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A STUDY FRAMEWORK FOR ASSESSING THE PERFORMANCE OF THE URBAN FREIGHT TRANSPORT BASED ON PLS APPROACH

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***Abstract**:*

The urban freight transport (UFT) is an important component of the urban logistics. It represents a driving force for the economic dynamics and attractiveness of a city. It can be treated as all movements of goods necessary for the economic activities, the institutions and the residents of urban life. Through, it faces with problems relating to the congestion, unsafety, atmospheric and noise pollution that constrain its performance and hinder its development. This performance is a complex subject on which a great deal of research has emerged in the last decade. Accordingly, this paper aims to develop a model for assessing the performance of the UFT. The objective is to identify the determinants of the performance of the urban freight transport and measure the impact of each factor. Therefore the first part of this article concerns the elaboration of the model and the formulation of the hypotheses. First, an overview of the factors that could influence the performance of the UFT was identified based on a literature review. The result of this step allowed to model, by mobilizing the GRAI grid (Graph of results and interrelated activities), the UFT system in order to release the decisional links between these factors. Then, the grid will be decomposed into hypotheses explaining the relations between the factors and the performance of the UFT. The formulation of each hypothesis will be based on all the theoretical works that have treated it.

The second part includes the empirical study to test the model using the partial least squares (PLS) analysis. Therefore, we conducted a survey among managers and users of the UFT in the city of Fez. A hypothetico-deductive approach has been used with a sequential methodological complementarity between qualitative analysis for exploratory purposes and the support of quantitative analysis for confirmation. The results of the test, confirm a significant influence of the identified factors on the UFT performance. The practical scope of this paper is to provide a decision-making framework for urban management department explaining the impact of these factors on the UFT performance.

Keywords: *urban logistics, freight transport, performance, modeling, PLS approach*

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1. Introduction

The improvement of the urban logistics represents a vital importance for the development of the country's logistic competitiveness and for the development and attractiveness of urban areas. Thereby, the UFT is an important component of the urban logistics. It represents a driving force for the economic dynamics and attractiveness of a city. Through, it faces with problems relating to the congestion, unsafety, atmospheric and noise pollution that constrain its performance and hinder its development. In this context, decision making for the UFT is a complex experience since many parameters must be taken into account. However, the actors have no vision of the consequences of the decisions they will take given the lack of tools due to the youth of the field. Therefore, it seems interesting to propose a model that explains the factors determining the performance of the UFT and the influence of these factors on this performance. Before reflecting on the determinants of the UFT performance, it should identify this concept and positioning in its context.

The urban freight transport represents a preponderant component of the urban logistics which can be defined as an optimized management of the flows that enter, leave and circulate in the city, ensuring an optimal quality of service in order to rationalize the costs while reducing the nuisances induced (Guyon et al., 2010). The UFT is a complex problematic, as much by the objectives it seeks to optimize (economic, environmental, societal) as by the issue and multiplicities of the actors it tends to consider. It can be treated as all movements of goods necessary for the economic activities, the institutions and the residents of urban life. What is referred to as a UFT is not restricted to deliveries only but also to pick-up operations. It consists of three essential components (Toilier et al., 2014, Comi et al., 2018) :

– The exchange of goods between all the economic establishments of an agglomeration.
– The pick-ups operations generated by the shifting household purchasing behaviours.
– Auxiliary flows: This includes the transport of waste, the specific needs of public services, the relocations, the home deliveries and the postal services.

According to data from the World Bank in 2017[1], the UFT is responsible for between 30% and 40% of CO_2 emissions in the case of large cities. Thus, in major Moroccan cities, the city freight traffic accounts for about 25% of the total city traffic[1], which indicates the importance of the UFT in the urban mouvements. In addition, it plays a major role in the accessibility and congestion of urban areas. Therefore, it seems interesting to treat the subject of the UFT especially the performance component.

Logistics performance can be defined as the result of a number of actions aimed at satisfying customer demand at the lowest cost and with the minimum impact on the environment (Amiri et al., 2015). If logistics performance follows company rules, the performance of urban logistics is linked to the actions and objectives of the authorities, and yet "enterprise" visions are confronted with "authorities" visions (Morana, 2015). Given the complexity of operations, the multiplicity of actors, the stakes and the conflicting objectives of the transportation of goods in the city, its performance deserves to be approached in a transverse and global logic (Moufad and Jawab, 2017). In fact, this concept has long been taken from purely financial perspective. However, the emergence of sustainable development (SD) thinking has forced the association of financial and non-financial indicators (Jacyna-Gołda et al., 2018; Jacyna et al., 2014). The aim is to design a multicriteria and multidimensional evaluation in which the interests of all actors are integrated (Jacyna-Gołda et al., 2018; Moufad and Jawab, 2018).

Therefore, it seems interesting to propose a model that explains the factors determining the performance of the UFT and the influence of these factors on this one.

To do this, we conducted a literature review of theoretical and empirical works that addressed this topic. At the end of this literature review, we formulated a set of hypotheses explaining the influence relationships between the factors identified and the performance of the UFT. To test the veracity of these hypotheses, we conducted an empirical study based on the structural equation modeling estimated by the Partial Least Square (PLS) method. Our empirical analysis is based on data from a survey of the freight transport managers and users in the city of Fes.

[1] http://www.worldbank.org/en/results/2017/12/01/mobility

2. An overview of the determinants of the UFT performance

Several studies introduce indicators for the evaluation and the improvement of UFT performance (Rai et al., 2017; Galkin, 2017; Ciaramella et al., 2014; Figlus et al., 2017; Morana and Gonzalez-Feliu, 2010; Patier and Routhier, 2009). Other study, highlight performance objectives in several locations and provide a framework to describe the different levels of decision making in city logistics (Ambrosini and Routhier, 2004).

According to this work, we can follow an approach that falls within the framework of SD and thus defines the performance of the UFT in three levels:

– Economic performance: this category can include economic indicators (transportation cost) and operational performance indicators (timeliness, product quality, inventory level)
– Environmental performance: this can group indicators on the levels of pollution, energy consumption and noise related to the ecological aspect as well as indicators of safety.
– Social performance: it can include indicators not only related to job creation but also to habits and changes in organizational methods and ergonomics.

In the same vein, Figlus et al. (2017) raised the concept of the urban transport from the level of noise. They assess the influence of the different types of means of transport and their speeds on traffic noise near a road, along with possible ways to reduce its level.

From the same perspective Morana and Gonzalez-Feliu (2010) have identified a series of indicators of sustainability and urban logistics divided into five broad categories of factors: economic and commercial factors; technical and logistical factors; social and ergonomic factors and factors related to the environment regulation and occupation of public sphere. We also find the surveys that helped to develop a series of indicators and contribute to a complete diagnosis of the performance of urban freight transportation (Patier and Routhier, 2009). We can note that Szczucka-Lasota (2017) describes the influence of road transport on urbanization and the transport of oversized loads.

On the other hand, (Galkin, 2017; Ciaramella et al., 2014) raised the environmental performance of freight transportation. They indicated that safety, air pollution, energy consumption and noise are criteria for assessing the environmental sustainability of freight transportation. It is also important to note that the works of (Mori and Christodoulou, 2012) allows introducing conventional indicators of the transport of goods that can be considered at the interface between urban transportation and interurban one. More, Merchan et al. (2015) have discuss several urban metrics (including accessibility) and how they impact and measure urban logistics performance. Finally, several projects (Trailblazer, CityMove, CityLog, Bestufs1 & 2, Mosca, Fleat, and Civitas) sought to evaluate the performance of UFT and to better identify the main factors that influence it (Graindorge et al., 2015).

Based on this literature review, it can be inferred that the most frequent factors that influence the performance of UFT are: accessibility, congestion, ecological impacts (vacillated in air pollution and energy consumption) and road safety.

We indicate that the UFT is dependent on the realization of a set of stakes which are mainly: set up and develop the infrastructure; organize freight flows in the city; improve safety and ensure sustainable development (Moufad and Jawab, 2017). These issues are supported mainly by factors related to: accessibility, congestion, safety, and ecological impacts. Based on a wide variety of literature we divided each factor into a set of indicators contributing to a diagnosis of the UFT performance. In the last two columns, we defined the measurement object and the founding references of each indicator. All these factors are identified through the references mentioned in the last column (Table 1). All the elements listed in this table will be used for the formulation of the model and the hypotheses.

3. Methodology

3.1. Research model and Hypotheses

The main objective of this work is to propose a model of the determinants factors of the performance of urban goods transport, particularly in Morocco by examining the causal links between these factors and the performance of the UFT system. Our model (Figure 1) is built from the summary made on the main factors determining the performance of the UFT system presented above. Our model aims to explain the performance of the urban freight transport system through four factors that represent the latent variables (LV): accessibility, congestion, safety, and ecological impacts.

Table 1. An overview of the determinants of the urban freight transport performance

Issues	Factor	UFT performance indicator	Purpose of the indicator and measures allowed	References
Set up and develop infrastructures	Accessibility	Service performance rate	Capacity of a platform (warehouse) to process and assign all requests	Graindorge et al. (2015)
		Distance between platform and delivery location	Impact of the location of the platform delivering the products for its market area.	
		Road capacity	Adaptation of supply on demand	Patier and Routhier (2009)
Organizing & improving deliveries of UFT	Congestion	Density of deliveries and pick-ups in an urban area	importance of freight vehicle flows in an area in terms of vehicle numbers	
		Delivery time ranges	Frequency of delivery	Figlus et al. (2017)
		Number of delivery spaces	Importance of delivery areas	
		Stop time of delivery vehicles	Availability of delivery spaces	
		Average distance required to deliver and pick-up	Contribution of deliveries and pick-ups to urban traffic	Żochowska (2014)
		Delay of delivery vehicles	additional travel time created by congestion	Juhász et al. (2017)
		Sprawl Peak	Peak period during which the network is affected by congestion. Congestion is defined in this case by the presence of at least one queue of two minutes or more.	Muñuzuri et al. (2017)
		Length of duplicate deliveries & pick-ups to loading/unloading an activity in an area.	Contribution of each activity sector to the congestion of roads by parking on double lane road by zone.	Mori and Christodoulou (2012)
		Average distance traveled to loading/unloading an activity with a vehicle type.	Average distance traveled to loading and unloading an activity with a vehicle type	Szczucka-Lasota (2017)
		Total number of freight vehicles in the urban area	Contribution of total activity to the generation of urban motorized traffic.	Patier and Routhier (2009)
Improving safety	Road safety	Number of freight vehicle accidents on urban roads	Impact of goods movements on road safety	Galkin (2017)
		Speed control points in urban areas	Strengthening urban speed and behavior controls road behavior in urban areas	Żukowska (2015)
		Number of infractions		
		Mechanical condition of vehicles	Impact of the mechanical condition of vehicles on road safety in urban areas	Morana and Gonzalez-Feliu (2010)
Ensuring sustainable development	Ecological impacts	- Greenhouse Gas (GHG) emissions /(km.delivery) - Noise - Energy consumption	Impact of goods movements on energy consumption and the emission of greenhouse gases.	Liimatainen et al. (2015) Figlus et al. (2017)

So the performance of the urban freight transport represents the variable to explain. The hypotheses H1 to H4 means that: "Variables F1 to F4 has a significant influence on the performance of the urban freight transport system". The Table 2 presents these hypotheses.

For measuring the impact of each factor, we have decomposed each latent variable into five manifest variables based on a wide variety of literature presented in the last column which explain the influence relationships between the manifest variables and their latents variables (Table 3). This is the step of operationalization of the variables of the model.

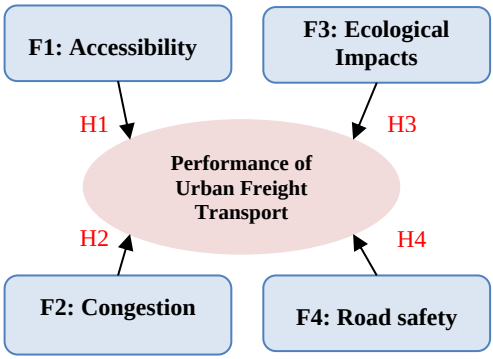

Fig.1. The hypotheses of the research model

Table 2. Research hypotheses

Research hypotheses
H1: The implementation and development of accessible logistics infrastructure significantly influences the movement of goods in the urban areas
H2: The congestion influences significantly the organization of the urban freight flows
H3: The implementation of an environmental policy significantly influences the performance of the urban freight transport
H4: The implementation of a road safety policy significantly influences the performance of the urban freight transport

Table 3. Operationalization and coding of the variables of the model

Latent Variable	Manifest Variable (MV)	References
F1 : Accessibility	F1.1: The planning policy of the city	Morana and Gonzalez-Feliu (2010)
	F1.2: Regulation of public space and access zones	Szczucka-Lasota (2017)
	F1.3: The use of information and planning systems	Crozet (2012)
	F1.4: Development of logistics infrastructures	Guyon et al. (2010)
	F1.5: Distribution networks	Johansson and Björklund (2017)
F2 : Congestion	F2.1: Flow control	Delaître (2008)
	F2.2: Coherence in the implantation of industrial and commercial activities	Graindorge et al. (2015)
	F2.3: Actor politics / sharing of roads	Szczucka-Lasota (2017)
	F2.4: The balance between supply and demand	Swamy and Baindur (2014) Marcucci et al. (2015)
	F2.5: Traffic measurement	Graindorge et al. (2015)
F3 : Ecological Impacts	F3.1: Integration in international agreements	Jami and Kammas (2013) Hickman et al. (2013)
	F3.2: The choice of the environmental policy	Lyons et al. (2012)
	F3.3: The development of a pollution emergency plan	Kishimoto et al. (2017) Carrara and Longden(2016)
	F3.4: Ecological measures	Morana and Gonzalez-Feliu (2010)
	F3.5: the level of green house gas emissions	Jaegler & Gondran (2013) Liimatainen et al. (2015)
F4 : Road safety	F4.1: Positioning against international standards	Jami et Kammas (2013)
	F4.2: The development of a road safety strategy	Tiwari et al. (2016) Żukowska (2015)
	F4.3: The rules of the road safety policy	Tiwari et al. (2016)
	F4.4: Strengthening the arsenal of the road traffic control	Reiman et al. (2018)
	F4.5: Awareness and communication actions	Jami et Kammas (2013)

3.2. Validation of the research hypotheses

The objective of the empirical study is to validate all the hypotheses of the model. The methodology proposed in this article is organized around the following steps (Fig.2).

3.2.1. Methodological choice

The Structural Equation Modeling (SEM) aims to define complex interacting systems and study the causal links between several variables of these systems (Chin, 1998; Chiou et al., 2016). This type of modeling is important for testing hypotheses of conceptual models (Chin, 1998). There are two methods of modeling by SEM which allow estimating the relations of causalities between the constructs: the LISREL method and the PLS method (Song et al., 2016). The use of the PLS method is justified by the fact that it is widely used when we test the complex causal models, incorporating several latent variables. It is a suitable tool for testing complex relational models typical of our situation (Song et al., 2016). The PLS approach can be manipulated even in the presence of a small sample (under certain conditions) and a complex structural model (Peng and Lai, 2012). It also presents a great flexibility in the testing of models with latent formative and reflexive variables, which the LISREL approach does not allow under certain conditions (Hwang et al., 2010). The PLS method works best in practice, because field data used in modeling are never perfect, and are often highly correlated (Kaufmann and Gaeckler, 2015). By selecting the best linear combination to predict the dependent variables, it provides more significant structural coefficients than the LISREL method. This method works best when the data are obtained using experimental design (Hair et al., 2012). However, this type of design is rarely possible in practice, especially when the data are obtained by using a questionnaire.

3.2.2. Presentation of the PLS approach

The PLS approach is an analysis method based on simple and multiple regressions of latent variables with their indicators and the latent variables between them. It was developed by Herman Wold (Kaufmann and Gaeckler, 2015). The validation of the model requires the estimation of the scores of the latent variables. This estimation is done using an iterative algorithm. Once the scores are obtained, the coefficients of the internal model are estimated by classical multiple regressions (Song et al., 2016). A structural model PLS is described by two sub-models (Song et al., 2016):

– The measurement model (or external model) linking the manifeste variables Xjh (VM) to the latent variables ζj (VL) associated with them;
– The structural model (or internal model) linking latent variables to other latent variables.

Several software packages have been developed to operationalize the PLS method like PLSGRAPH, LVPLS, XLSTAT and SMARTPLS. We chose the latter to analyze the data of our survey.

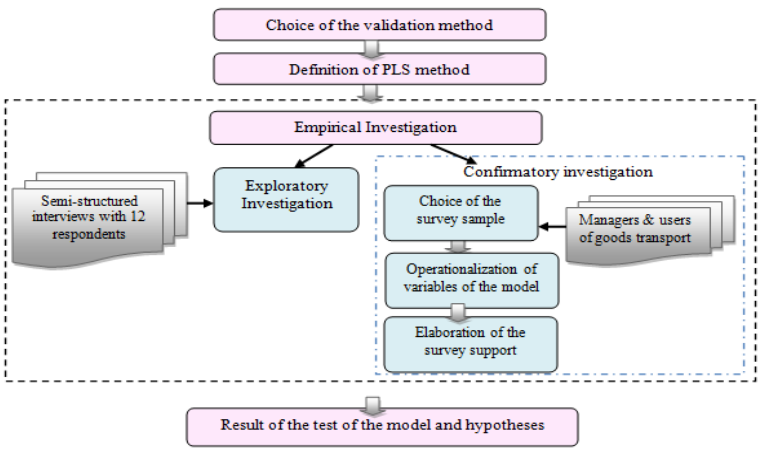

Fig.2. The steps of the validation methodology of the model

3.3. Empirical investigation

3.3.1. Exploratory investigation

After identifying the potential variables influencing the performance of the urban freight transport, an exploratory survey is prepared to conduct a face-to-face interview with managers and users of the UFT in the city of Fez in order to acquire knowledge about the field of investigation and to ensure the relevance of the assumptions made (Table 4).

The table 5 summarizes the main testimonies and findings of the exploratory survey.

The results of this exploratory survey have enriched our understanding of the context of our field of investigation, and promote the operationalization of our latent variables, through an enrichment of the scales of measurement that will be inserted in the framework of the confirmatory quantitative survey.

3.3.2. Confirmatory investigation

a) Sample size

The confirmatory survey was conducted during the period of March & April 2017 administered by a questionnaire and conducted face-to-face with managers & users of goods transport in the city of Fez. Referring to the list of companies of the General Confederation of Enterprises of Morocco (CGEM - Fez) as well as the list of institutional actors, we built a random sample made of 60 people belonging to different institutions. The Table 6 defines the selected characteristics of the sample surveyed (number of actors, sex, length of experience and the rate of representativity in the sample).

b) Questionnaire structure

The writing of the questionnaire represents the transformation of assumptions into measurement tools applicable to the sample of respondents (Smith, 2015). Therefore, the different variables of the model have been transcribed as a multi-item measure evaluated by a five-point Likert bipolar scale (from "strongly agree" to "strongly disagree"). This is the stage of operationalizing the variables. The questionnaire is divided into 20 blocks which represent the scales of measurement of the manifest variables. The administration of the questionnaire was very difficult since we chose as the interlocutor directors or heads of service who rarely find the time to give us a chance for an interview. Despite all the obstacles, we were able to complete 57 questionnaires that could be used. This represents a response rate of 95%.

Table 4. The exploratory sample

Actors interviewed
Regional director (Regional directorate of the ministry of transport, equipment and logistics)
Head of urban studies & travel department (Urban municipality of Fez)
Traffic manager (Urban municipality of Fez)
Head of transport and planning department (Urban & safeguard agency of Fez)
Logistics manager (N°1)
Logistics manager (N°2)
Logistics manager (N°3)
Logistics manager (Logistics service delivery company) (N ° 1)
Logistics manager (Logistics service delivery company) (N ° 2)
Logistics manager (Logistics service delivery company) (N ° 3)
Member of the information systems and documentation department (Regional investment center)

Table 5. The exploratory findings

Testimony
The interviewees insist that the UFT is an important lever for the development of urban areas.
The interviewees insist that the UFT performance is the target of each actor, and everyone seeks the path to achieve. In this sense, most interviewees mentioned that congestion, accessibility, road safety and ecological impacts are the main problems that constrain the performance of the UFT.
The logistics managers of both companies 1 & 2 insist on the lack of consolidation platforms and the lack of space dedicated to delivery vehicles in the city.
The head of the urban transport studies department of the urban commune has highlighted the importance of scheduling the delivery of the UFT vehicles to reduce congestion.
The interviewees insist on the availability of infrastructures before starting the question of the balance between supply and demand. They confirmed the lack of infrastructure dedicated to the UFT vehicles
Regarding the road safety theme, all respondents said that the road safety problem of the UFT is the result of congestion and poor parking management.

Table 6. Characteristics of the survey sample[2]

Institutional actors interviewed	Responsibility / Function	Number of interviewers	Sex	Experience	Representativeness in the sample
Regional Directorate of the Ministry of Transport, Equipment and Logistics	Regional director	1	M*	> 10 years	18,33%
	Members of the road transport & road safety service	5	2F* 3M	< 10 years	
	The members of the planning & technical studies department	5	2F 3M	< 10 years	
Urban municipality of the city of Fez	The leaders of the transport & urban displacement division	4	1F 3M	< 10 years	20%
	Members of the urban studies & travel department	4	2F 2M	< 10 years	
	Traffic service members	4	1F 3M	< 10 years	
Urban & safeguarding agency of Fez	Geographer & Head of Transport & Planning Department	2	M	> 10 years	10 %
	Members of the transport & development department	4	2F 2M	< 10 years	
Logistics service companies	Logistic managers of the National Logistics Transport Company (SNTL)	4	M	> 10 years	31,67 %
	The logistics managers of 'Poste Maroc'	5	1F 4M	> 10 years	
	Logistics managers of Transport & Messaging Company (CTM)	4	M	> 10 years	
	Delivery drivers	6	M	< 10 years	
Freight carrier companies	Logistics manager (Company 1)	1	M	> 10 years	15 %
	Logistics manager (Company 2)	1	M	> 10 years	
	Logistics manager (Company 3)	1	M		
	Delivery driver (1)	2	M	< 10 years	
	Delivery driver (2)	2	M	< 10 years	
	Delivery driver (3)	2	M		
Regional Investment Center	Members of the information and documentation systems service	3	M	< 10 years	5 %
Total		60	11F 49 M	68, 33% < 10 31,67% > 10	100%

*M: Male; F: Female

4. Result & Discussion

The implementation of the PLS method was carried out on the Smart PLS software (version 2.0 M3) which is particularly suitable for survey data on relatively small samples (Abreu Silva et al., 2017). The model was tested according to a Bootstrap procedure (re-sampling) on 300 replications, to ensure the robustness and stability of the meanings obtained (Lee et al., 2011). The validation of the model starts with an examination of the general characteristics of the variables of the model (descriptive statistics, level and significance of the correlations to verify that the links postulated between the variables exist). Next, the measure of the validity and reliability of the external model (quality of measurement of latent variables) will be conducted. Finally, the test of the structural model is tested against the assumptions made (Streukens and Leroi-Werelds, 2016).

4.1. Measurement model

Our model includes four latent variables. These variables are measured by manifest variables operationalized by several items. Each manifest variable is associated with a latent variable by the equation (1) (Abreu Silva et al., 2017):

[2] List of public administrations and establishments; http://www.khidmat-almostahlik.ma/portal/fr/acteurs/administration-etablissement-publique

$$x_h = \pi_{h0} + \xi_{\pi h} + \varepsilon_h \quad (1)$$

Knowing that ξ has an average m and a standard deviation 1. The only hypothesis needed in this case is formula (2). Hence the residue εh has an average of 0 and is not correlated with the latent variable ξ.

$$E(x_h|\xi) = \pi_{h0} + \xi_{\pi h} \quad (2)$$

The first step is to verify the unidimensionality of the blocks by the principal component analysis of a block (Abreu Silva et al., 2017).

4.1.1. Reliability of measurement

Reliability measures the degree of accuracy of a measuring instrument when the same identical result is obtained by repeating the measurement of the same phenomenon several times (Abreu Silva et al., 2017). The verification of reliability is done through the two indexes: Cronbach Alpha and Dillon-Goldstein Rhô (D.G. Rho or composite reliability).
From the result analysis (Table 7), the composite reliability and alpha indexes exceed the threshold of 0.7 which indicates a reliability of the variables according to the requirements of the PLS approach (Kaufmann and Gaeckler, 2015).

4.1.2. Convergent validity

Convergent validity measures the amount of variance captured by the construct in relation to the amount of variance attributed to the measurement error (Ramachandran and Tsokos, 2014). It is considered adequate if the mean variance extracted (AVE) is greater than 0.5 (Boik, 2013). The test (Table 8) reveals an AVE that exceeds 0.5, which shows that it is able to prove half of the variance of its indicators.

4.1.3. Discriminant validity

Discriminant validity makes it possible to verify that there is no correlation between the items of a construct with the items of another (Streukens and Leroi-Werelds, 2016). The verification is based on the comparison of the square root of the average extracted variance (AVE) of each latent variable with the correlation of the different latent variables two by two (Streukens and Leroi-Werelds, 2016). The test reveals the verification of the discriminant validity. It is observed that the off-diagonal elements (correlation of the constructs) are smaller than the square root values of the AVE diagonally (Table 9).

Table 7. Results of analysis of the reliability of measurements

Latent variables	Alpha de Cronbach	Rho de D.G
F1: Accessibility	0,717	0,752
F2: Congestion	0,841	0,706
F3: Ecological Impacts	0,778	0,759
F4: Road safety	0,878	0,750
UFT performance	0,841	0,875

Table 8. Convergent validity test results

Variable	AVE
F1	0,588
F2	0,570
F3	0,732
F4	0,794
PUFT	0,528

Table 9. Discriminant validity

	F1	F2	F3	F4	PUFT
F1	**0,767***				
F2	0,449	**0,755***			
F3	0,506	0,608	**0,855***		
F4	0,453	0,441	0,420	**0,891***	
PUFT	0,100	0,005	0,224	0,024	**0,726***

* Square root of the AVE

4.2. Validation of the internal structural model with PLS

Assessing the quality of the structural model refers to checking whether the variables are predictive and whether the model is stable. The equations must all be positive for the model to be considered valid (Peng and Lai, 2012). It is based on two main criteria: the evaluation of the coefficients of determination (R^2) that derives from the Bootstrap and the communality and redundancy indices (Bougeard et al., 2008). The coefficient of determination of the model (R^2) is calculated for each latent variable. These usual values are: > 0.7 (substantial), 0.33 (moderate) and 0.19 (low). The value of the commonality index is between 0 (invalidation value of the model) and 1 (value of perfect validation of the model). Concerning the index of redundancy, a model is judged of quality if all the obtained coefficients are positive. Table 10 presents the values of R^2, commonalities and the index of redundancy for each of the variables of the model.

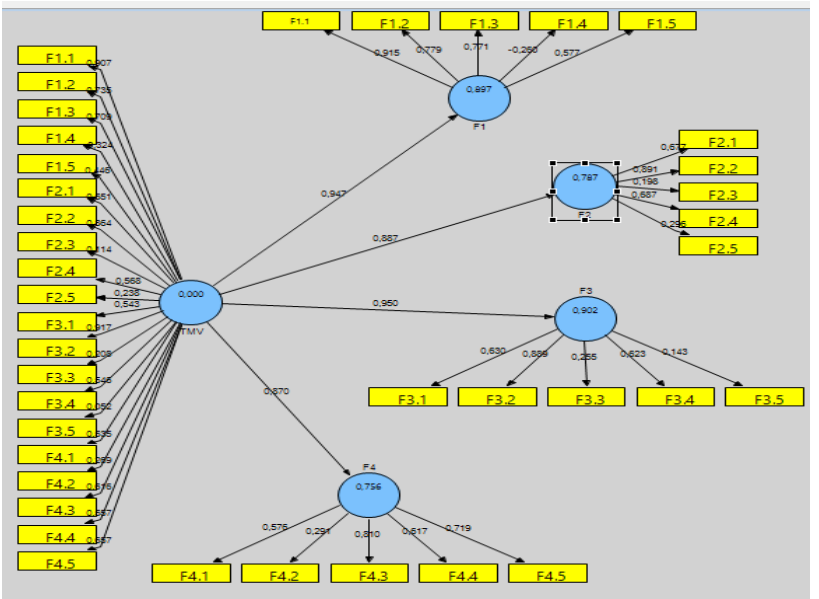

Fig.3. The structural model according to the Smart PLS Software

Table 10. Validation results of the internal structural model

Variable	R Square	Communality	Redundancy
F1	0,997	0,488	0,430
F2	0,797	0,370	0,286
F3	0,902	0,332	0,292
F4	0,756	0,394	0,294

The results of testing our model through the PLS approach are shown schematically in Figure 2.
Our model holds four latent variables that are: (F1), (F2), (F3) and (F4), and a variable to prove which is the performance of the urban freight transport (PUFT) that we tested using the PLS approach. The structural equations of the model are presented as follows:

$$PUFT = (0{,}947 \times F1) + (0{,}887 \times F2) + (0{,}950 \times F3) + (0{,}870 \times F4) \quad (3)$$

$$F1 = (0{,}915 \times F1.1) + (0{,}779 \times F1.2) + (0{,}771 \times F1.3) + (0{,}260 \times F1.4) + (0{,}577 \times F1.5) \quad (4)$$

$$F2 = (0{,}677 \times F2.1) + (0{,}891 \times F2.2) + (0{,}198 \times F2.3) + (0{,}687 \times F2.4) + (0{,}296 \times F2.5) \quad (5)$$

$$F3 = (0{,}630 \times F3.1) + (0{,}889 \times F3.2) + (0{,}255 \times F3.3) + (0{,}687 \times F2.4) + (0{,}143 \times F3.5) \quad (6)$$

$$F4 = (0{,}576 \times F4.1) + (0{,}291 \times F4.2) + (0{,}810 \times F4.3) + (0{,}617 \times F4.4) + (0{,}719 \times F4.5) \quad (7)$$

4.2.1. Test of the hypotheses

The test of hypotheses mainly involves the evaluation of the T Statistics value. This index provides a statistical condition for the variable to be considered significant at the 1%, 5% and 10% threshold if and only if its Student's T is greater than the absolute value of 2.57, 1.96 and 1, 64 respectively. If the results are below these values, the assumption is declared as rejected (Abreu Silva et al., 2017).

4.2.2. Evaluation of the effect of latent variables

The table below summarizes the results obtained from testing the hypotheses of the effects of latent variables (F1, F2, F3, and F4) on the performance of the UFT.

Table 11. Hypothesis test result from H1 to H4

Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	Validation
H1: F1 => PUFT	0,9468	0,9474	0,0092	10,9581***	**Validated**
H2: F2 => PUFT	0,8869	0,8941	0,0278	3,8650***	**Validated**
H3: F3 => PUFT	0,9496	0,9491	0,0095	9,2806***	**Validated**
H4: F4 => PUFT	0,8695	0,8699	0,0289	3,0472***	**Validated**

*** Significant at 1%

Interpretations & discussions of the results:

The hypothesis of the impact of accessibility on the performance of the UFT was verified in the context of this study. Indeed, the value of T Statistics is 10.9581. Therefore it is greater than the threshold of 2.57 for a significance of 1%. The standardized multiple regression index represented on the table by the "Sample Mean" is a value of 0.9474. This proves that the implementation and development of accessible infrastructures has a 94.47% influence on the movement of goods in the city. In the same way, the second hypothesis was validated for a significance of 1%. The sample mean is worth 0.8941. This proves that congestion has an 89.41% influence on the organization of goods flows in the city. The third hypothesis was also validated for a significance of 1%. The result proves that the implementation of a sustainable development policy influences the performance of the UFT by 94.91%. In the same degree of significance, the fourth hypothesis was also verified in the context of our study. The sample mean index is 0.8695. This proves that the implementation of a road safety policy affects the performance of the UFT by 86.95%.

4.2.3. Evaluating the effect of manifest variables

The test results reveal some validated and rejected hypotheses. These are three cases in which the influence relationship has proved insignificant in the context of this study. Below, the results of tests of the effects of manifest variables on their associated latent variables.

Interpretations & discussions of results:

The first hypothesis rejected “H2.4” stipulated that the balance between the supply of transport and the demand for movement of goods in the city has a positive influence on the control of flows.

Table 12. Effect of manifest variables

Influence	Original Sample	Sample Mean (M)	Standard Error (STERR)	T Statistics (|O/STERR|)	Validation
F1.1 => F1	0,9154	0,9142	0,0186	9,1143***	**Validated**
F1.2 => F1	0,7794	0,7812	0,0402	4,3808***	**Validated**
F1.3 => F1	0,7710	0,7647	0,0516	4,9196***	**Validated**
F1.4 => F1	0,2602	0,2485	0,1371	1,8972*	**Validated**
F1.5 => F1	0,5766	0,5753	0,1068	5,3985***	**Validated**
F2.1=> F2	0,6869	0,6788	0,0777	8,8407***	**Validated**
F2.2 => F2	0,8906	0,8907	0,0169	5,4419***	**Validated**
F2.3 => F2	0,2958	0,2880	0,1382	2,1394**	**Validated**
F2.4 => F2	0,1982	0,1762	0,1519	1,3050	**Rejected**
F2.5 => F2	0,6773	0,6702	0,0986	6,8635***	**Validated**
F3.1 => F3	0,6300	0,6305	0,0901	6,9858***	**Validated**
F3.2 => F3	0,8887	0,8879	0,0265	3,4975***	**Validated**
F3.3 => F3	0,2549	0,2234	0,1800	1,4158	**Rejected**
F3.4=> F3	0,6228	0,6029	0,1229	5,0665***	**Validated**
F3.5 => F3	0,1430	0,1576	0,1841	0,7764	**Rejected**
F4.1 => F4	0,5760	0,5653	0,1086	5,3013***	**Validated**
F4.2 => F4	0,2908	0,2951	0,1569	1,8530*	**Validated**
F4.3=> F4	0,8095	0,8031	0,0644	3,5615***	**Validated**
F4.4 => F4	0,6172	0,6037	0,0894	6,8975***	**Validated**
F4.5 => F4	0,7190	0,7250	0,0730	9,8382***	**Validated**

*** Significant at 1%; ** Significant at 5%; * Significant 10%

This hypothesis is based on the work of (Swamy & Baindur, 2014; Marcucci et al., 2015) who mentioned that the flow control passes through the guarantee of a balance between the offer that designates the all the infrastructure networks devoted to travel and their exploitation and the demand that represents the movement of goods in the city. Indeed, the analysis of the equilibrium is based on the analysis of demand and that of supply. The first relates to the commercial structure of the city and to all the movements generated by social and economic activities (Swamy and Baindur, 2014). The second concerns the capacity and size of the road infrastructure, which depends on the mode of organization and guides parking practices (Marcucci et al., 2015). On the basis of data collected in the field, this relationship was not confirmed due to the lack of transport supply explained by the lack of infrastructure dedicated to the transport of goods in the city. The study conducted between 2014 and 2016 by the Moroccan Agency for Logistics Development (AMDL)[3], on the structuring of urban logistics in Morocco[4], found a lack of infrastructure dedicated to delivery needs. Also, the report of the Ministry of National Land Planning, Housing Urban Planning and City Policy[5] has indicated the absence of a global scheme for the organization of traffic and parking of UFT vehicles. Even more, the report of the World Bank[6], on the evaluation of the program of support of the sector of the urban displacements in Morocco, confirmed also the deficit in terms of plan of circulation and parking of the vehicles of the UFT and revealed that the development of traffic plans for the urban transport sector is limited to the management of urban public transport. With this in mind, it is far from talking about controlling flows before even ensuring a balance between supply and demand for transport.

Hypothesis H3.3 which stipulated that the existence of an environmental policy affects positively the limitation of the ecological impacts of UFT was also rejected. It is based on the work of (Kishimoto et al., 2017; Carrara and Longden, 2016) who studied the impact of implementing a policy environment on the transport of goods in the city. This can be explained by the fact that even though Morocco has embarked on a voluntary initiative to protect the environment[7], it seems that the legal framework of the environment poses problems of implementation[8,9].

In fact, the country has acceded to a number of multilateral environmental agreements[10]. It has signed the main international conventions related to the environment. However, while the legislative arsenal is relatively comprehensive[11], the monitoring and enforcement processes of the various laws need to be strengthened to ensure rigorous enforcement[12].

[3] AMDL: Public institution with legal personality and financial autonomy under the supervision of the State. It was created by Law No. 59-09, published in the Official Bulletin of July 21, 2011. It is a structure dedicated to the management and coordination of strategic studies and actions to improve logistics competitiveness in Morocco. http://www.amdl.gov.ma/amdl.

[4] AMDL Report, National Guide of Urban Logistics. Process of structuring urban logistics in Moroccan cities, 2016, pp. 1-56.

[5] Report of the Ministry of Housing of Urban Planning and Spatial Planning, Direction of urbanism. Guide of development and exploitation of the public space for a better management of the urban displacements. Kingdom of Morocco, April 2016.

[6] World Bank, Evaluation of Morocco's Urban Travel Sector Support Program, Report No. 101010-MA, 16 November 2015.http://documents.worldbank.org/curated/fr/669341467996728102/pdf/101010-FRENCH-PAD-p149653-PUBLIC-Box394816B-MA-UT-PforR.pdf

[7] Ministry of Energy, Mines, Water and Environment. National Strategy for Sustainable Development 2015-2020. Final report. August 2014. http://www.environnement.gov.ma/fr/strategies-et-programmes/sndd?showall=1&limitstart

[8] ARTEMIS 2016 Report, Environment in Morocco - The Rule of Law, November 2016. http://www.artemis.ma/pdf/veille/2016/11/ArtemisCop22_Dossier.pdf

[9] United Nations Economic Commission for Africa, "Review of Morocco's Environmental Performance", 2016.

[10] Summary of international agreements to which Morocco has acceded: United Nations Framework Convention on Climate Change May 9, 1992 at the 1992 Rio Earth Summit; Rio de Janeiro (June 13, 1992); Dahir No. 1-01-333 of 19 moharrem 1423 (April 3, 2002) issuing the Kyoto Protocol to the United Nations Framework Convention on Climate Change in Kyoto on December 11, 1997 (Accession February 25, 2002); Stockholm Convention on Persistent Organic Pollutants in 2004; Copenhagen Conference 2009 (COP 15); COP16 in Cancun Mexico in 2010; Paris Climate Agreement 2015 COP21 in Paris; COP 22 in Marrakech.

[11] Legislative arsenal: Laws already promulgated: Law 11-03: Protection and Development of the Environment (2003), Law 12-03 on Environmental Impact Assessments, Law 13-03 on Combating Pollution of the Environment air, article 47 of the law n ° 52-05 relating to the limits of the characteristics of the engines and to the polluting emissions, article 66 of the law n ° 52-05 relative to the technical inspections of vehicles, Law 22-07 relative to protected areas, Law 13-09 on renewable energies, Law No. 30-05 on the transport of dangerous goods by road, Law 28-00 on the management of wastes and their disposal, Framework Law 99-12 on Charter of the Environment and Sustainable Development (January 2014), Decree No. 2-14-782 (19 May 2015) on the organization and operating procedures of the environment police. http://www.environnement.gov.ma/fr/lois-et-reglementations/textes-juridiques

[12] Ministry delegated to the Minister of Energy Mines, Water and Environment, in charge of the environment with the support of the US State Department, 3rd Report on the state of the environment in Morocco , 2015.

In fact, according to the 2017 report of the Secretariat of the State to the Minister of Energy, Mines and Sustainable Development, in charge of Sustainable Development, there are some limits persist[13]. Firstly, financial limits, since the scale of the projects to be carried out, in particular for projects to adapt to the adverse effects expected from Climate Change, requires the support of the international community through the acceleration of the implementation of the Green Fund for the Climate[14]. Secondly, technological limitations, because the implementation of adaptation strategies of developing countries to the expected adverse effects of climate change and GHG emissions mitigation requires the deployment and mastery of proven technologies and clean technologies.

In addition to these limitations, the very limited level of involvement of professionals in sustainable development practices in terms of predisposition and willingness to put them into the near or medium future (Jami and Kammas, 2013) explains even more the phase difference observed between the policy and its implementation and therefore the invalidity of hypothesis H3.3.

Hypothesis H3.5 which stated that the performance of UFT and the low level of greenhouse gas emissions (particularly CO_2) are positively related was also rejected. It is based on the work of (Liimatainen et al., 2015; Jaegler and Gondran, 2013) according to which, a high performance UFT system is one that emits less CO_2. According to data from the World Bank in 2017[15], UFT accounts for an average of 18% of urban travel. In addition, it is responsible for between 30% and 40% of CO_2 emissions in the case of large cities.

The study conducted in the city of Fez to measure the ecological impact of the UFT and which only concerns the inter-institutional trips, revealed that the CO_2 emissions of the latter is about 25067 tons of CO_2 / year (Moufad and Jawab, 2018a), representing 14% of the urban transport CO_2 emissions (175,167 tons of CO_2/ year[16]). Taking into account that the share of inter-institutional trips in the urban mobility is 6% according to statistics assigned by the Regional Directorate of the Ministry of Equipment, Transport and Logistics of the region of Fez[17]. If the 6% of urban trips are responsible for 14% of CO_2 emissions, it seems to us quite logical and objective to consider that the addition of the other two components, namely: shopping trips and those related to urban management would be well above the world average. By making a connection to the world data bank, it can be stipulated that the 6% of the trips must emit just 10% of CO_2 emissions.

This environmental situation can be explained by three factors. The first concerns the obsolescence of the vehicle fleet. In fact, 53% of trucks are over 10 years old, while 34% are over 15 years old and 22% are over 20 years old[11]. The second factor relates to the growth of the vehicle fleet in circulation. According to statistics from the ministry of equipment, transport and logistics[18], the national park has evolved from 5,95% between 2013 and 2014 and that of the city of Fez by 4,76% between the same period. This phenomenon is accompanied by the lack of infrastructure dedicated to delivery needs. The third factor relates to the fact that heavy goods vehicles are still allowed to circulate in urban areas throughout the day. For all these reasons, the economic United Nations commission for Africa in its assessment of the state of the environment in Morocco in 2016 recommended the restriction of the movement of heavy goods vehicles in the city[8].

5. Conclusions

The theoretical contributions of this paper come, in the first place, from the fact that we have pushed the reflection on the interest of modeling. So, in this

[13] State Secretariat to the Minister of Energy, Mines and Sustainable Development, Responsible for Sustainable Development, Report of major achievements and new programs, Report 2017. http://www.environnement.gov.ma/images/Mde_PDFs/BILAN-SEDD-2017.pdf

[14] The Green Fund for the Climate is a global funding platform established by 194 governments to limit or reduce greenhouse gases (GHGs) in developing countries and help vulnerable countries to adapt to the impacts of climate change. http://www.4c.ma/fr/mediatheque/docutheque/le-fonds-vert-pour-le-climat

[15] http://www.worldbank.org/en/results/2017/12/01/mobility

[16] Ministry Delegate to the Minister of Energy, Water Mines and Environment, in charge of the Environment, National Report on the state of the environment in the Fès-Boulemane region, 2014. http://www.environnement.gov.ma/fr/119-etatenv/1063-region-fes-boulemane

[17] Statistical data of the Regional Directorate of the Ministry of Equipment, Transport and Logistics of the Fez region. Modal distribution of urban travel in the city of Fez in 2016: Total travel: 2 113408 trips ; Cars: 265017 trips ; UFT vehicles: 116,423 trips .

[18] http://www.equipement.gov.ma/chiffrescles/routier/Pages/Transport-routier-en-chiffres.aspx

work, an evaluation model of the performance of the UFT was developed by the GRAI grid, which focuses on four main factors: accessibility, congestion, safety and ecological impacts that represent the latent variables of the model. For each latent variable in the UFT system, five manifests variables are represented. In order to examine the impact of each factor studied on the performance of the UFT, the grid was decomposed into hypotheses expressing the influence of factors F1 to F4 on the performance of the UFT on the one hand. The influence of the proposed action on their associated factor on the other hand. The theoretical contributions are also derived from the use of the PLS method for the validation of the model and hypotheses showing the feasibility of such an approach in the case of the UFT, usually used in the modeling of organizational processes. To do this, the hypothetico-deductive reasoning method was adopted which combining a qualitative survey and a quantitative survey. All statistical processing was performed on SmartPLS software (version 2.0 M3). The results obtained affirm the positive and statistically significant influence of the variables of our model: accessibility, congestion, safety and ecological impacts respectively represented by F1 to F4 on the performance of the UFT. The evaluation of the status of the effects of the manifest variables on the latent variables revealed that of the twenty hypothesis tests, three hypotheses proved to be insignificant and were not validated in our study. Through these results, we were able to build an image on the performance of the UFT, in particular that of the city of Fez.

In the context of the UFT, decision making is a complex experience since many parameters must be taken into account. But, the actors have no vision of the consequences of the decisions they will take given the lack of tools due to the youth of the field. So, the operational contribution of this work is manifested in the fact that is provides a framework for the managers (Enterprise and public authorities) explaining the impact of a combination of factors on the performance of the UFT. It thus provides decision-making through a set of principles of actions that help them to improve the urban freight transport and make decisions correctly. However, the limits of this article are related to the amount of work required to complete surveys for validation of model assumptions on the field. That's why the empirical study was conducted in the city of Fez. Indeed, the validation of the model for evaluation the performance of the UFT has limitations since a sample from a single city was selected and the results focus heavily on explaining why the three rejected assumptions may not fit in this framework. Therefore as a perspective, the model will be validated on other samples because the collection of data from several cities would not only increase the size of the research sample, but would also provide variations in the city's freight transport systems, levels of accessibility and congestion and variables of result.

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