

# SUSTAINABLE SUPPLY CHAIN MANAGEMENT CAPABILITY MATURITY: FRAMEWORK DEVELOPMENT AND INITIAL EVALUATION

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# SUSTAINABLE SUPPLY CHAIN MANAGEMENT CAPABILITY MATURITY: FRAMEWORK DEVELOPMENT AND INITIAL EVALUATION

*Research in Progress*

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## **Abstract**

*Owing to global importance given to sustainability, commercial and government organizations alike are becoming aware about the need for them to implement sustainable supply chain management (SSCM) practices. These practices are mostly inter-organizational in nature, which introduce complexity due to the need for managing activities and information across the supply chain. However, currently there is still a lack of studies assessing the required organizational capability for implementing SSCM practices. Therefore, in this research-in-progress paper, we propose a SSCM capability maturity framework and provide an initial evaluation of the proposed framework through an in-depth case study with a large Australian city council. The framework together with the supportive empirical evidence represents a contribution to theory and practice. For practice, it helps organizations to understand their current SSCM maturity level and establish an appropriate strategy to progress in their maturity level. For theory, the study contributes to the on-going conceptual development related to SSCM and has clear implications for understanding the roles of IS/IT in building the required SSCM capability.*

*Keywords: Sustainability, sustainable supply chain, sustainable supply chain management, capability, maturity, local government council, case study, Australia*

## **1 Introduction**

Sustainability has become a global concern and therefore many forward-looking organizations are revisiting their supply chain operations taking into consideration the environmental and social impacts of their supply chains (Capaldi, 2005; Carter and Easton, 2011; Chaabane et al., 2012). This has given rise to the concept of Sustainable Supply Chain Management (SSCM) which basically refers to *the management of material, information and capital flows as well as cooperation among companies along the supply chain, taking into account the economic, environmental and social dimensions, based on customer and stakeholder requirements* (Seuring and Müller, 2008). SSCM requires organizations to implement a series of practices to make supply chain activities more sustainable, thereby addressing sustainability concerns across economic, environmental and social dimensions which are collectively known as triple bottom line (TBL) (Seuring and Müller, 2008). There is a growing recognition among

the business and public sector communities about the significance of implementing SSCM practices. Implementing SSCM practices is, however, complex due to the involvement of multiple trading parties with diverse and sometimes conflicting interests operating within even different legal frameworks (Linton et al., 2007; Simchi-Levi et al., 2010; Kurnia et al., 2012). The increased complexity imposed by SSCM practices requires a better coordination of activities and a higher level of information sharing among supply chain participants for monitoring, controlling and collaboration purposes. Information System / Information Technology (IS/IT) is thus expected to play a key role by contributing to building organizational capabilities for successfully implementing SSCM practices (Erek et al., 2009; Dao et al., 2011; Elliot, 2011; Erek, 2011; Hsu, 2011). As many of the SSCM practices are inter-organizational in nature and require mutual support from business partners, having different levels of capabilities across a supply chain may impede the successful implementation of these practices. Organizations thus need to be aware of their own SSCM capability and that of their partners so that necessary joint actions can be undertaken to address any discrepancies such as setting up appropriate policies to harmonise the capability differences for each sustainable practice.

For organizations to understand their and trading partners' capability, there is need for frameworks that can differentiate various levels of capabilities that organizations can develop overtime. Such frameworks can help organizations identity their current capability and guide them in establishing a clear vision, direction and strategy for specific business process transformation required (Reefke et al., 2010). Currently, there exist limited studies that adequately address this issue within the SSCM context (Lockamy III and McCormac, 2004; Baumgartner and Ebner, 2010). However, while the proposed models are useful in identifying possible strategies and maturity levels for each sustainability practice, there is limited guidance for organizations in developing their capability. We argue that assessing the SSCM maturity level based on organizational capability can at a later stage help improve current understanding about the key roles of IS/IT indicated by (Dao et al., 2011; Elliot, 2011) in supporting SSCM practices. This particular aspect has not been adequately addressed in the literature (Wolf, 2013). In addition, these existing models have not been validated with empirical evidence.

To address limitations with the existing maturity models in the context of SSCM, in this research-in-progress paper, we develop a SSCM capability maturity framework by identifying six types of capabilities required for implementing SSCM practices. We define four specific maturity levels for each capability type, and identify four categories of organizations based on their overall SSCM capability maturity level. Our framework development was informed by relevant existing models and theories related to capability and maturity concepts, aiming at producing a simple enough but meaningful framework to understand the required capabilities for supporting SSCM implementation. We then evaluate the framework by analysing the SSCM capability maturity level of an Australian city council, which is one of the leaders in promoting sustainability. We conclude the paper by outlining the future directions of the study.

## **2 Literature Review**

### **2.1 SSCM literature**

Existing literature on SSCM is quite diverse and fragmented. From a review of the literature, we have identified three key themes that have been discussed in the literature. Each is briefly discussed.

*Theme 1 (Dimensions of SSCM):* In the last two decades, supply chain management practice among leading organizations has addressed not only economic concerns, but also environmental and social concerns, under the notion of Sustainable Supply Chain Management (SSCM) (Hertwich and Peters, 2009). Economic sustainability assesses various aspects of SCM focusing on ensuring healthy cash flow, good profit margins and a proper return on investment, business performance improvement and

competitive advantage (McCormack et al., 2008; Ketchen et al., 2011). As environment sustainability is attracting more attention, the literature on SSCM practices focusing on environmental performance has created a stream known as green supply chain management (Sarkis et al., 2011). Scholars examine such initiatives as supplier selection and development, green purchasing, renewable energy use, environmental friendly disposal or reverse logistics (Sarkis, 2003; Walker et al., 2008; Ninlawan et al., 2010; Sarkis et al., 2011). Furthermore, the literature has addressed the social dimension of sustainability by investigating various social aspects such as community issues, corporate governance, diversity considerations, employee relations, human rights and diversity, educational and ethical considerations, training and development and safety (Chabowski et al., 2011; Closs et al., 2011; Scott, 2011).

*Theme 2 (Organisational motivations for SSCM):* Those organizations that are engaged in SSCM practices have been motivated by various factors including pressure from consumers who are becoming more aware of the global sustainability concerns, pressure from other stakeholders including workers, investors and unions (Hall, 2000; New et al., 2000; González-Benito and González-Benito, 2005; Mollenkopf et al., 2010), compliance to legal requirements set by governments (Min and William P. Galle, 2001; Zhu and Sarkis, 2006; Zhu et al., 2008; Tate et al., 2010). Some organizations are also motivated to engage in SSCM to enhance their organizational reputation, to reduce costs, to improve overall performance and to gain competitive advantage (Noori and Chen, 2003; González-Benito and González-Benito, 2005; Nunes and Bennett, 2010; Testa and Iraldo, 2010).

*Theme 3 (Challenges of SSCM adoption):* Despite the many potential benefits of practising SSCM (Carter and Dale S. Rogers, 2008; Mollenkopf et al., 2010), there are a number of key challenges identified in the literature. The common challenges include the costs required to develop the required SSCM initiatives, the complexity due to the extended scope of concerns imposed by the TBL, the mindset and cultural changes as well as uncertainties involved (Zhu and Sarkis, 2006; McCormack et al., 2008; Ageron et al., 2012). Implementing SSCM practices can require a lot of effort of management, cooperation, collaboration, controlling, monitoring and evaluation. Therefore, (Giménez and Lourenço, 2008) conclude that organizations need to implement collaborative practices with their supply chain partners to implement SSCM, which in turn highlights the importance of IS/IT to facilitate the required collaboration. In terms of measuring outcomes, the fusion of the TBL practices requires necessary trade-offs among the three dimensions. The increased complexity in measuring outcomes implies the need to have information provision and transparency within and across organizational boundaries for monitoring and evaluating performance (Wittstruck and Teuteberg, 2012). Again, in such a situation, IS/IT has important role to play. IS/IT particularly supports supply chain partners in SSCM knowledge creation and sharing as well as facilitating exchange of expertise and experience.

## 2.2 Maturity Models in the Sustainability Literature

Both academic scholars and practitioner community have proposed a range of maturity models for the sustainability context. We now briefly describe some of the widely reported models.

*Maturity models in the scholarly literature:* (Baumgartner and Ebner, 2010) propose a set of frameworks that defines four levels of corporate sustainability maturity for each of the economic, environmental and social sustainability aspects. These are defined based on four corporate sustainability strategies, which are introverted (risk mitigation strategy), extroverted (legitimization strategy), conservative (efficiency strategy) and visionary (holistic sustainability strategy). Although the proposed model is insightful, it is difficult to use by organizations to assess their current maturity level and to identify the appropriate strategy to progress further. In addition, little guidance is provided on the assessment of organization capability and how it should be developed. Furthermore, it focuses on corporate sustainability in general and little reference to sustainable supply chain aspect. Another relevant model is proposed by (Reefke et al., 2010) which is specifically related to SSCM maturity to

help organizations identify a common structure to achieve specific goals. The model intends to offer a roadmap to guide organizations in their business transformation journey. The model has six maturity levels: level 1 (Unaware and Non-compliant), level 2 (Ad-hoc and Basic Compliance), level 3 (Defined and Compliance), level 4 (Linked and Exceeds Compliance), level 5 (Integrated and Proactive) and finally, level 6 (Extended and Sustainability Leadership). For each level, specific goals and requirements are defined. To guide the progression between maturity levels, the authors also propose an interactive roadmap of five defined stages of discovery and learning, strategizing, design, transformation, and monitoring and controlling. The model is comprehensive as it considers other supply chain members and three dimensions of sustainability. However, the model involving the five stages for each maturity level is complex and challenging to validate in empirical studies. In addition, organizational capability has not been addressed adequately.

*Maturity models in the practitioner literature:* Some industrial research and consulting groups have proposed diverse sustainability maturity models for business and supply chain contexts such as Sustainability Management Maturity Model by FairRidge Group, the GAIA Supply Chain Sustainability Model by the LMI Research Institute, and Sustainability Maturity Model by Terra Infirma. While these models help us understand the possible aspects to consider in studying capability maturity in the context of sustainability, the diversity of the models may indeed inhibit the development of clear understanding regarding the required increasing capabilities that need to be developed over time. Moreover, the development of concepts and relationships between concepts used in the models are typically not well and systematically explained and the models have not been validated rigorously. Building upon the existing models and to complement the existing models, we aim to focus on developing SSCM capability maturity framework which will have some implications for the role of IS/IT in supporting sustainability capability of organizations.

### **3 Research Methodology**

We have adopted the principles of design science approach involving building and evaluating an artefact (Hevner, 2004). The building phase involves development of a framework to evaluate SSCM capability maturity. The framework is developed based on a review of sustainability literature which was selected by searching papers related to SSCM, sustainability maturity, capability maturity, SSCM maturity using Google Scholar, various databases including PROQUEST, and leading IS, logistics and sustainability related journals such as MISQ, Journal of Cleaner Production. To evaluate the framework, we adopt a multiple case study approach involving various Australian organizations that are engaged in SSCM practices. For this paper, we only consider one of the case studies for the initial evaluation of the framework. In this case study, we conducted semi-structured interviews with four senior business managers: Head of Sustainability function, Head of Procurement function, Head of Finance function, and the Project Manager responsible for implementing a new IT system for sustainability reporting. The interview protocol consists of general questions related to the SSCM practices (e.g. current practices, motivations, benefits and barriers) and specific questions relating to capabilities for supporting implementation of those practices. Interviews lasted for about one hour, were recorded, and analysed using coding schemes drawn on the concepts included in the framework. In addition, various reports are collected and information provided on the council web site is considered for the purpose of triangulation. Due to the space limitation, we provide a high level overview of the SSCM capability maturity assessment of the case organisation.

### **4 SSCM Capability Maturity Framework**

In developing the proposed SSCM capability maturity framework, we have borrowed ideas from Resource-Based Theory of Firm – RBTF (Barney, 1991), business process orientation (BPO) literature

which emphasises the need for increased maturity of organisational processes (Hammer and Champy, 1993; Dorfman and Thayer, 1997), and sustainability literature. Drawing on the notion of ‘capability’ as espoused in RBTF (Kangas, 2003), we define SSCM capability as an organisation’s capacity to deploy its resources exercised through organisational processes involved in sustainability practices. These resources include complex bundles of skills and accumulated knowledge (Day, 1994). We further view that these capabilities as being specific to individual organisations which can be developed over time. In line with RBTF, we believe that capability development is central to successful implementation of SSCM practices. However, the concept of maturity has been discussed in several contexts: business process, software development process, and project management process. Specific to business process context, maturity involves the notion of process lifecycle that is assessed by the extent to which the process is defined, measured, benchmarked, and governed. Furthermore, as an organisation improves its process maturity, a greater level of formalisation takes place in terms of policies, standards and organisational structures (Hammer and Champy, 1993) and the focus changes from an internal to external perspective (Dorfman and Thayer, 1997). As such, the reliance on IS/IT is expected to be greater.

To address the limitations related to the existing maturity frameworks within the SSCM context which do not adequately address the capability maturity concept, we propose six distinct capability types drawn from the literature on SSCM (eg. Dao et al. 2011; Kurnia et al. 2012). Sustainability data collection capability (C1) refers to the ability of an organization to efficiently gather a range of data related to sustainability practices and the impacts within the organization and across the supply chain. Sustainability performance reporting capability (C2) refers to the ability of an organization to efficiently generate reports related to various aspects of sustainability practices as required by the internal and external stakeholders as well as government. Sustainability benchmarking capability (C3) refers to the ability of an organization to compare the sustainability performance across various units (internal) and supply chain members (external). Sustainability training capability (C4) refers to the ability to create awareness among senior managers, various levels of employees, and other stakeholders. Training can also be provided on how to record sustainability data, generate reports, and make informed decisions for formulating sustainability related policies. Sustainability risk analysis capability (C5) refers to the ability to identify and evaluate potential negative consequences associated with implementing a SSCM practice, which if not addressed may threaten the success of SSCM practices implementations. It involves evaluating cost implications and resistance to changes triggered by sustainability, among others. Finally, sustainability governance capability (C6) refers to the ability to manage and align the sustainability goals across organizational units and supply chain members. It involves creating an organizational work unit which specialises in sustainability practices and which is responsible for policy formulation, report generation, monitoring and authorisation, among others and aligning the goals of the sustainability unit with other organizational units.

Building upon the maturity concept discussed in previous studies (Hammer and Champy, 1993; Dorfman and Thayer, 1997; Reefke et al., 2010), for each capability type we define four levels of maturity based on the *extent of coverage* within the supply chain and *the scope* of the TBL addressed. The first capability type (C1: Sustainable data collection), for example, can be distinguished across four levels of maturity depending on the breadth of data collection related to each sustainability practice implemented and the scope in addressing the TBL. The maturity level is low when a few data are collected from selected units within an organization, and these collected data are related to either environmental or social aspect of TBL for each of the sustainable practices implemented. On the other hand, the maturity level for this capability is considered high when sustainability data related to all aspects of TBL for all sustainable supply chain practices are collected across the organization and supply chain members.

Table 1 presents the complete framework of SSCM Capability Maturity. It includes four components: six capability types (shown in Column 1), four increasing levels of maturity associated with each capability type (second row in the table header), brief characteristics describing each maturity level for

each capability type (shown as bullet points), and four categories of organizations (i.e. Unaware, Unprepared, Committed, Advanced) which differ in the status of their respective maturity levels of SSCM capabilities.

**Table 1: SSCM Capability Maturity Framework**

SSCM Capability	Level of Maturity			
	Non-existent	Low	Moderate	High
C1: Sustainability data collection	No data collection	<i>Limited internal data collection</i> ♦ Data are collected from a few internal organizational units ♦ Few data are collected on a single aspect (e.g. environmental) of TBL	<i>Greater internal data collection</i> ♦ Data are collected from most internal organizational units ♦ More data are collected on both environmental and social aspects	<i>Internal &amp; external data collection</i> ♦ Data are collected from most supply chain members ♦ Data are collected on both environmental and social aspects
C2: Sustainability reporting	No reporting	<i>Limited internal reporting</i> ♦ Reporting is only for top management ♦ The scope of reporting is only for a single aspect of TBL	<i>Wider internal reporting</i> ♦ To both top management and across all layers of management. Hence, greater transparency in reporting ♦ The scope of reporting is for both environmental and social aspects	<i>Internal &amp; external reporting</i> ♦ External reporting may involve reporting to regulatory bodies and public in general ♦ The scope of reporting is for both environmental and social aspects
C3: Sustainability benchmarking	No benchmarking	<i>Limited internal benchmarking</i> ♦ Comparing environmental performance against the target set by top management ♦ The scope of benchmarking is only for a single aspect of TBL	<i>Rigorous internal benchmarking</i> ♦ Comparison is made across multiple organizational units over time and against the targets set by top management ♦ The scope of benchmarking is for both environmental and social aspects	<i>Internal &amp; external benchmarking</i> ♦ Comparison is made across multiple organizational units over time and across the supply chain members ♦ The scope of benchmarking is for both environmental and social aspects
C4: Sustainability training	No training	<i>Limited Internal training</i> ♦ Training given to key business managers to generate sustainability awareness ♦ Training focuses on a single aspect of TBL	<i>Broader internal training</i> ♦ Training given to key business managers and supervisory staff to develop sustainability awareness on sustainability and to make informed decisions ♦ Training focuses on both environmental and social aspects	<i>Internal &amp; business partners training</i> ♦ Training given to internal managers, supervisory staff, and business partners involved in sustainability practices ♦ Training focuses on both environmental and social aspects
C5: Sustainability risk analysis	No risk analysis	<i>Limited risk analysis for internal sustainability practices</i> ♦ Cost and implementation risk implications are assessed in selected organizational units ♦ Risk analysis focuses on a single aspect of TBL	<i>Rigorous analysis for internal sustainability practices</i> ♦ Cost and implementation risks from changes made in organizational structure and processes are evaluated in organization ♦ Risk assessment is for both environmental and social aspects	<i>Risk analysis across supply chains</i> ♦ Cost and implementation risks arising from implementing sustainability practices are fully evaluated with partners ♦ Risk assessment is for both environmental and social aspects
C6: Sustainability governance	No overall governance	<i>Limited sustainability governance</i> ♦ Sustainability governance is limited to only a few business units within an organization ♦ Sustainability governance scope is limited to a single aspect of TBL	<i>Some sustainability governance</i> ♦ Sustainability governance formally exists, and is integrated with other functions ♦ Sustainability governance scope is for both environmental and social aspects	<i>Inter-organisational sustainability governance</i> ♦ A joint sustainability governance is established with partners ♦ Sustainability governance scope is for environmental and social aspects

The first three categories of organizations have internal focus for their implemented SSCM practices. Only organizations representing instances of 'Advanced' category focus on both internal and external sustainability aspects and actively interact with their supply chain members. An organization is considered to represent the 'Unaware' category when its top management and employees in general have little understanding about the benefits of SSCM practices and are not keen to invest resources to develop any of the six capability types included in the framework. In contrast, an organization is considered to represent an instance of 'Advanced' category when it demonstrates a high level of maturity for each of the six capabilities identified in the framework. Organizations representing 'Unprepared' and 'Committed' lies in between these two extreme ranges as indicated in Table 1. Our framework suggests that higher SSCM capability maturity levels will rely more on IS/IT as the supply chain member coverage and the TBL scope will be increased. For example, an organization with a high maturity level for sustainability data collection capability will rely heavily on IS/IT to efficiently collect sustainability data related to environmental and social aspects across the supply chain members. On the other hand, an organization with a low level of maturity only collects less complex data on one aspect of sustainability from a limited number of internal organizational units will need little support from IS/IT. The use and role of IS/IT, however, is not explicitly discussed in this paper and will be explored in our future studies.

## **5 Preliminary Framework Evaluation and Conclusion**

The participating case organization represents a large city council employing 1300 staff with an annual budget of about A\$400 million. The council oversees one of the capital cities in Australia and a number of its inner suburbs, and serves a residential population of almost 100,000. Management structure of the council is divided into five directorates involving 30 work areas. The directors report to the CEO of the council who in turn reports to the Mayor and a group of councillors. The council is a recognized leader in the field of environmental and social sustainability. One of the goals outlined by the council is to develop a sustainable city, and it had adopted zero net emissions strategy as its sustainability vision. To support this vision, the council has embarked on such sustainability initiatives as low-carbon and renewable-energy infrastructure, embedding municipal-wide waste management practices to increase recycling, reducing waste generation, improving sustainable water management by developing integrated water management infrastructure, embedding a stronger focus on sustainability in council's procurement systems, governance, tools and knowledge. Hence, it seeks to do business with contractors and providers who have similar sustainability objectives and operational policies.

Drawing on the empirical evidence collected from various sources at the council, we summarize our overall evaluation in Table 2. In terms of sustainability data collection capability (C1), the council has a moderate maturity level since the council collects sustainability related data from a number of organizational units, but the main focus is still on the environmental dimension only with limited data related to social dimension collected by the procurement unit. Likewise, for reporting capability (C2), the evidence suggests that wider internal reporting and some external reporting focusing on the environmental aspect are conducted by the council, which fits the moderate level characteristic outlined in our framework. Similarly, for benchmarking and training capabilities (C3 and C4), the evidence suggests that the council has a moderate level. The council conducts internal performance comparison with limited external comparison focusing on the environmental performance and training is provided broadly across organizational units for both environmental and social aspects. However, for risk analysis capability (C5), the council is still at a low level since evaluation is done for environmental practices and focuses on cost aspects only. Finally, for sustainability governance capability (C6), the evidence shows the existence of holistic sustainability governance across units focusing on both environmental and social aspects. The council has just embarked a new project to consolidate the overall sustainability data requirements from across the organization which will be



used to develop an integrated system to enable automatic capture of sustainability information from various legacy systems and to facilitate better decision making and efficient generations of various reports. Thus, we surmise that overall the council demonstrate a moderate level of SSCM capability maturity.

Table 2: A summary of the SSCM capability maturity level assessment of the participating council

SSCM Capability	Key empirical observations	Maturity Level
C1: Sustainability data collection	<ul style="list-style-type: none"> <li>◆ Sustainability related data are collected from all major work areas of the council</li> <li>◆ Main focus of data collection is on environmental issues</li> <li>◆ Sustainability data are collected for carbon emissions, usage of gas, electricity and water, and sustainable procurement</li> </ul>	Moderate
C2: Reporting sustainability	<ul style="list-style-type: none"> <li>◆ A number of interim sustainability reports are generated which are sent to the CEO and Directors</li> <li>◆ External reporting is done and sent annually in October each year to a government body</li> </ul>	Moderate
C3: Sustainability benchmarking	<ul style="list-style-type: none"> <li>◆ Sustainability usage data are compared among major work areas of the council</li> <li>◆ Monitoring takes place to determine if the sustainability performance is supporting the sustainability vision set by the council top management</li> </ul>	Low
C4: Sustainability training	<ul style="list-style-type: none"> <li>◆ Presentations on sustainability are made to the council top management</li> <li>◆ New staff joining the council are required to train (using web-based tools) in sustainability policies</li> </ul>	Moderate
C5: Sustainability risk analysis	<ul style="list-style-type: none"> <li>◆ Cost overruns (above 10%) are considered</li> <li>◆ Analysis is only for environmental aspect</li> </ul>	Moderate
C6: Sustainability governance	<ul style="list-style-type: none"> <li>◆ A formal sustainability work group exists which includes 4-5 staff and is responsible for preparing reports by compiling collected data from various work areas of the council.</li> <li>◆ The sustainability group reports directly to the CEO</li> <li>◆ The sustainability group is responsible for preparing sustainability policies and guidelines (in consultation with the heads of each work area of the council)</li> </ul>	Moderate

In conclusion, we have demonstrated the applicability of our proposed framework through our preliminary assessment of the SSCM experience of the participating city council. The framework bears significance for practice and research. It is simple yet meaningful to understand the increasing SSCM capabilities that organisations need to develop. The extent of supply chain coverage and the scope of sustainability dimensions considered are systematically embedded in the framework. Moreover, the capability dimensions of the framework can be readily linked to IS/IT capability that organizations need to support SSCM practices. As such, the framework can be useful for helping organizations establish priorities for future capability development to support their SSCM practices. It can trigger further studies to identify challenges for organizations to migrate between successive maturity levels, propose strategies to overcome the challenges, and relate maturity levels to the use and roles of IS/IT as well as SSCM performance. Additional case studies will be conducted in the future to validate our framework and explore the possibility of discovering additional capabilities, which will eventually lead to a development of a survey instrument. Future work is also needed to examine whether realised benefits would be affected by SSCM maturity level and to find out how IS/IT support would differ for various levels of SSCM maturity levels.

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