition that everyone is a customer within the organization and consumer goods or services provided by other internal suppliers, but at the same time is an internal supplier of goods and services for other internal customers.

In this concept, processes are broken into micro operations that takes an input from a previous work step (i.e. internal supplier), adds value to it and provides an output to the next work step (i.e. internal customer). Thus, purchasing can be viewed as a supplier within the organization serving its internal customers such as research and manufacturing (Schiele, 2006; Wisner and Stanley, 1999; Wynstra et al., 2003; Young and Varble, 1997). The quality of the output in each micro operation is a prerequisite of a company's overall performance (Large & König, 2009). When both the customer and suppliers in each micro operation have limited resources, they must work together as partners to maximize the return (Besterfield, 2009), as opposed to a transaction relationship. The quality of internal partnerships can determine supply management in the organization and operates at the tactical or the strategic level (Smith & Nelson, 2009).

The development of strategic internal client partnerships is considered a best practice that can provide significant benefits such as "optimized business results" and "value chain integration" (Smith & Nelson, 2009). Purchasing internal service has also become a critical value driver (Cousins et al., 2006). Jun & Cai (2010) identified six key internal service quality dimensions as perceived by the purchasing department's internal customers: customer intimacy, team-based continuous improvement, communication, reliability/competence, requisition process and tangibles. In addition, this study reveals that customer intimacy is the most influential dimension to achieve both high internal customer service quality and satisfaction. Furthermore, Sánchez-Rodríguez et al. (2004) conducted an empirical research which showed that the implementation of quality management practices in purchasing is significantly related to the achievement of increasing levels of purchasing's operations and internal customer satisfaction. Van Pouckea et al. (2014) suggested that purchasing's internal service quality is also affected by the purchasing maturity process

5. PURCHASING VALUE−ADDING ACTIVITIES IN PRACTICE: "STANDING ON THE SHOULDERS OF GIANTS"

Benchmarking in the achievement of better results in the purchasing function positively affects the overall business performance (Sánchez-Rodríguez et al, 2003). When benchmarking externally, the organization examines the same function in peer organizations for comparative analysis and understands what constitutes "good" performance. The benchmarking study in this research includes the desk research on purchasing added value in 56 top technical universities in UK & US, as well as case studies for the best purchasing practices in 5 universities. The first method aims to grasp the up-to-date value adding activities and innovations of the purchasing function in technical universities, as presented in Subsection 5.1. The second method aims to gain the insight of the internal processes and shares the experience and perspective of purchasing directors. The 5 top technical universities are University of California - Sante Cruz (UCSC), University of California – Irvine (UCI), NC State University (NCSU), ETH Zurich and KU Leuven. The interview questions focus on purchasing process and system, stakeholder management, as well as any best practice. The indicated value adding activities are summarized in Subsection 5.2 to 5.4. The more elaborated description of the purchasing function of each university can be found in Appendix E.

5.1 "Primary impression" of purchasing services

In order to gain a general understanding about purchasing in technical universities, the researcher has visited the website of many top universities and identified some common features. The list of the desk research is from the Times Higher Education World University Rankings 2016-2017, consisting of 20 top technical universities ranked in "engineering and technology", 10 top ones in "computer science", and 26 top ones ranked in both subjects (It should be 27 in total, but University of Southampton was removed because it shares really limited information on its website). Among 56 universities, 14 of them are from UK and the rest are from US. The attention has been paid to purchasing activities and added values, as well as the organizational structure, mission and vision statement of the purchasing department.

It is noticeable that 91% of these universities set up the purchasing function under the finance division. The vision and mission of purchasing in different universities are almost the same. They want to be a high performing strategic partner contributing to the financial health of the university. The mission is normally to provide cost savings and efficient services for teaching and research, as well as professional and qualitative purchases. 30% of the universities claim that they take consideration of the sustainability, environment (e.g. "buying green", "Planet Blue") and social responsibilities. Besides, all the procurement departments are also responsible for the compliance of laws, internal and external regulations and rules. The overview of all the universities and the link of their purchasing services, as well as key finds, is attached as Appendix D.

"Value of money" is a word seen very often, and cost savings are often called "benefits" in American universities. For example, the P200 program and the SC500 program have been implemented in 10 campuses of University of California. The system-wide savings program P200 was devised by UC Office of Procurement in FY12/13 (Fiscal Year 2012/2013), as part of the Working Smarter Initiative. The goal of the program is to build an integrated, sustainable procurement framework, to leverage UC's system-wide talent, technology and buying power. The UC community states that "By developing and utilizing competitive contracts, innovative supply chain strategies and robust reporting and analytics, we will recapture $200 million annually currently lost through sub-optimal purchasing contracts and practices, redirecting these critically needed funds to support UC's core missions of teaching, research and public service". In 2013, the program P200 successfully delivered $132 million in savings, and the achievement brought honor to the UC Office of

Procurement with the SuperNova Award in the category of Technology Optimization and Innovation. In FY15/16, it is reported that the program delivered $268.7 million in annual benefits, which is one year ahead of the program goal. In 2016, the P200 program has evolved to SC500, as one of the key strategic initiatives to increase the annual benefit to $500 million. SC500 expands upon P200 "by leveraging the successful cross-campus governance model, expanding Centers of Excellence (COE), fully integrating procurement and payable processes, consolidating program benefits, continuously improving procurement processes, and optimizing the supply chain". Not only purchasing, the program also includes accounts payable, shipping/receiving, warehouse/stockrooms, inventory and equipment management (disposal/surplus/recycling), and travel.

Except UC, some other universities also publish the cost savings at the website to manifest their accomplishments. The main sources of benefits are from competitive bidding and contracted suppliers. Thus, universities stipulate the solicitation of public bids for high value requisitions. For instance, Brown University requires three signed and dated written bids for all purchases of $25,001 or more. For purchases of $5,000 or more, it is also recommended that bids be solicited. Individual purchases from Preferred Contract Suppliers do not require competitive bidding. Since their pricing and other conditions have been predefined, the benefits have been realized by discounting or other negotiated terms. The user only needs to simply indicate on the sole source form that a Purchasing Services Preferred Supplier was used. This policy means the authority of supplier selection has been transferred to the customers within a predefined framework.

For the majority of universities, small purchases are decentralized using procurement cards and e-Procurement system, while higher value purchases are mainly the territory of procurement department. 55 out of 56 universities have procurement card program for small value miscellaneous purchases with a different threshold, and all the visited universities have e-Procurement system (or called iProcurement, eMarket, eStore, and any nickname). e-Procurement is an internal online ordering system connected with external supplier portal. For instance, the MIT's eCatalog is described as "a great first choice for purchasing because no credit cards are necessary and no sales tax will be included in any order". e-Procurement is generally promoted with efforts by the procurement department.

The website of procurement department is often customer-oriented. It provides clear information for internal customers about the purchasing strategy and instructions for different needs. Commodity management or category management makes the user more convenient to select and order the goods. Code of conduct and policy documents are normally shared. They also provide a training workshop or online tutorial about the purchasing method and process, in particular the training for e-Procurement and purchasing card program. To build connection with customers, some universities publish newsletters regularly. For example, University of Colorado – Boulder sends the PSC Communicator by email, which is a regularly-published 1-page newsletter from the Procurement.

Most of the websites are also supplier-friendly, with a supplier center to guide the supplier to have business with the university. Bid/tender opportunities are also posted and updated at the website. For example, at the University of California Public Bid Site, suppliers can create an account and browse public bid opportunities with the University of California's 10 campuses. Some of universities specially have "Supplier Days" or "Vendor Fair" to create the opportunity for suppliers' exhibitions. Most of the universities share externally or internally (intranet username and password needed) their own supplier base or so at the website

called supplier directory, the supplier portal, the list of preferred and contract suppliers, or the list of approved or recommended suppliers. When a supplier is qualified under certain conditions, it will be included in the e-Procurement of the university and customers feel free to buy directly from this supplier. Furthermore, most of American universities put the statement of supplier diversity development and similar programs at the website, to protect Small & Medium Size Enterprises (SMEs), local businesses, woman-owned or minority-owned businesses. The best example is the program of SWaM (Small, Woman-owned and Minority-owned Businesses) of Virginia Polytechnic Institute and State University, which accompanied with an annual SWaM Vendor Fair and SWaM supplier database.

5.2 Visible cost reduction

As mentioned above, financial control is very important for the universities and regarded as the most important purchasing added value at many universities. This purchasing added value is also reflected in the mission statements of the purchasing department of universities. For example, the mission of UCSC Procurement is "Generating strategic procurement opportunities and benefits for the campus while delivering exceptional customer service in support of expanding the boundaries of knowledge". The mission of UCI Procurement is "To expand opportunities for teaching, research and public service by delivering savings and efficient procurement services across the University of California.". All the 5 interviewees were willing to share their achievement in this area.

In both UCSC and UCI, the benefits are measured according to a standard developed by the UC system in the program P200 and SC500 which has been introduced earlier. The total annual benefit can be generated from four types of procurement actions:

Cost Reduction. Benefit achieved when procurement action results in a total cost that is lower than baseline cost, and the baseline cost calculation is supported by documented historical price (i.e. previous contract, historical costs, or imputed historical cost).

Cost Avoidance. Benefit achieved when procurement action results in avoidance of additional cost (i.e. maintenance fees, requested price increases, or other ancillary costs).

Incentives. Benefit achieved when procurement action results in new gross incentive (based on volume, compliance/utilization, transaction size, electronic payment, e-commerce, signing bonus, GPO, management fees, etc.).

Revenue. Benefit achieved when procurement action results in revenue generation.

The UC requires that a baseline type and amount must be specified in order to calculate a benefit, and listed the first three baseline types in order of preference. The UC Procurement Services also present a list of examples of activities that may generate benefit. The complete information about this *benefit recognition and generation* can be found in Appendix F. Both universities have a good achievement in cost reduction. For example, the "Benefits Achieved" in UCSC was over $4 million savings for fiscal years 2015 and 2016, which exceeded annual benefit goals with more than 28%. For Fiscal Year 2017, they set a goal to realize $2 million in benefit. Below are examples of activities that may generate benefit.

Sharon Loosman, the Chief Procurement Officer of NCSU, claimed that they have saved more than $33 million in accumulative total since 2008. She stressed three ways to realize the financial benefits. The main savings are generated by the e-Procurement system, where the approved supplier provides

discounting for the University. Secondly, the automatic systems such as e-Procurement and Purchase Card save a lot of time and labor cost. According to Snehal Bhatt, the Chief Procurement Officer of SCI, the cost to process one regular purchasing order is $150, while a purchase with procurement card can be one third of it. The NCSU also pays e-Procurement suppliers with the virtual card. Each supplier has an account offered by the bank to pay the e-Orders. In this way, the administrative work and accounting cost are significantly reduced. The third channel is the Surplus inventory catalog, available online, and increases the rate of recycle and resale inside or outside the campus, which saves a lot of costs and generates revenue for the customer.

There is also report in cost reduction through public tenders at ETH Zurich, and it has been less emphasized. However, Stefaan Saeys, the Head of Central Purchasing of KU Leuven, stated that customer service quality is more important than cost savings. "Make customer happy!" is their slogan. Since the resource is limited, if they spend too much effort on the price negotiation, they may not provide high quality of services. To ensure customer satisfaction, every customer has their own purchasing specialist to provide intimate services. For every project, the specially-assigned buyer gets evaluated for his/her performance by the customer. In this way, the customer satisfaction is very high and central Purchasing has a good reputation. Thus, the universities have various goals and strategies.

5.3 Efficient Purchase-to-Pay processes
Compared with the traditional purchasing function "We buy it for you", the new trend for the university procurement is "We tell you how to buy", especially for those low value purchases. For example, UCSC states that Procurement Services is responsible for providing the tools and business processes for acquiring goods and services at the University. The vision is "Within the framework of UC guidelines and policies, Procurement Services delivers innovative solutions with professional integrity through simplification and creativity, making us a highly sought after strategic partner". The most common tools are e-Procurement and Purchase Cards, which are always viewed as the "meritorious statesman" for cost savings, as introduced in Subsection 5.2. In addition, Sharon Loosman from NCSU also stated that one extra value added by the Procurement to the internal customer is annual reporting generated automatically by the MarketPlace and PCard system. The systems collect all the data and provide different reports (spending per category or per department) to all the using departments. The report with visualized chart helps every department to make a good decision on the budget plan for the next fiscal year.

e-Procurement is a very important tool to realize the automation of purchasing control and management. A Purchase Card be used to procure low-risk and low dollar-value goods. All the five interviewed universities have their own developed systems to release e-Procurement. They are similar in structure and integration within the financial system, but tailored according to the need. ETH Zurich has an e-Procurement system where all the customers can order laboratory equipment, office supplies and other products. The purchasing order is sent to the suppliers directly and the goods will be shipped to the customer directly. However, they have no procurement card program yet. In contrast, NCSU has a very mature Purchase Card (PCard) program, which has developed and evolved over 20 years. This is an individual credit card paying for travelling, small services and other urgencies. Currently, 25% of the purchasing volume has been spent via PCard, i.e. $ 100 million per year. The process of PCard is much leaner than a standard purchasing process and leads efficiency and savings. When asking how to ensure the success of automatic system implementation, Ms. Loosman stressed the key factors: information system support, leadership support, and motivation of the procurement department and partner departments.

5.4 Effective sustainable procurement
In addition to the contribution to cost-reduction, the paperless office is often a resulted from of the automatic Purchase-to-Pay processes. This brings a big value for the environment protection. In addition, all the interviewed universities have sustainable procurement program.

In UCSC, EPP (environmentally preferable products) is an important criterion in the selection of products and services. It is claimed that sourcing from suppliers who promote sustainability within their own companies is making a positive difference within the University. They advertise three main benefits of EPP products: environmental, financial and practices. UCSC has its own annual sustainability metrics. For example, earth friendly janitorial cleaning and paper products have increased up to 80% of the total purchase in 2016. It is the first campus in the UC system to officially make the CEH-Safer Furniture Pledge. This is a pledge developed by the Center for Environmental Health in US. It expresses a commitment by an organization to purchase furniture that is free of chemical flame retardants, fluorinated compounds, and polyvinyl chloride (PVC). In UCI, similar approaches and measurement with UCSC are used to encourage sustainable procurement. Its Green Purchasing includes "the acquisition of recycled content products, environmentally preferable products and services, bio-based products, energy- and water-efficient products, alternate fuel vehicles, products using renewable energy, and alternatives to hazardous or toxic chemicals".

In NCSU, the Surplus Property Office is specially set up to manage the surplus property, which is has a re-sale value, but is no longer needed by the university department to continue its operation. The surplus property items will be picked up and made available for acquisition by other departments, public agencies or non-profit organizations. Surplus items not acquired by these entities are sold at public surplus sales. This program generates revenue for the customers and also contributes to the environment. Thus, university departments are strongly encouraged to obtain surplus items for their departmental needs, instead of buying new, more expensive supplies and equipment directly.

ETH Zurich Procurement focuses on "an economically viable and sustainable procurement and provision of goods and services". This means that they not only look at the price, but also check the energy efficiency and lifetime of machines. This concern also is also reflected in tendering. The KU Leuven participates in the Flemish Supercomputer Centre (VSC), which guarantees access to a world-class high-performance computing infrastructure and studies critically into environmental sustainability, atmospheric modeling, researching of new materials, and medical research.

6. CURRENT POSITION OF THE UTPD: "WHERE ARE WE?"
The UTPD serves as an adviser and operator who does not own the budgets. This section uses a mixture of assessment, interview, evidence and discussion to develop a clear picture of the current position of the PD and to identify its strengths and weaknesses. First of all, a purchasing maturity model has been used for self-reflection, which enables the PD to conduct a structured review of purchasing performance and benchmark its purchasing function against best practice. Each diagnostic item examines the current situation against a range of criteria and determines how

far-off it is from the goals. The assessment results allow the PD to provide focused insights into the strengths and areas less developed within the department, as presented in Subsection 6.1. However, this assessment has pros and cons: it is comprehensive and convenient, while lack of flexibility to gain a deep understanding with the limit of all rigid predefined descriptions. Therefore, the complementary interviews have been conducted and brought more insights to the researcher about the department, especially when it comes to the processes and systems. The observation and unstructured communication of the researcher in the field will be also taken into account. In addition, internal reporting and documentation was also offered for more detailed data. The results will be presented in Subsection 6.2 to 6.4.

6.1 Developing purchasing function

Stephen Guth's Procurement Maturity Model has been selected for the assessment of the PD, based on two criteria: it is an assessment model with measurable scales, and it is applicable in public procurement. According to Guth (2010), there is a broad set of external factors in the procurement profession which directly affect organizational performance: customers, policy, staff, processes, vendors, tools, and organization. As an assessment model, it facilitates the process of benchmarking by pre-defining over 60 procurement best practices. In each of the practice, there is a clear statement of what is expected in each area, and a definition of each of the three levels of achievement (while "0" means the lowest rating, "×" when no data is available, and "3" is the highest). The results enable a gap analysis between the PD's performance and the corresponding performance of a best-practice. The overall score of all right areas is interpreted in this way: 0.5 is "Inhibiting", 1.0 "Performing", 1.5 "Enabling", 2.0 "Optimizing", 2.5 "Best in

Class", and 3.0 "World Class". The UTPD got the final score 1.69, which is between "Enabling" and "Optimizing".

The individual score for each area is shown in Figure 2. The highest score is the area of "Organization" and "Policy", with 2.3 and 2.2 out 3.0 respectively. "Organization" factors cover strategic plans, structure, mission and vision, while "Policy" includes delegation, authority and standards. This means there is a minimal gap towards the best practices with clearly stated objectives and well-defined structure. The area "Tools" measures the management of contracts and RFx, website, and automatic information systems. It achieved a score of 1.95. In general, The PD is developed sufficiently in the "Staff" area (1.9), with training, engagement and performance management. The following sufficiency is the management of "Customers" (1.7) reflecting the effort of customer relationships and satisfaction. "Processes" scored 1.65, including audit, purchasing planning and forecast, purchasing order generation, and spending analysis. The university's audit department does audit every 3 months and then there is a general audit by KPMG (a large Dutch accounting company). The audit is being done for all purchases of above € 50,000 that have been processed by the PD. The "Value" (1.2) follows sub-questions about risk control, contract ratio and turn-around time, and cost savings. These elements are scored low basically because some of them are not measured by the PD. For example, the Manager stated that it was hard to judge the cost savings for each transaction. The price and quality can be optimized via public tendering, but still it is hard to calculate the cost reduction. The area of "Vendors" got 1.0 overall, which reflects that the PD has paid less effort on supplier management with significant gaps.
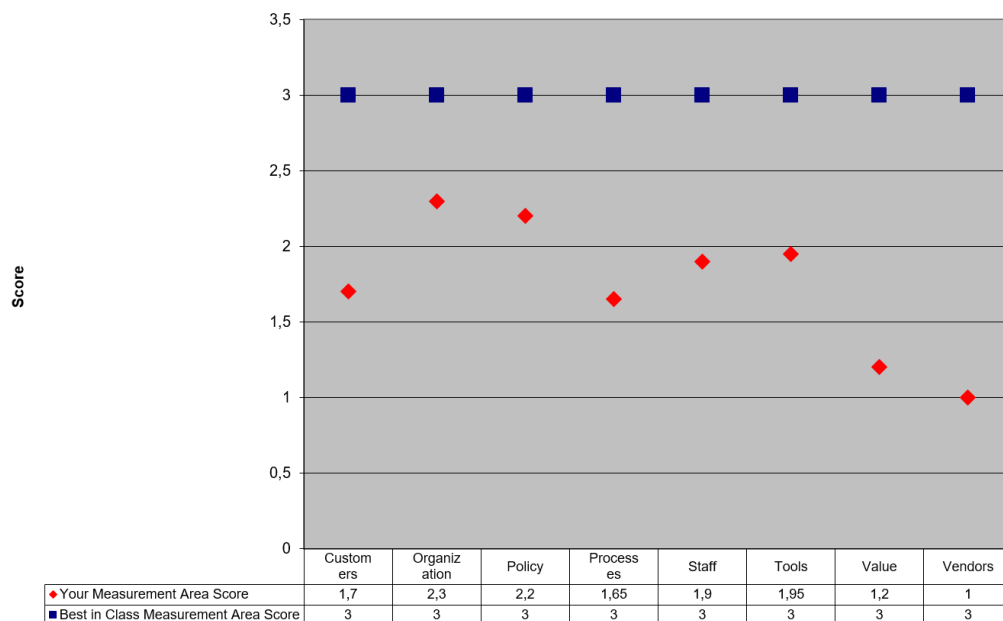

	Customers	Organization	Policy	Processes	Staff	Tools	Value	Vendors
◆ Your Measurement Area Score	1,7	2,3	2,2	1,65	1,9	1,95	1,2	1
■ Best in Class Measurement Area Score	3	3	3	3	3	3	3	3

Figure 2. Procurement Maturity Model Score Comparison.

6.2 Striving for early involvement

As introduced earlier, the PD is divided into "Operational" team and "Tactical" team. This division corresponds to the steps of the purchasing procedure. Normally, there are 7 steps to complete a purchasing task: 1. Orientate; 2. Specify; 3. Select; 4. Contract; 5. Order; 6. Monitor; 7. Follow-up. The first four steps are in the

scope of Tactical Purchasing, while the last three steps are moved to Operational Purchasing. The first one focuses on the tendering process, contract management, related projects and customer relationships. The second one concentrates on all the operational activities such as quotations, orders, shipments, customs clearance and purchase monitoring. This is an ideal approach to

manage these various processes, since they have different characteristics and require different strategies and professionals.

It is easy to understand that not all the acquisitions are required to go through all the 7 purchasing steps. For those products with relatively small amount or frequently ordered, Step 1-4 may be skipped and purchasing orders are directly placed with suppliers. Any procurement of goods and services with a value above €50,000 has to be handed by Tactical team. However, no matter what value and nature an acquisition has, its user is not obligated to go through all the steps. Thus, the purchasing procedure can have been completed in any random step when the PD gets involved. Sometimes the pricing and contract clauses have been negotiated already by internal customers. Basically, the PD wants to be involved earlier and the possibility for the PD to add value.

For example, if a high-tech lab wants to buy a big and complex machine system for a new research project, the researchers may start contact with potential suppliers already during planning. The lab applies for the responding budget for each project and the researchers know exactly what equipment they need for the new experiments. Sometimes they even expect ideas and collaboration from suppliers when searching for possibilities of solutions and decide the specifications for an equipment. In this way, suppliers and end users may already have a close cooperation for a long time before informing purchasers. The biggest advantage of this direct contact is that it can be more efficient and more effective in the communication about complex specifications and technology. After all, it is not possible for purchasers to own different specialized knowledge and skills in various high-tech industries. Although professors and other end users may have a good motivation to involve the suppliers directly and early before involving the PD, it brings some potential risks. The greatest risk is that the earlier contact with suppliers may make the UT, in some cases, to be in breach of competition laws in public tenders. The current solution of the PD for this situation is that the end user is required to sign an agreement to acknowledge responsibility for any risk related to laws and regulations. However, although this means avoiding the PD to be the main risk taker, the UT as a public organization still face risk against related laws and regulations. Another potential risk is the fraud during the free cooperation without regulations and rules. Generally, the "seesaw battle" between purchasers and end users exist in this processes of purchasing. Purchasers want to "pull" more work and participate the acquisition as early as possible, while one end user may tend to "bypass" the purchasing function as long as possible. In the past years, the PD put effort to improve the purchasing involvement and made a great progress: the participation of the PD has been promoted from 57% of the purchasing volume in 2012 to 77% in 2016.

6.3 Fragmented Purchase-To-Pay systems
The overall complaint heard in the interviews, especially in the staff of the PD and the Logistic Department, is about the current computer systems. Those systems are expected to support the whole acquisition process from request, to order, to shipment and finally to payment to save manual work as much as possible.

The current order process starting in the Operational team is as follows, of which steps are interpreted if it is a manual or automatic procedure.

1. Fill in a purchase request form (uniform "OTA" form). Use one form for each supplier. This is a PDF form which needed to be filled in and sent to purchasers by email. This is an automated action. After the budget holder has approved of the OFI number, the PDF will automatically be sent to the Procurement mailbox.

2. The Procurement Department processes the purchase request form and enter it in the purchasing module of the Oracle system. An authorized financial person within the applicant's faculty/service center is asked to approve the order in the system.

3. After approval, the Purchasing Order (PO) will be generated by the system and placed at the supplier in a PDF-file via email, which is also CC to the applicant for follow-up.

4. The Procurement department receives an order confirmation from the supplier by email, with the estimated delivery date. The applicant receives the order confirmation from the supplier or from the PD as well.

In Step 1-4, signed OTA form and confirmed PO will be archived in the Join system by a click in Outlook.

5. The supplier delivers the goods at 'Centrale Ontvangst' (Central Reception). The Logistics Department is responsible for the distribution of the goods to the buildings.

As soon as the goods are delivered at the Central Reception, the applicant can trace the order with CEGOON (CEntraal GOederen ONtvangst) with the PO number. The shipment information is entered by the Logistics Department manually, since they do not have a bar-code scanning system.

6. The caretakers within the applicant's building are responsible for the distribution of the goods. The daily lists are produced out of CEGOON, based on the registered packages.

7. The invoice is sent to FEZ (Financial Services), who takes care of the payment. The payment is executed in the financial module of the Oracle system.

As described above, the manual and automatic operations are intersected. The systems are discontinuous and lack necessary connection, and enormous communication via emails cannot be avoided. When taking into consideration the 7,104 orders in 2015 and 8,275 orders in 2016, the cost of dealing with all the orders manually is incredible. Moreover, the systems do not support the export of needed reporting, which are mainly done in Excel sheets. In fact, the PD has realized the problems with IT systems for a long time, since those systems were developed about 20 years ago. The PD had initiated one new system development in 2010, but it got rejected by the top management due to the great amount of investment. This year, in 2017, a new initiation of Purchase-To-Pay system has been started again. It is expected to be an integrated in-house system to deal with cross-functional processes, with a transparent information flow.

6.4 Challenge in stakeholder relationships
The stakeholders of the PD include executive board, partnering departments like the logistics and finance department, internal customers, as well as external suppliers. The research focus mainly on the internal stakeholders and the related value added by the purchasing to internal customers.

In the presentation in 2016, the UTPD stated their roles to the internal customer: central contact point for both suppliers and end users; providing advice and support for applications above €50,000; dealing with requests of quotations, warrant of contract compliance; advice, registration and management of web shop accounts; handling and advising on import / export business. The PD states that serving the internal customer with high quality is their mission, ant the collected data of the shows that the customer satisfaction in 2016 was around 70%. The frequent complaint from customers include too long purchasing process and too much paperwork. They always expect a fast delivery and more information sharing. Currently, there is no strategic scheme to improve the relationship, but the PD is always well aware of the importance of commutation with customers and has made an effort to improve it.

The 2016 report shows that there are over 7,000 suppliers in the business with the UTPD. Currently, every supplier has a folder in the PD's database, outlining the basic performance records. The main metrics are shipment-on-time and feedback from customer about quality. When there is a problem, the Tactical Purchaser will meet with suppliers. The common complaint about suppliers is that they do not always ship the goods with the required documents, especially the PO number. In order to bridge the supplier and the end user, the PD has a pilot of web portals, via which end users can place orders from the contracted suppliers.

When asking about the cooperation with FEZ, the most frequent answer was the different culture from the PD. Although there are regular meetings between Finance and Procurement, there is still space to improve the collaboration. The cooperation and collaboration between the PD and the Logistics Department is going on smoothly in general. One of the few complaints is that they feel reactive because of the one-way contact and lack of agenda. The Logistics Department is also calling for a new all-in-one system and wish the participation of its development.

7. VISION & OPPORTUNITY: "WHERE ARE WE GOING?"

The mission of the PD is the *continuous improvement* of the procurement services of the UT. The PD functions as an integrated part of the business process and contributes to the unimpeded progress of the primary process. The PD proactively provides advisory services around purchasing activities to administrative departments, faculties and research institutes. In addition, the PD provides professional contract management and supports requesting, ordering and delivering processes.

The main strategy of the UTPD is *customer centricity*. This means putting the customer at the core of the business. As a department, the PD has to cope with a multitude of internal and external changes. The developments at the UT directly affect and afford opportunities for the PD. It includes the Vision 2020 of the UT and its direction: international, collaborative, entrepreneurial (experimenting, pioneering and taking risks). The external opportunities are mainly the renewed procurement law with more space for innovation and digitization with more space for e-Procurement. Based on the opportunities and customer demands, the UTPD has identified three goals for the period 2017-2020.

1. Fulfilling innovation: The new procurement law stimulates innovative ability. It is the buyer's job to exploit space and the potential of these legal frameworks. As a launching customer, the UT will be the first customer of innovation developed by the supplier and helps bring the innovation into market. Innovation and launching customers join the theme of "Living Smart Campus" and help the UT companies to commit themselves. ("The Living Smart Campus is a true living lab. In this program, scientists, students, and external parties work on solutions for complex societal matters that require a scientific approach. To explore solutions, the campus is used as an experimental environment where students and scientists live and work, which makes conducting experiments easy and visible. Given its exceptional facilities the campus offers a unique place to prepare solutions before they are introduced into society.")

2. Set up an efficient order-to-pay process: The current order-to-pay process is not optimal and customer are dissatisfied with the laborious process. Therefore, a brand new procurement process will be designed, supported by an e-Procurement system. This can make the biggest impact in terms of lead time, information provision on orders and invoices, insight into budget utilization, efficiency and legitimacy of the process.

3. Professionalization of contract management: It aims to make internal customers more satisfied with supplier performance, to maximize the utilization of contracts, and to minimize contract risks.

All the attempts above aim to improve customer experience. The UTPD expects better customer relationship and early purchasing involvement. They hope the procurement function is known better by the customer and the customer is pleased to contact the PD in any need. They hope learning from "best practices" in other technical universities and want to know what quality and competency they own. In other words, the goal of the UTPD is to add as much value as possible in purchasing process, especially to internal customers.

8. STRATEGY & ROADMAP: "HOW TO GET THERE?"

So far, the status quo of the UTPD and its vision for the near future have been identified. It is very easy to make the comparison and identify the gap. This section proposes the strategy and a roadmap for the development of the PD to pursue its goal. As reported earlier, the culture of the UTPD is "customer centric" and its vision is "Happy customer". Thus, the customer satisfaction is the top priority and the value added by purchasing to internal customers is the primary objective. This philosophy is the same as KU Leuven and different from American universities which normally regard monetary "benefits" as the greatest purchasing added value. However, cost control and reduction is still regarded an important purchasing added value in both literature and practice. It cannot be ignored when looking at the huge amount of savings American universities have reported. Thus, cost savings will be also taken consideration in the further proposals. In order to add more value for the internal customer, the main strategy proposed is *developing a more mature purchasing function* and *improving the early involvement*. A roadmap will be developed for the UTPD to pursue its desired performance and create more purchasing added value. It is divided into three main steps, each of which included a number of detailed proposals. The best purchasing practices identified in the research in the literature and top technical universities will be applied. The scope to be developed can be shaped into three concentric circles: the department itself, internal stakeholders which are mainly customers and partner departments, and external stakeholders which are mainly suppliers.

Step 1: Develop a more mature purchasing function to nourish value creation

As reviewed in the literature, purchasing maturity is the most important factor positively affecting the purchasing added value such as cost savings and financial performance. The more developed the purchasing function is, the more purchasing added values are brought to the organization. A mature purchasing function is highly developed and has sufficient competence to perform its mission. The earlier assessment of purchasing maturity of the UT (Section 6.1) indicates some significant or substantial gaps between best practices. Therefore, the first step of the roadmap is to develop the PD to a higher maturity level.

Step 1.1: Differentiate purchasing strategy based on portfolio management

When talking about the portfolio management in the purchasing domain, one may immediately recall the Kraljic Portfolio Purchasing Model, which classifies the purchased commodities according to the supply risk and potential profit impact of each (Kraljic, 1983). However, this model may be not practical to apply in the purchasing of non-profit originations. Thus, it is necessary to design a portfolio management model according to the characteristics of purchases in technical universities. Many

universities manage various commodities in two big groups: standard and non-standard products and services, and no portfolio model is formulated. This following portfolio is prepared for the PD to optimize the purchasing process and give the customer a clearer guideline.

On the one hand, the goods and services needed by a technical university can be divided into two big groups, according to their requester and utilization. One is facility purchasing, including office supplies, hygiene, catering, security and surveillance, safety engineering, cleaning, secondary waste management, plant care, maintenance of buildings and fixtures. The common characteristic of these supplies and services it their "hygiene" nature, which means they do not give positive satisfaction, though dissatisfaction results from their absence. The same as Herzberg's Two-Factor Theory of Motivation about job satisfaction, the term "hygiene" is used in the sense that these are maintenance factors (Herzberg, 1959). However, right quality of scientific lab equipment and solutions can help meet research goals. Good performance in these purchases can be motivators of the customer's positive satisfaction. Thus, the purchasing function in technical universities may make efforts to add more value to professors and researchers by supporting their purchasing.

On the other hand, the amount of purchasing orders is also one of the common criteria for purchase classification. Different universities follow different internal policy and rules, as well as laws and regulations. Normally, there are at least two thresholds, one is defined as small amount purchases financially, and another is public tenders/bids. In the UT, the orders are divided into four groups according to its own policy and EU directives: the requisition up to €5,000 is considered as small amount purchases; the requisition between €5,000 and €50,000 is handled by the Tactical Team; the requisition between €50,000 and the EU public procurement threshold is required for three quotations; and the requisition above the threshold of EU public procurement (varied for different works and services) has to follow the European public tendering procedure.

Therefore, all of the requisitions requested by different departments can be classified into eight segments according to the functional nature of the goods and services and the approximate amount of requisitions. Each item can be marked in the appropriate place on the product purchasing classification matrix. The classification in the matrix can be dynamic according to two criteria, namely flexible ways to divide commodities and variable thresholds. Table 2 presents a proposal for current portfolio management. It distinguishes the characteristics of facility procurement and scientific & laboratory procurement, and devises different purchasing strategy and methods for different segments.

For small purchases of facility supplies, the eProcurement environment accessing the supplier portal is an easy solution. As a one-stop shop, the eProcurement software solution streamlines purchasing requisition and purchase order processes and lets the customer easily track and manage purchase orders in real-time. The next proposal will give an elaboration about this electronic procurement method. For the small purchases of laboratory supplies, a Procurement Card may also be a feasible method. The customer can utilize a Visa card to make purchases of goods and services (up to policy) of €5,000 or less. Using the Procurement Card for buying and paying is quite cost-effective for the university. The same as eProcurement, Procurement Card allows the customer to make purchases in a timely manner, track expenses, and reduce the accounting work. Both methods decentralize purchasing authority by enabling the customer to make purchases without a paper trail and reduce transaction processing costs considerably. The cost saving facilitated by these adoptions can be significant when considering thousands of orders per year in the UT (80% of purchases may account for 20% payment volume). Low-value items generate low-cost transactions and high-value buying attracts more professional input. This is one of the advantages of purchasing portfolio management.

The strategy devised for each segment is inspired from Porter's Generic Strategies (Porter, 1985). In this context, "Cost Leadership" means focusing on pricing and efficiency. "Differentiation" means creating uniquely desirable services for internal customers. "Focus" means offering a specialized service in a niche market. The "Focus" strategy here can be also subdivided into two parts: "Cost Focus" and "Differentiation Focus". According to the expectation of customers, different strategy may be used. For "hygiene" commodities, "best value for money" may be the goal. Thus, the strategy can be "Cost Leadership", which creates cost savings. For those professors and researchers for high technology (like nanoscience and nanotechnology), they have much higher demand on quality and cooperation from suppliers. Thus, "Differentiation Focus" strategy can be used for the purchaser to provide strategically differentiated services to the specific customer niche.

Please note the suggestions about purchasing strategy and methods are just for reference. Due to the time limit, it is hard for the researcher to identify what kind of value each customer really expects from the purchaser. The Value Proposition Canvas (see Appendix G) is recommended to make the PD focus on getting the right things done. In this context, a value proposition can be defined as where the purchasing services offered intersect with the customer's desires. The Value Proposition Canvas offers an easy way to understand what a specific customer segment needs (and why), by presenting their "pains" and "gains". "Pain Relievers" describes how the purchaser addresses the problem the customer faces, and how to eliminate negative emotions, undesired costs or avoidable situations. "Gain Creators" describes how the purchaser creates value for the customer. With the help of this mindset, the UTPD can make the right strategy for each customer niche and satisfy their unique needs.

Table 2. Portfolio management based on the customer and commodity.

Amount of Procurement

	€ 0	€ 5,000	€ 50,000	EU Public Procurement Thresholds (e.g. € 209,000)
Facility Procurement		Cost Leadership strategy Standardization Combination Operational purchases e-Procurement	Cost Leadership strategy Tactical + Operational purchases Three quotations	Characteristics: Anticipated demand through expiring/terminating contract Framework contracts for long term Free market More bargaining power of buyer EU tendering Strategy: Cost Leadership strategy Tactics: Optimize contribution Continuous supplier performance
Scientific & Laboratory Procurement	Cost Leadership strategy Maximize efficiency Minimize buying costs Autonomy of users Self-service purchasing: e-Procurement & Procurement Card	Focus strategy Flexibility Operational purchases e-Procurement	Focus strategy Tactical + Operational purchases Three quotations	Characteristics: Unanticipated and emergent needs Knowledge insufficiency of buyer Changing customers within certain years Project-based purchasing orders Less substitute products or service More bargaining power of suppliers EU tendering is not always possible No contract except maintenance agreement Strategy: Differentiation Focus strategy Tactics: High-quality product and services Build a win-win team between buyer and internal customer Co-development with supplier Good after-sales services

Step 1.2: Create a technology buying team for the Purchase-to-Pay system

Purchase-to-Pay (often abbreviated to P2P, also called Procure-to-Pay, e-Procurement, or req-to-cheque) refers to an integrated system that fully automates all the activities of requesting (requisitioning), ordering, receiving, paying for and accounting for goods and services. All the studied universities in the research have a universal application of P2P system, and many of them have engendered a wealth of efficient and financial consequences. Lederer et. al (2001) suggested that application of e-Procurement can bring greater business efficiency and better information access and flexibility, thereby creating strategic advantage through improved customer relationships. Accompanying with the maturation of Internet-supported supply chain processes, P2P is emerging internationally in the public sector to optimize the purchasing process. Keating (2017) claimed that "purchasing technology requires different mindsets and skillsets than other types of procurements". A technology buying team is a committee within an organization whose members are responsible for making decisions on software and hardware procurement. The optimization project of the P2P system has been on the agenda of the UTPD since 2016, since the current systems use software dating back two decades and are disadvantaged with outdated Electronic Data Interchange. Thus, it is wise to build a technology buying team, when the department attempts to buy a new Purchase-to-Pay system.

Through EDI and the Internet, P2P has the power of timely communication in this network and connects all the stakeholders through an automatic information and reporting flow. For example, a requisition under the pre-defined authority would be programmatically routed for approval, converted into a purchase order once approved and immediately sent to the correct supplier by email. The financial control can be also realized effectively for each process, to comply with the University's financial regulations. For instance, the software might cross-reference purchasing budgets to ensure compliance with pre-defined buying authorities.

P2P requires large amounts of money, as well as time and energy. Before making the decision, the technology buying team should conduct a good sourcing research on suppliers and solutions as necessary. It is also very important to communicate with different internal stakeholders about their expectations, especially the internal customers, financial department, and logistics team. Externally, large suppliers may also give good input based on their experience with the systems of other customers. It is wise to have a complete list of requirements beforehand, instead adding fragmentary expectations in the half way. It may cause delay, extra labor cost, and even failure when the organization keeps changing the requirement during the development.

All in all, the implementation of P2P is a big challenge for the university. The PD has to play the role of initiator and leader in this project. Its success will benefit the whole university and

promote its administration management to a higher level, which is consistent with the UT's motto "High Tech, Human Touch". For the PD, purchasing added value can be increased significantly, in the light of the purchasing process optimized by the P2P system.

Step 1.3: Design a SMART purchasing performance measurement and evaluation system

All the universities in the benchmarking study have their own performance metrics and report to the university every year. Performance measurement system is one major organizational variable which empowers the performance of value-based purchasing (Dumond, 1994). He recommended to develop "a performance measurement system that emphasizes quality, process improvement, and customer satisfaction". Performance management can be applied by organizations or a single department or a single unit under the department, as well as an individual person. The department may be evaluated with performance indicators against the overall goal of the organization. Likewise, different employees may have distinct performance evaluation according to their function, in order to perform the department's mission. The first job for an effective performance management in a department is setting right objectives and measurements, which should reflect its strategy and vision. The UTPD's top concern, as a supportive department, is to "make the customer happy".

O'Reilly (2000) suggested to be more results oriented and claimed that "indicators of performance must reflect the strategy of the organization and contributes to its goal". In order to ensure the effectiveness of performance management, the objectives must be SMART: Specific (target a specific area for improvement), Measurable (quantify or suggest an indicator of progress), Assignable (specify the responsible individual), Realistic (be achievable, given available resources), and Time-related (set an expected time for each milestone). The common metrics of purchasing services can be savings, response time, and customer satisfaction. In practice, the UTPD can design its own KPI (Key Performance Indicator) system according to the current priority. For example, except the specific metrics for e-Procurement itself mentioned above, it is also feasible to measure the percentage of purchases via the system among all purchasing transactions. Customer satisfaction is the most important performance indicator for the UTPD. A methodology for continuous improvement on customer satisfaction is suggested:

1. Identify internal customers and their needs;

2. Determine performance measurement to reflect the actual experience perceived by internal customers;

3. Measure satisfaction level of internal customer with respect to needs and expectations (gaps);

4. Identify improvement opportunities and develop action plans;

5. Monitor, control and update.

However, too much focus on customer often leads to procurement departments neglecting to find metrics to measure their other successes, and in turn not being fully recognized as a strategic role at the UT. Yet, this is not an issue when looking at its observations and measurement. For example, the procurement involvement (% of the total volume, from 57% to 77% within the past 4 years) is a good indicator reflecting its goal. Moreover, monetary bonus based personal KPI for each employee can be a good solution to stimulate performance. The good example about this is the Central Purchasing in KU Leuven introduced earlier: the staff in the department are evaluated based on the feedback of customers. Even more specifically, the staff is scored by the

customer according to the experience of the service provided for each order/project.

Step 2: Promote added value in earlier involvement with the customer

Researchers consider purchasing involvement a keystone of a mature purchasing organization (Schiele, 2007; Wolf, 2005), which positively affects cost savings (Van Poucke et al., 2015) and has been recognized as a potential source of sustainable competitive advantage (Luzzini et al., 2015). Thus, managers can analyze the current level of involvement and develop improvement plans to achieve integration even though lack of awareness, skills, motivation or opportunity (Bals, Hartmann & Ritter, 2009).

All the purchasing professionals interviewed in this research believe earlier involvement with the purchasing process and customer needs can bring the opportunity to create more purchasing added value. When informed earlier, the purchaser has enough time to select the right supplier and prepare the order or contract. The purchasing professional can examine what is important to the customer and what is the challenge, and see how to help. Normally, the greater the amount of the purchasing project is, the earlier the purchaser wants to participate. This is because the procurement above a certain threshold should follow stricter regulations, for example public tendering. For those scientific procurement, the most ideal collaboration model is: the customer takes the advantage of their expert knowledge and the purchaser contributes their professional skills, and together they build a mini team to perform the big purchasing project. The main value created in this model is reducing risks and enhancing effectiveness.

In order to get earlier involved, the PD must ensure the recognition of the purchasing department's value by internal customers. This means to increase visibility of purchasing activities and added value in the using departments. Purchasing professionals need to demonstrate the contribution they make to their organization success. Thus, the PD must promote themselves at the University and make all the faculties and research institutes aware of their achievements. According to the experience of other universities, "benefits" may still be the best "signboard". Another strategy is being more participative in the planning process (O'Reilly, 2000), which involves the participation of the purchasing department in the planning sessions. Forecast management is an important channel of planning participation to improve engagement with internal customers. For the broad array of goods and services that are essential for the daily operation of the University, most of the demands are predictable by checking the expiration date of contracts. For scientific and technical procurement, the PD can always encourage the customer or the executive officer to share the agenda of research.

When involved earlier, the purchasing professional will have an increased incentive and motivation to deliver a high level of internal service quality, enhancing the internal customer's satisfaction (Ellram and Tate, 2015; Jun and Cai, 2010). Customer intimacy is one of internal service quality dimensions as perceived by the purchasing department's internal customers (Jun and Cai, 2010). Peregrina (2011) stated that internal customers should be treated as well as external customers, and the principles of exceptional customer service should be followed when dealing with internal clients. Compared with manufacturing industry, the customer served by the purchasing at the University are more complex and diverse. The current customer relationship management has been cultivated and maintained in an unplanned or unintentional manner. Thus, reasonable times of meetings and visits with the internal

customer may be necessary to build an intimate relationship. Meanwhile, a customer-friendly environment can be created though emails and the website. Customer-friendly environment can be built in different ways. For instance, for foreigner staff at the university, the English language is much more convenient than Dutch. Since the UT has a strong international focus with more than 3,000 international students, there are also more and more international employees. In addition, it is also helpful to provide the training program for the new staff and make the video tutorial and purchasing manual easy to access online. The open culture of the PD can be expressed through an e-Newsletter, as the purchasing department of some universities already do. All in all, the PD must deliver the image of a collaborative and supportive role in both real and virtual settings.

Step 3: Explore added value with other stakeholders

Functional interaction empowers the performance of value-based purchasing (Dumond, 1994). The PD has to deal with the relationship with different internal stakeholders except different kinds of customer: financial department, logistics department, and top management in the University. The external stakeholders are mainly suppliers and probably also other universities. The procurement's ability to achieve its objectives is impacted by the strength and quality of the relationship with all the stakeholders. As a part of the supply chain, the Procurement Department always needs both internal and external stakeholders to back calls for their collaboration to commit to providing resources. By making use of all possible resources for growth and daily jobs, more purchasing value can be added to the University. Thus, it is very important for the PD to build a value-adding relationship with all the stakeholders.

In the research of purchasing added value in practice, some attention has been paid to the relationship with finance and procurement. Different from the manufacturing industry, where the purchasing function is outstanding and always side by side with the financial function, the procurement in universities is often under the Financial Division. However, the interviewed purchasing professionals believed it is more logical to separate the two functions. No matter what the organizational structure looks like, it is no doubt that the two critical functions have to cooperate very closely. For example, the development and application of P2P system is a typical cross-functional project which requires the input of both departments. At the end, both would be benefited from its successful implementation. Being partners should be a wise strategy, which contributes to the organizational goals, including operational and financial performance objectives. Just as strategic relationship with suppliers is a part of the modern procurement approach, collaboration and co-development with finance and accounting should be part of a holistic approach to good overall management. Similar close relationship should be developed with the Logistics Department. Since they are a small team with limited resources and support at the University, the PD should raise them up to catch the development pace. In sum, procurement, finance, and logistics are responsible for buying, paying and shipping; only when the three work and developed together, the added value to the internal customer can be maximized.

Externally, the development of supplier relationships can be considered as critical resources for value creation and realization (Eisenhardt and Schoonhoven, 1996; Madhok and Tallman, 1998; Steinle and Schiele, 2008). Florez-Lopez (2007) summarized two groups of variables that affect the supplier's capacity to create value for its client: 1) Direct value variables, defined in a quantitative way: prices, quality mistakes or delivery

items; 2) Indirect value variables, provided by relational factors, such as: cooperation, commitment of resources, trust, customer orientation, communication, responsiveness, and customized services and products. The university can make use of this list to explore more added value during purchasing activities. Furthermore, the strategic cooperation of the supplier has been discussed a lot in the literature. This is also applicable for universities, especially for the technical university with many research and development projects. With those key suppliers who are very important for the research of the university, the win-win model is suggested. On the one hand, the experts in the research requires very flexible collaboration from suppliers, since what they need are often small quantity of high quality goods. Sometimes, equipment with the value of millions of dollars is purchased, and it requires tailored services and long term maintenance. A partnership with the supplier brings the customer more trust and less risk. In the process of a scientific research, a good supplier can also bring solutions and inspirations. On the other hand, when the supplier has a new product or new system, they may ask the university to try out. In this way, the university helps with the innovation of the supplier. The good example is the "Launching Customer" program in the agenda 2017 of the UTPD, which is inspired from the "Living Smart Campus" program of the UT. Furthermore, more value may be created by connecting internal customers and external suppliers formally or informally. The customer has more engagement in the purchasing process, and the supplier appreciate the opportunity to promote the business. The good example is the "Supplier Day" or "Supplier Showcase" at the interviewed universities. Last but not least, the purchasing added value can occur when the PD implements the sustainable procurement. As a public university, the corporate social responsibility should be in the agenda of management.

Finally, cost savings and resource sharing can be realized when working together with other universities. The typical example is that ten campus of the University of California form a strong buying power and win the financial benefits. Another good example is the North Eastern Universities Purchasing Group (NEUPG) in US, a consortium of over 20 universities and colleges. Eight contracts are now managed by this consortium: paper, telecoms, chemicals and solvents, minor laboratory equipment, minor IT equipment, audio visual, grocery provisions, and catering disposables. Obviously, scale economy is the most important added value in the purchasing consortium. Currently, the UT has involved Saxion University of Applied Sciences in the same city for the P2P system development. More other possible purchasing consortium may be initiated by the UTPD to seek for the potential benefits.

9. CONCLUSIONS AND IMPLICATIONS: AN ACTION SCHEME TO EXPLORE MORE PURCHAING ADDED VALUE

In the research, the synthesized results of the current performance give some focused insights into the areas for development of the UTPD. The proposed purchasing strategy and the development roadmap will help the department to create more added value, thereby contribute to the functional and organizational growth. Further in the implementation, journey and resources are needed to transform the purchasing function, which are not fulfilled in this paper due to the time limit. The key of the success is optimizing the self-service which gives autonomy to the customer for small purchases, and focusing on strategic purchasing activities as its core value. The development of e-Commercial technology enables superior solutions to realize the transformation.

At last, it is worth to notice one more challenge for the university procurement to increase added value. Although the importance of purchasing has been increasingly improved overall, there is still a lack of recognition by senior management (Bales and Fearon, 1993). The top university is usually deemed as pioneer of knowledge and innovation who drives high technology and advanced science. The board of directors and executive management devote themselves to manage the university to be the world-class academic leader. In contrast, rather less attention has been paid to the administrative affairs in some universities. Compared with top commercial companies, supportive departments in universities may be less concerned by top management. The reason behind is understandable: they do not contribute directly to the core competitive advantage of the university, which is normally academic competence, scholarship and research accomplishment. However, the rapid innovation of information technology and the more demanding students may call for the development of those functions behind the "scenes". Therefore, raising awareness about changing may be the first thing some universities need to do. As reviewed in the literature, organizational strategy is an important factor impacts purchasing added value (Telgen & Pop Sitar, 2001). First-movers will definitely capture the greatest opportunities and set a pioneering image to peer universities.

9.1 Contributions: multidisciplinary application + best practices → creative development roadmap

Since the rise of strategic position of purchasing, purchasing added value has played an important role in organizations and supply chains. However, the research has tended to focus on manufacturing purchasing and retail supply chain. Meanwhile, the research in the public procurement mainly focus on legal compliance and process innovation. There is little attention to the purchasing added value in the education industry. Given the theoretical and empirical results of the foregoing research as well as the strategy and roadmap proposed for the UTPD at the end, the paper has implications for both theory and practice.

This paper takes a step into the research niche with a case study and examined the best purchasing practices in 58 top technical universities. Firstly, it identifies the characteristics of purchasing in the technical universities, which has more various purchasing portfolio and customer groups than manufacturing industries and ask for different strategy and approaches. Secondly, the paper highlighted the importance of the internal and external stakeholder management by the purchasing department, which becomes more important along with the evolving role of purchasing function. Finally, the knowledge of multi-discipline (purchasing, HR, strategy and marketing) is applied to develop a roadmap to promote purchasing added value, which interprets "thinking out of the box". The business administration background of the researcher extends the framework for purchasing performance improvement.

For business and industry, the final result of this study will be valuable to universities and research institutes as well as related suppliers. The insights obtained from this paper can assist the purchasing professionals in their decision on how to improve their efficiency and manage stakeholders. It inspires the purchasing department to create more added value for internal customers and improve the customer satisfaction, thereby contribute to the organizational goal. By understanding what determines the value-adding activities of purchasing in technical universities, suppliers may better adjust their service offerings to universities' requirements. By understanding the strategy and vision of the purchasing function, it is a good chance for the financial and accounting professionals, as well as other partner departments, to build proactive and collaborative value-adding relationships.

9.2 Limitations of existing research: cross-sectional study in a single case

The development roadmap provides a guideline for the purchasing department in the technical universities by applying theoretical framework of multi disciplines. The short time frame of the research does not allow the implementation and monitoring, in the case of the given action plan put in practice by the UTPD, to be followed.

Meanwhile, it is worth noticing some limitations in this research design. First of all, a cross-sectional study probably could not reflect the real status quo of the UTPD. Bias probably might occur in the empirical research because of the sole researcher within a short term. Secondly, most of the given information for the assessment of the UTPD came from the employees. The results might be influenced by the subjective judgment. The third limitation may emerge from the small-scale research design. The practical study could not be conducted via a comprehensive and larger number all over the world. Target universities are selected because of their convenient accessibility and proximity to the researcher, which are not representative. Personal interviews were only based on five universities in the network, and the convenience sampling is a non-probability technique. Finally, this research has been done within a single case university to solve practical problems, which probably limits the generalizability of the results.

9.3 Further research: is there distinction between the procurement in European universities and American universities?

This paper highlights the characteristics of university procurement and suggests how to promote more purchasing added value in the technical universities. However, the researcher also noticed that the purchasing services may be distinct between European and American universities. For example, customer-oriented services in European university and great efforts on financial control in American universities. Thus, further research may focus on examining if they are different or not, and why.

10. ACKNOWLEDGMENTS

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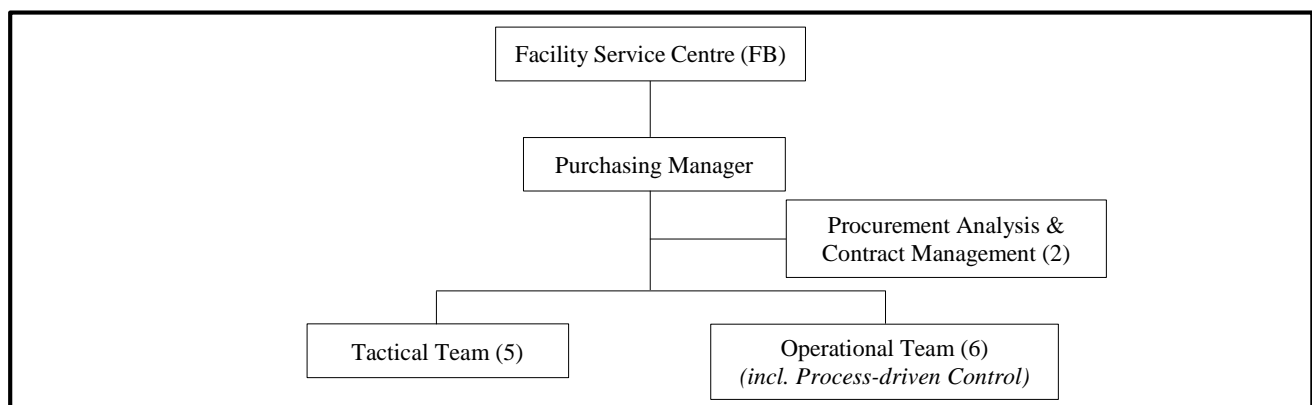Ferguson C.W., Hartley F.M., Turner, B.G., Edward M., Pierce, M.E., 1996. Purchasing's role in corporate strategic planning. *International Journal of Physical Distribution and Logistics Management, vol. 26, no. 4*, 51-62.

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APPENDIX A. CURRENT ORGANIZATIONAL STRUCTURE OF UNIVERSITY OF TWENTE
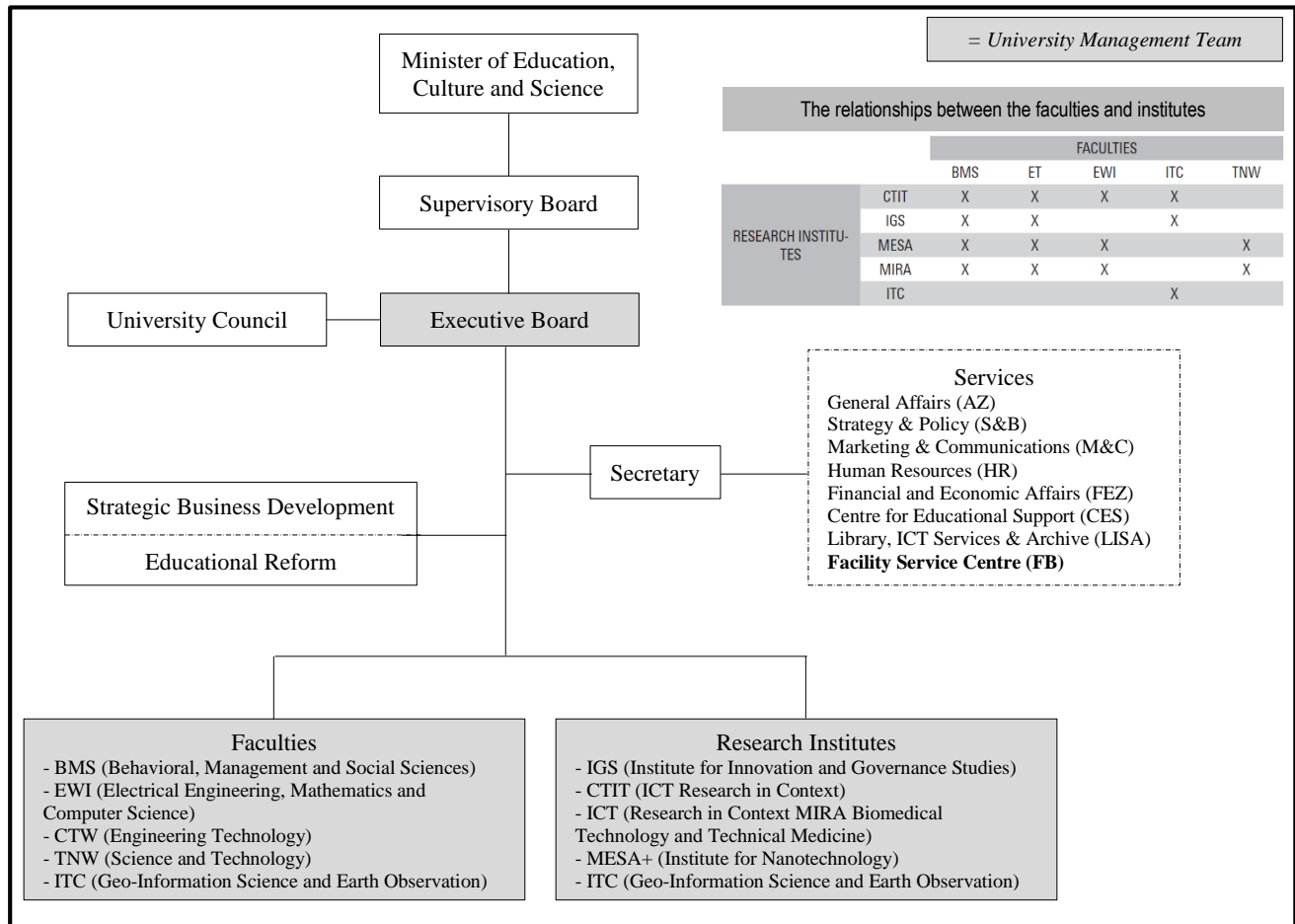
APPENDIX B. CURRENT ORGANIZATIONAL STRUCTURE OF THE UTPD

APPENDIX C. MAIN VALUES ADDED BY PURCHASING STRUCTURED IN PURCHASING MATURITY MODEL

Functional focus   **Cross functional focus**

Public utilities	Financial services	Pharma	Chemicals		
			Telecom	Electronics	Computers / Automotive / Retail

Effectivenes

| Transaction orientation | Commercial orientation | Purchasing orientation | Process orientation | Supply Chain orientation | Value Chain orientation |

Time

Assure the continuity of the supply	Savings Price reduction	Savings Cost reduction Shorter lead time Improved quality Cross unit co-ordination Greater compliance to pre-negotiated contracts Uniform buying policies and systems Reduction of internal cost of operation	Extensive use of cross-functional teams Improved purchasing efficiency Customer satisfaction Improved lines of communication Reduced total system costs	Closer and more cooperative relation with suppliers Early involvement in new product development Improved information system Improved competence of the purchasing staff, customers and suppliers	Extensive use of coss functional supplier development teams Upgrading supplier capabilities Collaborate on advance technology with suppliers Continuos improvement measures of supplier performance Satisfaction of the end customer
	Bales and Fearon (1993)		**Butler (1995)** **Dobler and Burt (1996)**	**Cousins and Lamming (1997)** **Lysons (1996)**	**Leenders and Schiele (1999)**

APPENDIX D. OVERVIEW OF THE PURCHASING FUNCTION IN TOP TECHNICAL UNIVERSITIES

Name of university	Ranking of engineering and technology	Ranking of computer science	Country	Number of FTE Students	Name of the Purchasing Function	Remark	Link
California Institute of Technology	1	2	United States	2,181	Business & Finance Departments > Procurement Services	P-Card, TechMart, Caltech's e-Procurement solution, Mobile App for TechMart, Small Business Program, the Supplier Management Team, The Uniform Guidance, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards	https://procurement.caltech.edu/
University of Oxford	3	3	United Kingdom	19,718	Finance Division > Purchasing, Payments and VAT	iProcurement, Credit Card, Petty Cash, Purchase to Pay, Tenders: £25k - £100k, Oracle Financials	http://www.admin.ox.ac.uk/finance/ppt/purchasing/
Massachusetts Institute of Technology	4	4	United States	11,192	The Office of the Vice President for Finance (VPF) > Department of Physics, Finance > Sourcing & Procurement	E-Catalogs, Procurement Cards	http://phys-finance.mit.edu/sourcing-procurement
Georgia Institute of Technology	13	5	United States	19,847	Executive Vice President for Administration and Finance -> Campus Services > Procurement & Business Services	PCard, BuzzMart, E-Verify	http://www.procurement.gatech.edu/
Carnegie Mellon University	15	6	United States	12,311	Finance Division > Procurement Services	Purchasing Card, Procurement Manual, Bid Checklist, Supplier Directory, Oracle	http://www.cmu.edu/finance/procurementservices/
Imperial College London	7	7	United Kingdom	15,236	Financial Services Team > Purchasing	Premier Farnell e-Procurement, Recommended suppliers, tenders, value for money	http://www.imperial.ac.uk/finance/purchasing
Cornell University	22	11	United States	21,593	Division of Financial Affairs > Procurement and Payment Services	e-SHOP, Preferred and Contract Suppliers, Procurement Card	https://www.dfa.cornell.edu/procurement
University College London	38	12	United Kingdom	28,602	Finance and Business Affairs > Purchasing	Good website structure, MyFinance, Corporate Cards, Purchasing Cards, Exhibitions and Supplier Days, Small & Medium Size Enterprises (SMEs)	http://www.ucl.ac.uk/finance/purchasing
University of Washington	43	13	United States	45,162	Financial Management > Procurement Services	Good website structure, PurchasePATH, ARIBA Quick Reference Guide, Active UW Contracts List, The UW Procurement Card (ProCard),Sole Source Purchasing, ProCard Expenditures, Catalog Purchases	http://finance.uw.edu/ps/

University of Edinburgh	59	16	United Kingdom	25,279	Corporate Services Group > Procurement Office and Printing Services	credit card, Good website structure, Buy@Ed: University Contract & Supplier database, Commodities (secured): Approved University suppliers, e-Procurement (secured): PECOS, SciQuest, training & support, Sustainable Procurement	http://www.ed.ac.uk/procurement
University of Illinois at Urbana-Champaign	16	18	United States	43,202	Office of Business and Financial Services > Purchases	iBuy (online purchasing), Purchasing Card (P-Card), Banner Purchase Orders, Contracts, Cash Purchases, University Amazon Group (UAG)	https://www.obfs.uillinois.edu/purchases/
University of Maryland, College Park	72	19	United States	31,353	Division of Administration & Finance > Department of Procurement and Strategic Sourcing	eMaryland Marketplace, Kuali Financial System, Procurement Card, Buy Green, Sustainable Practices	http://www.purchase.umd.edu/
Columbia University	26	20	United States	25,659	Finance Division > Procurement Services	ARC, Procurement Cards, Vendor Management (VM)	http://finance.columbia.edu/procurement/purchasing
University of California, San Diego	44	22	United States	28,416	Business & Financial Services > Integrated Procure-to-Pay Solutions: Procurement & Contracts	Marketplace, Express Card, Recharge, Shop on Campus	http://blink.ucsd.edu/sponsor/BFS/divisions/ipps/procurement-contracts/index.html
New York University	87	24	United States	43,021	NYU FinanceLink > Buying & Paying	i-Buy NYU, Global Card Program Team, Purchasing Card (P-card)	http://www.nyu.edu/employees/resources-and-services/financelink/buying-paying.html
University of Texas at Austin	25	25	United States	48,689	Office of the Senior Vice President and Chief Financial Officer > Purchasing Office	UT Market, sole authority, Procurement Card Program, Transparency Reports, BidWeb, Handbook of Business Procedures , UT Purchasing Centers and Buyers List	https://purchasing.utexas.edu/
University of California, Santa Barbara	24	28	United States	22,267	Business & Financial Services > Procurement Services	UCSB e-Procurement Gateway, Bids & Sourcing, Bid Savings, Flexcard, Vendor/Supplier Diversity, Sustainability, Small Business Program	http://www.bfs.ucsb.edu/procurement/news
Purdue University	27	31	United States	38,788	Office of the Treasurer > Procurement Services	Ariba, Purchasing Card, Office of Supplier Diversity Development, Buying Green	http://www.purdue.edu/business/procurement/

University							
University of California, Irvine		38	United States	29,304	Vice Chancellor of Administrative & Business Services > Purchasing and Risk Services	KFS Purchasing, Low Value Procurement Card, Requisition Low Value or High Value Goods in KFS, Buyers Commodity Directory, Bid Postings, FedEx Direct - UC discounts for shipping rates, Energy Star - help for purchasing energy efficient products, Green Purchasing - environmentally responsible buying, Scams, Small Business Program - overview, Suspension and Debarment - list of suspended contractors, Vendor Guide - how to do business with UCI	http://apps.adcom.uci.edu/cms/ResourceAC/public/Purchasing/PurchasingPublicDocs/index.html
Rice University	49	41	United States	6,447	Office of Procurement	Rice Marketplace e-Procurement system, purchasing card, Bid Solicitations, Vendor Requirements	https://buy.rice.edu/
Brown University	69	47	United States	8,694	Controller's Office > Office of Insurance and Purchasing Services > Purchasing Services	Workday@Brown, Business Ethics, Supplier Diversity Policy, Environmental Standards, P-Card, Bid requirements and sole source purchases	https://www.brown.edu/about/administration/purchasing/
University of Manchester	37	48	United Kingdom	34,015	Directorate of Finance > Central Procurement Office	Oracle Financials > iProc, Egencia, the Corporate Credit Card	http://www.finance.manchester.ac.uk/buyingexpenses/
King's College London		52	United Kingdom	21,986	Professional Services Directorate > Finance and Planning Directorate > Procurement Strategy & Services	King's e-Procurement System (KCeP), King's eTendering (KeT) system, value for money, Supply & contract opportunities	http://www.kcl.ac.uk/aboutkings/orgstructure/ps/procurement/index.aspx
University of Glasgow		60	United Kingdom	22,856	Finance Office > Procurement Office	uniBuy, Purchasing Cards, Sustainable Procurement, a strategic 5 year plan, Value Proposition, Tendering Procedure	http://www.gla.ac.uk/services/procurementoffice/
Arizona State University		72	United States	43,082	Office of the Executive Vice President, Treasurer and Chief Financial Officer > Business & Finance > Procurement	Purchasing Card, SunRISE and SunMart, the National Procurement Institute Achievement of Excellence in Procurement® Award, Small Business and Diversity Program, Procurement guide	https://cfo.asu.edu/procurement
Newcastle University		76	United Kingdom	20,307	Finance > Procurement Service	Due North, procurement cards, Sustainable Procurement, Tender Opportunities, Code of Conduct and Policy Documents, value for money	http://www.ncl.ac.uk/business/procurement/
Stony Brook University		77	United States	22,867	Vice President for Finance and Administration > Purchasing Division	WolfMart, Credit Card Programs	http://www.stonybrook.edu/procurement/
University of California, Santa Cruz		80	United States	17,203	Financial Affairs > Procurement Services	Pro-Card, UCSC CruzBuy e-Procurement System, Procurement Newsletter, Procurement Resources, Supplier Resources, Conducting bid events and processing procurement transactions,	https://financial.ucsc.edu/Pages/Procurement_Dept.aspx

North Carolina State University	94	84	United States	30,187	Finance Division > Materials Management	MarketPlace, Purchase Card (PCard), Fleet Card, Supplier Center	https://materialsmgmt.ofa.ncsu.edu/purchasing/card-services/pcard/
University of Nottingham	96	85	United Kingdom	29,738	Financial and Business Services > Procurement Department	SciQuest, Purchasing cards, e-tendering and contract portal 'Intend', Supplier Categories, Supplier Zone, Sustainability Strategy, value for money, risk mitigation, legal compliance, delivery of sustainable procurement	http://www.nottingham.ac.uk/fabs/procurement/index.aspx
University of Colorado Boulder	91	88	United States	29,741	Office of the Vice President for Budget & Finance > Procurement Service Center (PSC)	1-page newsletter, Procurement Card, CU Marketplace, Procurement Card, Supplier Information, Good website structure, Core Values	https://www.cu.edu/psc
Lancaster University		91	United Kingdom	11,673	Finance Division > Procurement Department	Marketplace, Category Management, Sustainable Procurement, Purchasing Cards	http://www.lancaster.ac.uk/procurement/
Virginia Polytechnic Institute and State University	81	94	United States	30,85	Vice President for Finance and Chief Financial Officer > Procurement Department	HokieMart, Purchasing Credit Cards (P-Cards), Bids and Solicitations, Vendor Classifications, SWaM (Supplier Diversity), 2017 VT SWaM Vendor Fair	http://www.procurement.vt.edu/
Indiana University		97	United States	66,057	Office of the Vice President & Chief Financial Officer > The Office of Procurement Services	Kuali Financial System (KFS), Procurement Card, agile and innovative supplier base, Create opportunities for minority, women-owned, and small business suppliers	http://www.indiana.edu/~purchase/purchase/index.php
University of Notre Dame		98	United States	11,821	Finance Division > Procurement Services	buyND e-Procurement System, Procurement Card, Procurement Services Policy Manual	http://buy.nd.edu/
University of Bristol	70	100	United Kingdom	18,544	Finance Services > Procurement Department	ERP, Bravo Solution, the University's Tender Opportunity Portal, UoB corporate credit cards	http://www.bristol.ac.uk/procurement/
Stanford University	2		United States	15,658	Financial Activities > Buying and Paying	Purchasing Card, Travel Card, iProcurement, FedEx	http://web.stanford.edu/group/fms/fingate/staff/buypaying/index.html
University of Cambridge	5		United Kingdom	18,605	Finance Division > Procurement Services	iProcurement, or iProc, Credit Cards, Petty Cash Arrangements	http://www.admin.cam.ac.uk/offices/purchasing/
Princeton University	6		United States	7,925	Office of Finance and Treasury > Financial Services > Procurement Services	Purchasing Card, Travel & Expense Card Application, supplier portal	https://finance.princeton.edu/our-organization/departments-people/financial-services/procurement-services/
University of California, Berkeley	10		United States	34,834	Business and Financial Services ((B&FS) > Procurement (Purchasing) services	BearBuy	http://sharedservices.berkeley.edu/finance/procurement/

University	Rank		Country	Students	Organization	Services/Programs	Website
University of California, Los Angeles	13		United States	38,392	Corporate Financial Services > Campus Purchasing & Accounts Payable > Campus Purchasing	BruinBuy, Procurement Card, P200 Savings Program, Commodity Directory	https://www.purchasing.ucla.edu/purchasing
University of Michigan	17		United States	41,912	Finance > Procurement Services	M-Marketsite, Pcard, MConnect, NewsLetters, diversity &"Planet Blue"	http://procurement.umich.edu/
Northwestern University	21		United States	18,57	Office of Financial Operations > Procurement and Payment Service	iBuyNU, Corporate Card, Purchasing & Strategic Sourcing, Vendor File Management, Wildcard or Northwestern-issued ID card	http://www.northwestern.edu/procurement/
Johns Hopkins University	42		United States	15,303	University Finance > Office of Procurement Services	HopkinsSelect eMarketplace, Procurement Card Program, Newsletters, Strategic Sourcing, Supply Store Catalog	http://finance.jhu.edu/depts/purchasing/about/purch_mission.html
University of Wisconsin-Madison	46		United States	40,048	Division of Business Services > Purchasing Services	Shop@UW, procurement card, External Requisition Generator	http://bussvc.wisc.edu/purch/purch.html
Pennsylvania State University	48		United States	45,359	Finance and Business > Departments of Business Services	eBUY, Purchasing Card, Supplier Diversity, Sustainabolity	http://purchasing.psu.edu/
University of Southern California	50		United States	38,466	USC Financial and Business Services > Departments of Business Services	USC eMarket, Kuali Financial System (KFS), USC Supplier Portal, USC Buyers (by Commodity), Corporate Card Services,	https://businessservices.usc.edu/purchases/
Ohio State University	57		United States	52,497	Office of Business and Finance > Purchasing Department	eStores, Pcards, Category Buyer Listing, Social Responsibilities, Buy Ohio Program	http://purchasing.osu.edu/
University of Minnesota	64		United States	46,625	PUniversity Finance > urchasing Services	U Market, Pcard, University-Wide Contracts, Competitive Bid, Supplier Diversity & Sustainability	http://purchasing.umn.edu/
Texas A&M University	71		United States	53,694	Division of Finance and Administration > Procurement Services	TxSmartBuy, Procurement Services Administration (SAP), Bid Opportunities, HUB Program, FAMIS Info, Payment Card Program	http://purchasing.tamu.edu/
University of California, Davis	77		United States	36,06	Accounting & Financial Services (A&FS) -> Procurement & Contracting Services	AggieBuy, Procurement Card, Commodity Code, Bid Advertisements, Sustainability	http://afs.ucdavis.edu/our_services/contracting-services/index.html
University of Leeds	89		United Kingdom	27,791	Finance Vision > Purchasing	SAP Intranet Purchase Requisition(SIPR), Purchase card, Science Warehouse, Sustainability, Category Managers & Commodities	http://purchasing.leeds.ac.uk/
University of Delaware	93		United States	19,426	Office of the Vice President for Finance and Deputy Treasurer > Procurement Services	UD Blue Hen Market, Credit Cards, Procurement Policies	http://www1.udel.edu/procurement/
University of Massachusetts	95		United States	58,624	Administration & Finance > Procurement and Campus Services	UMass BuyWays, U$ave program, Bids, Procard, Newsletter, Trainings	http://www.umass.edu/procurement/
University of Sheffield	96		United Kingdom	23,961	Department of Finance > central Procurement team	myPurchase Card, UoS Suppliers, e-Procurement portal, In-Tend, Contracts Finder.	http://www.sheffield.ac.uk/procurement

Boston University	100		United States	24,714	Office of the Senior Vice President, Chief Financial Officer and Treasurer > Sourcing & Procurement	Terrier Marketplace, Purchasing Card, Supplier Center, Training Newsletter	http://www.bu.edu/sourcing/
University of Southampton	92	54	United Kingdom	21,049	Finance Department > Procurement and Purchasing teams		http://www.southampton.ac.uk/finance/services/what-do-the-Procurement-and-purchasing-teams-do.page

APPENDIX E. THE PURCHASING FUNCTION IN THE INTERVIEWED UNIVERSITES

University of California - Santa Cruz, US

The university, also known as UC Santa Cruz or UCSC, is one of 10 campuses in the University of California (UC) system. As a public research university, it has been named to the 2017 US News & World report top 50 Best Global Universities. In the academic year 2016-2017, it has the total undergraduate and graduate enrollment of 18,063. In fiscal year 2015 had $152 million in research and development expenditures according to the National Science Foundation of US. The annual purchasing volume is around $82 million in 2016. Currently, there are 15 employees in the Procurement Services of UCSC: 6 transaction buyers and 2 strategic buyers for more complex and high-value purchases, 2 for business contracts, 3 for e-Procurement, plus Special Programs Manager and Assistant Director. The link of the website is https://financial.ucsc.edu/Pages/Procurement_Dept.aspx. The interviewee is the Director of Procurement, Darin Matthews.

Procurement Services is responsible for providing the tools and business processes for acquiring goods and services at the University. The vision is "Within the framework of UC guidelines and policies, Procurement Services delivers innovative solutions with professional integrity through simplification and creativity, making us a highly sought after strategic partner". The mission is "Generating strategic procurement opportunities and benefits for the campus while delivering exceptional customer service in support of expanding the boundaries of knowledge". The service portfolio includes:

Managing UCSC's e-Procurement tool - CruzBuy

Conducting bid events and processing procurement transactions;

Delivering procurement training programs

Providing consultation to help campus departments identify cost saving opportunities

Establishing campus and UC system wide supplier agreements

Advancing UC system wide procurement programs

The Procurement Services fully support the technical research at the University and aim to maximize the added value during purchasing activities. According to Matthews, the most important added value should be cost savings (benefits). The benefits are measured according to a standard developed by the UC system in the program P200 which has been introduced earlier. The monetary benefits include costs savings that the buyers have negotiated (lower prices), avoided costs (such as supplier price increases), and new revenue generated. In UCSC, the "Benefits Achieved" was over $4 million savings for fiscal years 2015 and 2016, which exceeded annual benefit goals with more than 28%. For Fiscal Year 2017, they set a goal to realize $2 million in benefit.

One other purchasing added value is sustainable procurement, which is defined as "making purchasing decisions based on economic, social and environmental factors". Under this guideline, EPP (environmentally preferable products) is an important criterion in the selection of products and services. It is claimed that sourcing from suppliers who promote sustainability within their own companies is making a positive difference within the University. They advertise three main benefits of EPP products:

Environmental: Reduces and prevents waste, resource consumption, pollution/toxin exposure

Financial: Reduces costs including material, waste disposal, operating, maintenance, and replacement costs

Practices: Before making a purchase, consider the total cost of ownership, including environmental, maintenance and disposal costs

UCSC has its own annual sustainability metrics, and put efforts on the purchase of copy paper with high content of post-consumer waste (PCW), energy efficient office equipment (copiers, scanners, computers), healthy office furniture (furniture pledge), and earth friendly cleaning products and sustainable lumber products. Earth friendly janitorial cleaning and paper products have been increased until 80% of the total purchase in 2016. UC - Santa Cruz is the first campus in the UC system to officially make the CEH-Safer Furniture Pledge. This is a pledge developed by the Center for Environmental Health in US. It expresses a commitment by an organization to purchase furniture that is free of chemical flame retardants, fluorinated compounds, and polyvinyl chloride (PVC).

Beyond sustainable procurement, the strategy of the UCSC Procurement also reflects other social responsibilities, for example "buy local". As a small community, the development of SMEs is very important for the economy and employment rate of Santa Cruz County. The local spend of the University has been increased in the past years, from 20% of the total purchases in FY2014 to 27% in FY2016. Besides, the Procurement maintains the relationship with diverse suppliers, and especially support those disadvantaged women-owned, and veteran-owned businesses. UCSC is also friendly for normal businesses. The Supplier Guide at the website provides detailed information for existing and potential suppliers providing goods and services to the university. All suppliers can enroll in Sourcing Director (SD), UCSC's bidding system, and can participate any bidding after pre-qualification.

The goal of UCSC Procurement is to better partner with the using departments. In order to have more opportunities to create value for internal customers, Procurement Services require earlier involvement with their purchasing needs. The quantitative metrics of purchasing involvement includes: Requisitions bypassing buyer approval V.S. Buyer approved requisitions, Buyer requisitions turn time, Requisition processed by Business Contracts VS. Buyer approvals bypassing Business Contracts. The "buyer approved requisition" from July 2016 through March 2017 is between 30% and 40% every month. Buyer requisitions turn times are based on time between final department approval and final Procurement approval and the report shows 65% of requisitions had been responded within the same day. The Procurement conducts the customer satisfaction survey every year, and the result shows that it has been raised from 60% to 80% in the past years. The measurement covers the quality of purchased goods, purchasing services, knowledge of buyers, responsiveness and communication, and other operational process. Based on the feedback from customers, the effort for improvements have been made to solve their "pain points". Regard to the interaction with the customer, the Director thinks they are relatively reactive right now and closer cooperation is needed to gain earlier involvement. Thus, the Procurement does necessary promotion in the campus. Although according to the rule of the University, the customers should use the service of Procurement, but they are only motivated to do so and it is not mandatory. Externally, although the rules about public procurement are not strict, while the ethical rules are very extremely strict and purchasing is highly regulated. Sometimes

the professor selects the supplier, the buyer provides support in the process of competitive bids and achieves the savings. In some other cases, the customer still does coursing by themselves and has to take his own risk and arranges the payment. Balance is need to when dealing with the conflict with customers. Most of time, the partnership is built for the interdependence between each other. Besides, it is believed that forecasting is important, although currently it is not provided. In general, the purchasing of UCSC is centralized and the accountability is taken into consideration to avoid fraud. The Procurement has to monitor all the purchases, since the purchasing volume is so high. To uphold the University's reputation for fair dealing, employees who are authorized to make purchases or otherwise influence purchasing decisions must abide by the Procurement Guidelines, which list all kinds of principles and rules.

The main buying tools are procurement cards and CruzBuy e-Procurement System. "How to Buy Guide" gives the instructions about bid events and procurement transactions. e-Procurement is a very important tool to realize the automation of purchasing control and management. Three specialists are responsible for e-Procurement system "CruzBuy": one manager, one senior analyst, and one help desk and training analyst. The existing system is not a fully integrated procure-to-pay system. Currently, all the suppliers have to be approved by the Procurement and all the invoices are sent to the Finance directly. But there are still some gaps in the system of supply chain. Procurement cards (Pro-Cards) are popularized among the staff, but they are released by the Finance, out of the authority of the Procurement. A Pro-Card may be used to procure low-risk and low dollar-value (maximum $2,500 per single purchase) goods. Currently in UCSC, the Procurement Services is one part of the Finance, the cooperation is well but not ideally. The Director thinks it makes more sense to separate them, since they have different duties and purchasing management is a part of supply chain management. Internally, the department has diverse and open culture. New ideas are always welcome. Debate with respect and is encouraged when a disagree occurs. The Director believes that "There's no one "right" way". He also stresses the significance of knowledge transfer, arranges different training for the staff and managers, and also encourages the staff to be students at the University. Likewise, the open culture is also reflected in the UCSC Procurement Services e-Newsletter in each Spring and Fall, which publishes transparent information about the performance and development of the department.

University of California - Irvine, US

The university, also known as UC Irvine or UCI, is another one of 10 campuses in the UC system. It is ranked as No. 9 among public universities nationwide by U.S. News & World Report. The university has more than 31,000 students and in total 92 majors. UCI is designated as having very high research activity in the Carnegie Classification of Institutions of Higher Education, and in fiscal year 2015 had $330 million in research and development expenditures according to the National Science Foundation of US.[1] The annual purchasing volume is around $80 million. The department of Purchasing and Risk Services (PRS) has 26 employees distributed in 7 functional units: 4 in Contracts and Agreements, 3 in Purchasing and Risk Services, 3 in Insurance & Risk Services, 7 Purchasing & Strategic Sourcing, 3 in PALCard/Low Value Purchasing, 4 in Equipment Management and 2 in Purchasing Training. The website is http://apps.adcom.uci.edu/cms/ResourceAC/public/Purchasing/PurchasingPublicDocs/index.html. The interviewee is the Chief

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Procurement Officer and Director of Risk Services (also called PRS, or Central Procurement), Snehal Bhatt.

The vision is "To be acknowledged by University of California executive and campus leadership, faculty, staff and students as a high performing strategic partner that is essential to the financial health of the University." The mission is "To expand opportunities for teaching, research and public service by delivering savings and efficient procurement services across the University of California.". The strategic objectives include:

Develop collaborative relationships with clients across the UC system to understand their needs and provide high quality procurement services that best meet those needs.

Pursue strategic initiatives in a coordinated manner that leverage the power of our collective spend and redirect savings to teaching, research and public service.

Invest in and optimize talent and technologies across the University to deliver far greater benefit than can be achieved by any single location working independently.

Drive down Total Cost of Ownership (TCO) and promote new revenue opportunities through effective sourcing, contract management and supply chain solutions.

Partner with suppliers to develop business relationships and solutions that optimize value for the University.

Purchasing added value in UCI is similar as UCSC which introduced above. The most important added value is still "benefits", which echoes with the system-wide savings program P200. Through maximizing the usage of these strategic supplier by customers, the University achieve the most benefits. However, the Director also stressed that they do not only look at the price. They have their own developed "best value" measurement with a series of quality metrics to help determine who is the best supplier. Buyers devote themselves to negotiation for better pricing, better terms and better guarantees. Sustainability is also one of the supplier selection criteria. UCI has many different programs to take consideration of the environment seriously and a new department is set up and specialized in these programs. In PRS, there is a specially-assigned person to be responsible for sustainability and small businesses. The Green Purchasing (environmentally responsible buying) includes "the acquisition of recycled content products, environmentally preferable products and services, bio-based products, energy- and water-efficient products, alternate fuel vehicles, products using renewable energy, and alternatives to hazardous or toxic chemicals". Similar approaches and measurement with UCSC are used to encourage sustainable procurement. The Small Business Program is "to help departments establish and maintain a process for providing equal access to opportunity for suppliers seeking to do business with the University". For many years, UCI Central Purchasing has been hosting Supplier Shows dedicated to small businesses. To introduce major campus suppliers with UC or UCI contracts to campus clients, "Supplier Showcase" has been held since 2015, with an emphasis on UCIBuy (UCI's eCommerce portal) and suppliers. Purchasing at UCIBuy portal is always encouraged, which provides data for buyers to manage the supplier relationship. Except the effort on supplier relationship, the complete information to guide the supplier to be a partner and up-to-date bid posting are also available on line. Supplier can register in the online system to track the bid opportunities. Furthermore, PRS has strategic relationship with those important

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[1] "Rankings by total R&D expenditures". National Science Foundation.

suppliers providing high value products or services. Those suppliers visit the campus very regularly and frequently, and meet the professor and researcher every day or twice per week to make them satisfied.

Similar with Purchase Services in UCSC, PRS in UCI also pursue earlier involvement in purchasing, since the current purchasing tasks are more transactional-centered. This is reviewed as one of their biggest challenges. The difficulty occurs when the user starts contact with suppliers already before submitting a requisition. This happens very often when a new professor or researcher is hired from other university. He may have a long relationship with the suppliers they buy very often for their research already. For example, a new professor may ask for help from CEO of Siemens directly for his new research project. He tells his own suppliers what he wants to buy, as he always did in the past career. In this situation, buyers are hard to interfere and only get involved in the transactional process. Another limitation is the limited number of staff in PRS, serving for 300 departments in the campus. It is very hard for PRS to reach every department and show the value they can bring. When the customer requests to choose a specific single supplier for a high value purchase while the buyer has to follow the bidding policy, the conflict has been dealt with very "carefully". Both sides should explain the reasons and seek for a balance. In extreme case, the requisition may be rejected by the buyer and the customer has to understand the policy and accepts it. It is known that one of the main functions of PRS is to protect the University from law sues and other risks against the regulations. For the purchases of high-tech equipment of which buyers do not have the knowledge, the buyer and the researcher work as a team. They work collaboratively and contribute both expertise in the purchasing process to get the best result. In general, the feedback from the customers are positive. The PRS is trying to build a good relationship with all the departments and make sure them understand PRS is a service organization for them and solve their needs. However, the Director said that the current service efficiency is not as good as they expect because of the limited sources. It is seldom to have a good forecast, since the research projects mainly depend on the financial grant from the state and it is not easy to predicted.

At PRS, different buyer is responsible for different commodity groups, and different commodity groups get different purchasing strategy. For those regular goods such as computer, office supply, laboratory tools and equipment, they have long term contracts with key suppliers. Most of departments buy from those well-established supplier base. There is a complete list of Purchasing Methods Guide for all the commodity groups. The main buying tools include KFS Requisition, PALCard (procurement card), and UCIBuy. The requisitions are handled in different approach according to their value. Small purchases less than $5,000 are done by the using departments and faculties and they can select their own suppliers. With the Low Value Purchase Authority (no purchasing orders needed), employees can purchase up to $5,000 per vendor/per day with a PALCard, or up to $5,000 per vendor/per day through the procurement module in Kuali Financial System (KFS). According to the Director, the biggest advantage of using procurement card is efficiency. The cost to process one regular purchasing order is $150, while a purchase with procurement card can be one third of it. The time of process is also dramatically reduced because no requisition and payment is asked for each purchase. When asking the control of purchasing cards, the Director said they have a very robust system to monitor the process and documents and the customers make sure they receive the right goods. In contrast, those requisitions with a higher value more than $5,000 have to be transferred to the Central Procurement thorough the system

and the purchasing order is placed by the buyer. In this way, even the professor or researcher has pre-selected the supplier, the requisition has to be approved by the Central Procurement. For all requisitions, the customer is encouraged to use the UCIBuy e-Procurement system in which suppliers are approved by PRS. Currently, a paper-less process is realized by the e-Procurement and all the transactional documents from requisition to invoices are made electronically. However, the financial system and e-Procurement system are still different systems and data exchange is necessary.

Different from UCSC, UCI Purchasing and Risk Services reports directly to the Vice Chancellor of Administrative & Business Services. Thus, they are parallel with Accounting & Fiscal Services which is also one of the A&BS Departments. The two departments have to work very closely in daily operations. Purchasing News in UCI keeps all the internal stakeholders informed of latest information. That is a bi-monthly publication providing the latest information, best practices, policy uthe PDates, and resources and tools for purchasing and strategic sourcing. There is also some practical information for customers, for example contracted discounts for bookstore and Apple products.

NC State University, US

North Carolina State University (also referred to as NC State) is an American public research university, as a part of the University of North Carolina system. With an enrollment of more than 34,000 students and excellent programs, NC State has been ranked as one of the best value public colleges in the US. The purchasing function is performed by Materials Management which is within the Finance Division. The purchasing volume is around $400 million per year. Its website is very clearly designed and offers rich information. The link is https://materialsmgmt.ofa.ncsu.edu/. The interviewee is Sharon Loosman, who is the director of the department and Chief Procurement Officer.

The main purchasing added value is the "best price". The department claims that they have save more than $33 million since 2008. There are different ways to realize the financial benefits. The main savings are generated by the e-Procurement system. Firstly, approved buyers for the e-Procurement system (MarketPlace) provide discounting for the University. The orders within the limit of $ 5000 can be placed by the customer via E-Procurement without additional review from the purchaser. For the order over $ 5000 in e-Procurement, the purchaser has to make sure it has the best price. Secondly, e-Procurement allows the customer and the purchaser to access the supplier's catalogue and order from them in automatic path. At MarkerPlace, the internal customer can shop for goods and services online, and the system creates and routes requisitions for approval, transmits orders to suppliers, and documents the receipt of orders online. As a self-service, e-Procurement tool, it automates the full procurement to payment process, saving both operational time and labor. Finally, the University pay e-Procurement suppliers with the virtual card. Each supplier has an account offered by the bank to pay the e-Orders. In this way, the administrative work and accounting cost are significantly reduced.

Another cost-reduction source is the mature Purchase Card (PCard) program, which has developed and evolved for around 20 years lang. This is an individual credit card paying for travelling, small services and other urgencies. Currently, 25% of the purchasing volume has been spent via PCard, i.e. $ 100 million per year. The process of PCard is much leaner than a standard purchasing process and leads efficiency and savings.

There are 12 colleges in NC State University and each of them has its own budget and purchasing needs. Although no formal customer satisfaction survey is conducted, the Director believes there is little complaint about the purchasing services. One extra value added by the Procurement to the internal customer is annual reporting generated automatically by the MarketPlace and PCard system. The systems collect all the data and provide different reports (spending per category or per department) to all the using departments. The report with visualized chart helps every department to make a good decision on the budget plan for the next fiscal year.

Environment protection is also a concern of the Department. The Surplus Property Office is specially set up to manage the surplus property, which is has a re-sale value, but is no longer needed by the university department to continue its operation. The surplus property items will be picked up and made available for acquisition by other departments, public agencies or non-profit organizations. Surplus items not acquired by these entities are sold at public surplus sales. This program generates revenue for the customers and also contributes to the earth. Thus, university departments are strongly encouraged to obtain surplus items for their departmental needs, instead buying new, more expensive supplies and equipment directly. The online Surplus inventory catalog is available and increases the rate of recycle and resale.

Except financial contributions, the department also protects the University from risks related to laws and regulations. Competitive bids are required for large purchases. In the procedure of specification, publication, evaluation and selection, the using customer offers expert knowledge of the products or solutions and the purchaser navigates to meet his need. The competitive bidding ensures the best deal for high value purchases and has big saving potential. All in all, the cost reduction generated by automatic processes is still the largest savings. When asking how to ensure the success of automatic system implementation, Ms. Loosman stressed the key factors: information system support, leadership support, and motivation of the procurement department and partner departments.

ETH Zurich, Switzerland

ETH Zurich is abbreviated from Eidgenössische Technische Hochschule Zürich in Germany, i.e. Swiss Federal Institute of Technology in Zurich. It is a science, technology, engineering and mathematics university in the German-speaking city of Zürich, Switzerland. ETH Zurich is currently ranked as 5th best university globally for the subject of engineering and technology in the QS World University Rankings. It forms part of joint procurement in the ETH domain together with another 5 institutions. These institutes are all linked up in many different ways and share the same conditions with suppliers. The Procurement Department reports to the Vice President Finance and Controlling. The link of the department website is https://www.ethz.ch/services/en/finance-and-controlling/procurement.html. The interviewee of the research is Marco Seliner, who is responsible for tenders and major procurements.

The Procurement is divided into six procurement units, which are responsible for the strategic management (best procedure and conditions) of their portfolio. The procurement of general goods and services follows general terms and conditions stipulated for the Domain of the Swiss Federal Institutes of Technology. Departments and research institutes may take responsibility for procurements under CHF 10,000 without involving buyers. When exceeding CHF 10,000, the requisition must be processed through the Procurement Coordination. After the application and approval completed in a system, the buyer will receive the requisition in the inbox and transfer it into a purchasing order in

the SAP system (ERP). For each requisition, one sole source or three quotations from different suppliers (when more than CHF 50,000) are required. Wherever possible, internal goods and services suppliers or ETH partner firms should be used. However, professors and researchers can always develop new suppliers by themselves. For example, they can go the fair or the market to seek for potential suppliers, and they can also meet the new supplier during the visit of the University. Before qualification of a supplier, the pricing and other terms are negotiated.

Other groups (Construction work, furniture & interior fittings and rent & leases, Supply lines and operation and maintenance of buildings, and ICT goods and services over CHF 10,000) follow different conditions and procedure and are handled by different procurement units. In addition, ETH Zurich also has its own procurement policy which sets out the expectations in the interests of efficient, coordinated and transparent procurement, as well as requirement for its suppliers. For all kinds of requisitions above the threshold value, for example CHF 230,000 for general goods and services, tendering has to be solicited at simap.ch. This is an electronic platform for public procurement in Switzerland. For those requisitions needed tendering, the Procurement expects earlier involvement, since the process takes long and normally occurs a lot of delay. In order to have closer relationship with customer, the Procurement starts to talk to the new staff in the early stage. For instance, when a new professor is just hired by the University, there is a series of training which includes the purchasing part. Besides, the people from the Procurement may meet him and let him know procurement services are there whenever he needs help (for example, building a new laboratory or buying a new equipment). This intimate support and collection is very helpful for the new staff, especially when he is new in this country and not familiar with the procedure and rules. Earlier involvement can be also realized by forecast from the customer. When the agenda of research requiring large investments is known, it will be shared with the executive of the school and then handed over to the Procurement. In this way, the customer may get informed if the amount exceeds the threshold of tendering. Active support from the Procurement will be provided to the researcher in charge, and they work together for the best solutions. Currently, there is no regular meetings with customers, but when the customer contacts the Procurement they are always very helpful. According to Seliner, the Vice President Finance and Controlling also promotes the earlier involvement via the close connection and communication with each department and research institute. Seliner believes that more purchasing added value can be added when the Procurement get involved before the customer starts selecting suppliers.

Except the initiation and collaboration of the above purchasing policy and processes, ETH Zurich Procurement also contributes purchasing added value in cost savings. For example, more than $1.5 million was saved for the purchase of a large system in tendering, and the customer was very happy since it exceeded what they expected. Except cost savings, the Procurement has other metrics to measure its performance and added value. For example, they manage different customers based on the number of purchasing orders. Currently, they do not have a survey to examine the customer satisfaction, but it may be developed in the near future.

ETH Zurich also has an e-Procurement system where all the customers can order laboratory equipment, office supplies and other products. The purchasing order is sent to the suppliers directly and the goods will be shipped to the customer directly. Furthermore, Mr. Seliner told the researcher they have no

procurement card program yet, and instead they have a specialist booking all the tickets for travelling. ETH Zurich Procurement focuses on "an economically viable and sustainable procurement and provision of goods and services". This means they do not only look at the price, but also check the energy efficiency and lifetime of machines. This concern also is also reflected in tendering. Besides, SME businesses are convinced to participate the tenders as well, although it may be difficult for them because of different paperwork. In this case, the Procurement may make the tendering procedure as lean as possible. Less attention has been paid to female-own business, which is different from American universities. However, in the general terms and conditions, there is a term about the same salary payment between male and female in supplier companies.

KU Leuven, Belgium

KU Leuven is abbreviated from Katholieke Universiteit Leuven in Dutch, i.e. Catholic University of Leuven, also known as the University of Leuven. It is a leading European research university and co-founder of the League of European Research Universities (LERU), situated in the Dutch-speaking city of Leuven in Flanders, Belgium. This Belgium's largest university conducts teaching, research, and services in the sciences, engineering, humanities, medicine, law, and social sciences. KU Leuven is consistently ranked among the top 100 universities in the world. For example, in 2016-2017, it is ranked as 40th globally according to Times Higher Education. The Central Purchasing is clearly separated with the Finance Department, under University Administration and Central Services. The link is https://admin.kuleuven.be/td/aankoop/english/central-purchasing. The interviewee in this research is the Head of Central Purchasing, Stefaan Saeys.

The objectives of the Central Purchasing are: providing customer-oriented, professional and qualitative purchases for the entire University; the development and implementation of a university-wide purchasing policy; better purchasing conditions by combining purchasing volumes through framework contracts. Different purchases follow different procedure and policy. The SAP system is used to manage all the orders and payments. In general, Central Purchasing ensures the right procedure and policy is followed. Purchases under € 8,500 are accomplished by using departments, without involving buyers. For other requisitions over €8,500, Central Purchasing will provide professional advices to make sure all the laws and regulations in Belgium and Europe are complied with. For any requisition over the threshold of European public procurement tenders (in particular construction works), Central Purchasing publishes a tender together with the detailed specifications and also requirements for the supplier at the official website. In the collaboration of a purchasing project, the using department provides all the technical specifications, and the Central Purchasing provides professional purchasing support.

Framework contracts are signed with suppliers for bundled procurement to gain better pricing and terms. Framework contracts at the University are owned and managed by each using department, but the Central Purchasing helps make all the conditions as detailed as possible to reduce the risk. Thus, Central Purchasing plays a role more like mediation and collaborate the purchasing tasks. When the performance or the quality of the goods is not as expected, a written report will be sent to the supplier. Sometimes penalty or even the termination of the contract is necessary. The motto in supplier management is "Good arrangement, good operations, and good feedback".

Sustainability is one of the important criteria when selecting suppliers and products. is the common concern. For different products and services, specific requirement reflecting energy usage and environment protection is required. For example, an electrical auto is more preferred, and the special attention is paid to cleaning products. The KU Leuven also participates in the Flemish Supercomputer Centre (VSC[2]), which guarantees access to a world-class high-performance computing infrastructure and studies critically into environmental sustainability, atmospheric modeling, researching of new materials, and medical research. There are more and more "green" purchases in recent years. In the selection of supplier, SME businesses gain the same chance with large businesses. It is believed that small businesses are more flexible.

Central Purchasing in KU Leuven ensures that all purchases are done in compliance with internal and external regulations. The relationship between Central Purchasing with customer was described as "very good". Every customer has their own purchasing specialist to provide intimate services. For every project, the specially-assigned buyer gets evaluated for his/her performance by the customer. In this way, the customer satisfaction is very high and central Purchasing has a good reputation. As said, "Make customer happy!" is their slogan. The Head of Central Purchasing thinks this is more important than cost savings. Since the resource is limited, if they spend too much effort on the price negotiation, they may not provide high quality of services. The forecast is partially feasible. The demand of the services under framework contracts and regular goods are easy to predicted. However, scientific products are hard to get the forecast, since there is no fixed agenda is available for a certain research subject.

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[2] Vlaams Supercomputer Centrum (VSC) is a consortium of the five Flemish universities: K.U.Leuven Association, Ghent University Association, Universitaire Associatie Brussel, Antwerp University Association and Associatie Universiteit-Hogescholen Limburg. The VSC is funded by the Flemish Government, Department of Economy, Science and Innovation and the Hercules Foundation.
Source: https://www.vscentrum.be/

APPENDIX F. UC PROCUREMENT SERVICES: RECOGNIZING THE BENEFIT

UC Procurement Services:
Recognizing Our Benefit

VISION	To be acknowledged by University of California executive and campus leadership, faculty, staff and students as a high performing strategic partner that is essential to the financial health of the University.
MISSION	To expand opportunities for teaching, research and public service by delivering savings and efficient procurement services across the University of California.
IMPORTANCE OF UC BENEFIT	Total UC Benefit is important because it allows us to highlight and communicate the work we do every day as procurement professionals in a consistent, accurate, and verifiable way.

Total UC Benefit is defined as the total annual benefit generated by procurement actions. These actions have been divided into four types.

Benefit Type	Definition
Cost Reduction	Benefit achieved when procurement action results in a total cost that is lower than base-line cost, and the baseline cost calculation is supported by documented historical price (i.e., previous contract, historical costs, or imputed historical cost).
Cost Avoidance	Benefit achieved when procurement action results in avoidance of additional cost (i.e., maintenance fees, requested price increases, or other ancillary costs).
Incentives	Benefit achieved when procurement action results in new gross incentive (based on volume, compliance/utilization, transaction size, electronic payment, e-commerce, signing bonus, GPO, management fees, etc.).
Revenue	Benefit achieved when procurement action results in revenue generation.

A baseline type and amount must be specified in order to calculate a benefit. The first three baseline types are listed in order of preference.

	Baseline Type	Definition
Cost Reduction	**Previously Contracted**	The pricing, terms and peripheral costs in the baseline are as specified in pre-existing vendor agreements; the current procurement project scope is for a like set of products or services.
	Historical Costs	The pricing, terms and peripheral costs in the baseline are the actual costs for a specific Category or Sub-Category of spend over the 12-month period immediately preceding a sourcing event.
	Imputed Historical Costs	The pricing, terms and peripheral costs in the baseline are to be established either by: I. the initial quoted price from a vendor for a basket of goods, processes and/or services. II. the average of all responsive, non-awarded bids from a multi-vendor RFP process III. the budget, index, or other benchmark
Cost Avoidance	**Cost Inclusive of Increase**	The pricing, terms and peripheral costs in the baseline are to established either by: I. the supplier's request for a price increase II. a documented trend in market price increase III. other contributing factors to an increased cost

Training material is available at *www.ucop.edu/procurement-services/procurement-systems*.
For additional information, please speak with your UC Benefit Approver.

Below are examples of activities that may generate benefit. The list is not intended to be comprehensive.

TYPE	ACTIVITY	EXAMPLE	BENEFIT TYPE
Purchase Price Reduction	Reducing the cost of goods or services from previous pricing through professional actions such as negotiations, bidding, etc.	The hourly cost for marketing services is reduced through negotiations from the previously agreed-to rate.	Cost Reduction
Specification Changes	Initiating a change to specifications for goods or services, resulting in cost reduction.	The thickness specifications for trash can liners exceeded actual needs and a new specification was developed for future purchases resulting in a cost reduction to the campus.	Cost Reduction
Contract Compliance	Redirecting spend and/or implementing processes to achieve maximum benefit from established strategic contracts.	Requisition submitted with the requested source being McMaster-Carr, which does not have a contract with UC. Purchase is redirected to Grainger, which is under contract at a lower price.	Cost Reduction
SLA / Maintenance Contract Changes	Initiating a specification change to a Service Level Agreement (SLA) or maintenance contract that reduces costs and maintains required service levels.	Reducing a 24 hour x 7 day hardware maintenance contract to 9 hour x 5 day, when round-the clock support is not necessary.	Cost Reduction
Demand Management	Managing demand through alternate solutions to achieve lower overall costs.	A purchase of several projectors reduces the demand for printer materials, supplies, and maintenance.	Cost Reduction
Cost of Quality	Improving the quality of a specification to reduce overall costs.	Requiring higher standards in bolt specifications reduces the number of bolts per order that must be rejected due to defects.	Cost Reduction
Market Adjustment	Negotiating price caps or price changes tied to specific indices.	Negotiated with software supplier to replace annual 10% price increases with increases tied to changes in CPI or 3%, whichever is less.	Cost Avoidance
Purchasing Process Improvement	A purchasing process is implemented or revised resulting in lower costs.	An eProcurement system is implemented so that end users can place orders electronically.	Cost Reduction
Operational Process Improvement	Redirection of FTE time due to a change in operations.	An agreement is established for Grainger to manage UC inventory at no additional cost, freeing up procurement resources to focus on other value-add procurement activities.	Cost Reduction
Revenue Generation	Generating value through the sale of surplus or obsolete goods to an *internal* UC customer, in lieu of a new purchase from a 3rd party supplier.	Procurement/materials management arranges the sale of a surplus microscope to another campus department, avoiding a purchase from an outside supplier.	Cost Avoidance
Revenue Generation	Generating value through the sale of surplus or obsolete goods to an *external* customer	Procurement/materials management arranges the sale of obsolete furniture to a public customer, generating revenue.	Revenue
Prompt Payment Discount	Negotiation of price discount for prompt payment terms.	Buyer obtains agreement with supplier to pay with pcard on a large order, resulting in a rebate.	Cost Reduction
Signing Bonus	Negotiating an incentive for signing a contract	UCM negotiates a contract with Adidas that includes an upfront signing bonus	Incentive

APPENDIX G. THE VALUE PROPOSITION CANVAS

The Value Proposition Canvas

Value Proposition

Customer Segment

Gain Creators

Products & Services

Pain Relievers

Gains

Customer Job(s)

Pains